APPENDIX 1

INTERLABORATORY COMPARISON PROGRAM OF MASS STANDARDS AMONG LEGAL METROLOGY LABORATORIES OF ASEAN COUNTRIES

ASEAN SUPPORT

DIRECTORATE OF METROLOGY
DIRECTORATE GENERAL OF DOMESTIC TRADE
MINISTRY OF TRADE – REPUBLIC OF INDONESIA
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INTERLABORATORY COMPARISON PROGRAM OFF MASS STANDARDS AMONG LEGAL METROLOGY LABORATORIES OF ASEAN COUNTRIES

Coordinator : Directorate of Metrology (DoM) - Indonesia

1. Background

Based on the result of 7th Meeting of ACCSQ Working Group3 on Legal Metrology at Singapore, November 14th, 2006 agreed that Indonesia is the coordinator of Interlaboratory comparison among ASEAN countries. Indonesia will provide artefacts of mass standards, design and conduct the program of interlaboratory comparison. The importance of this program is for establishing and maintaining mutual recognition arrangements (MRA) that are very rigorous and are in part based on comparability of measurement data between the countries concerned. Consequently, this requires participation of ASEAN laboratories in this comparison program.

Interlaboratory comparison of mass standard is the somekind of important program to measure and improve the competence and capability of mass laboratory by comparing measurement results among standards of participant laboratories. The mass standards selected as artifacts are of OIML Class F2.

2. Program Design and Time Schedule

This program will be conducted in the year 2008 and all of technical documents and questionnare about possibility of time, availibity of standards and the needed of supported instruments will be distributed firstly via electronic mail and then presented to each participant countries at least on next ACCSQ WGLM meeting (8th meeting on year of 2007).

Directorate of Metrology - Indonesia is coordinator of the program and responsible to provide the reference value and conduct the program. The scope of work covers:

a. Providing the artefacts
b. Calibrating the artefacts
c. Preparing the calibration methods and procedures
d. Conducting the interlaboratory comparison and monitoring the circulation of the artefacts
e. Compiling and evaluating the interlaboratory comparison results
f. Reporting to ACCSQ WG3 Meeting

The artefacts (mass standards) will be firstly calibrated by DoM and then circulated to each member country for calibration according to an agreed timetable. After all of the member countries have finished the calibration, the artefacts will be returned to DoM and calibrated for the second time by DoM.

2.1 Participants

Seven (7) countries will participate in the intercomparison. They are:

a. Indonesia
b. Singapore
c. Malaysia
d. Thailand
e. Cambodia
f. Philippines
g. Brunei

2.2 Time Schedule

The interlaboratory comparison program is scheduled to begin in the year 2008 according to a proposed schedule as in the table. For this program, each participant has two weeks to complete this calibration.

No.	Time	Place	Activity
1.	**2008 April**	**Indonesia**	Artefact calibration (Initial)
2.	2008 May	Singapore	Artefact calibration
3.	2008 June	Malaysia	Artefact calibration
4.	2008 July	Thailand	Artefact calibration
5.	**2008 August**	**Indonesia**	Artefact calibration (Middle)
6.	2008 October	Cambodia	Artefact calibration
7.	2008 November	Philippines	Artefact calibration
8.	2008 December	Brunei	Artefact calibration
9.	**2009 February**	**Indonesia**	Artefact calibration (Final)

The above schedule is tentative and DoM will get confirmation of the suitability of the time allocated to each country. Please see paragraph 4 also.

3. Artefact Selection

The mass standards selected for use as artefacts shall be of OIML Class F2 and denominations 100 g, 200 g, 500 g and 1 kg.

4. Documentation

A *Letter of Intent* is sent to all applicant/participant laboratories to advise that the program will be conducted and to provide as much information as possible.

5. Artefact Stability

The artefacts are circulated to the participating laboratories sequentially. To monitor the stability of the artifacts, the artifacts will be calibrated at the start and at the end of the circulation by the reference laboratory.

6. Reference Value

The DoM Measurement Laboratory provides the reference values for this interlaboratory comparisons.

7. Intercomparison Method

Comparison would be based on OIML Recommendation R111, each comparison consisting of four weighings, i.e. ABBA.
A1 → weighing result of mass standard
B1 → weighing result of weight under test
B2 → weighing result of weight under test
A2 → weighing result of mass standard

$$\Delta m = \left(\frac{B_1 + B_2}{2}\right) - \left(\frac{A_1 + A_2}{2}\right)$$

The difference (Δm) should be determined 10 times and the average value calculated.

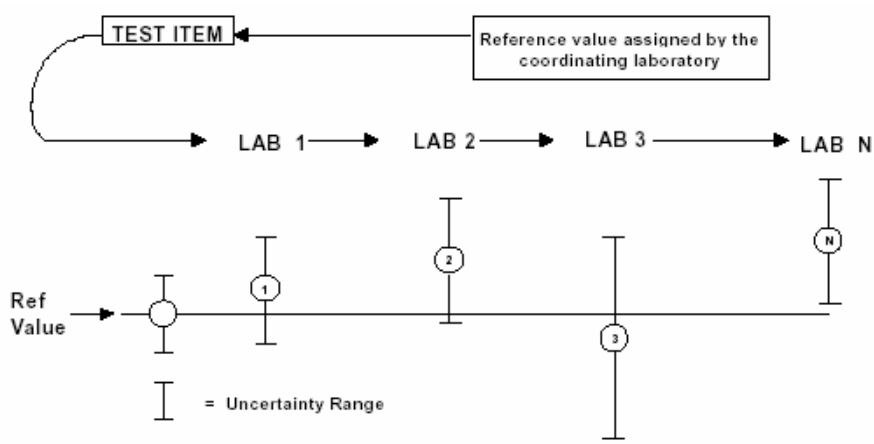
8. Evaluation of Performance

Evaluation of interlaboratory comparison program is reffered to ISO Guide 43 Interlaboratory Comparison's method.

$$E_n = \frac{\text{LAB} - \text{REF}}{\sqrt{U_{LAB}^2 + U_{REF}^2}}$$

where

LAB : participating laboratory's result
REF : Reference Laboratory's result
U_{LAB} : participating laboratory's reported uncertainty
U_{REF} : Reference laboratory's reported uncertainty



Graphical Display of *difference* between each laboratory's result and the appropriate reference value (LAB–REF)

9. Determination of the Uncertainty of Measurement

The uncertainty of measurement reported by the laboratory is used in the E_n ratio.
If a laboratory reports an uncertainty larger than their accredited uncertainty then they would generally be asked for an explanation or the standard must be investigated. The scope of uncertainty is

9.1 Uncertainty Type A

This type of uncertainty derived from the repeated measurement using standard deviation.

$$U_A = \frac{\text{Standard Deviation}}{\sqrt{\text{n}}}$$

with n = number of measurements

9.2 Uncertainty due to drift of mass standard (U_1)

Calculated or estimated according each laboratory procedure.

9.3 Uncertainty due to resolution of mass comparator (U_2)

Estimated by : $U_2 = \frac{\text{resolution}}{2\sqrt{3}} \cdot \sqrt{2}$ *(the factor √2 is due to the difference between two readings, Ref – Test)*

9.4 Uncertainty due to uncertainty of mass standard (U_3)

Estimated from the certificate of mass standard.

9.5 Combined Uncertainty

$$U_C = \sqrt{U_A^2 + U_1^2 + U_2^2 + U_3^2}$$

(Note : The uncertainty component due to the non-application of buoyancy correction may be estimated and included in the calculation of the combined standard uncertainty.)

9.6 Uncertainty

$$U = k \cdot U_C$$

with k = 2 (approximately 95% of confidence level)

10. Reporting

Whenever practicable an *Interim Report* is sent to laboratories to give them early feedback on their performance. The interim report states the E_n values for each measurement based on the preliminary reference values and usually does not contain any technical commentary.

A *Final Report* is sent to the Authorised Representative of each laboratory at the conclusion of the program. This typically contains more information than is provided in the interim report, including all participant's results and uncertainties, final E_n numbers, technical commentary and graphical displays.