Calibration of E2 Weights

APLAC INTERLABORATORY COMPARISON
APLAC APM M027

Final Report

December 2017

ACKNOWLEDGMENTS

The APLAC Secretariat wishes to acknowledge gratefully to the APLAC member for their participation, Komite Akreditasi Nasional (KAN) for its contribution and Pusat Penelitian Metrologi (P2M) – LIPI who acted as collaborator for assigning reference values on artifact.

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1. Introduction

This report summarizes the results of an interlaboratory comparison on measurement of conventional masses of a set of mass standards by laboratories accredited by accreditation bodies that are members of the Asia Pacific Laboratory Accreditation Cooperation (APLAC).

This program was the 27th APLAC interlaboratory comparison in the field of calibration. The program was divided into two groups that were coordinated by Komite Akreditasi Nasional (KAN) - Indonesia.

2. Aim of the Program

One of APLAC's main aims is to build up and maintain mutual confidence in the technical competence of APLAC members. Interlaboratory comparisons provide objective evidence that laboratories are competent and they can achieve the level of accuracy for which they are accredited. They also provide means for improving the quality and performances of laboratories throughout the region.

APLAC M027 Mass program was designed to test the participant's ability to perform measurement of conventional mass values of a sets of mass standards comprises 0.1 g, 2 g and 20 g nominal mass and to obtain values within their accredited uncertainties of measurement. A secondary aim was to assess the participant's ability to estimate their uncertainty of measurement.

3. Design of the Program

This group of APM 027 interlaboratory comparison program coordinated by KAN was involved two loops circulation of two set of artifacts around two groups of participating laboratories. The first set of artifacts (marked with "A") was circulated over 14 participating laboratories, while the second (marked with "B") was circulated over 14 participating laboratories.

National Metrology Institute of Indonesia (Pusat Penelitian Metrologi (P2M) – LIPI) acted as the Reference Laboratory, deriving the reference values from the measurement of conventional mass values of the artifacts at the beginning, half-way and the end of the program.

Laboratories were asked to do measurement of conventional mass in accordance with their accredited procedure and reporting appropriate uncertainty of measurement in accordance with their accredited least uncertainty in their scope of accreditation.

4. Participants

Twenty eight laboratories from 16 accreditation bodies participated in this program. These laboratories are accredited.

To keep the schedule, all participants were asked to carry out the measurement within one week of receipt of the artifacts.

To maintain confidentiality, participating laboratories were assigned a random laboratory code number and these numbers are used in the report.

5. Reporting by Participants

Laboratories were asked to report their measurement results on a Result Sheet form (refer to Appendix A). The participating laboratories were asked to report uncertainties at the 95% confidence levels.

The instruction requested participating laboratories to report the Conventional Mass Values of the Artifacts.

6. Stability of the Artifacts

A set of initial measurement of the artifacts involving subsequent measurements to predict long-term stability of the artifacts during the circulation in this program were done by P2M LIPI before delivery of artifacts on all participating laboratories. In the half-way of this program, these artifacts were sent back to P2M LIPI for stability check. The final stability check was done by P2M LIPI at the end of the circulation.

P2M LIPI assessed the stability of the artifacts by measuring the conventional mass of each artifact at the beginning, at the middle and at the end of the circulation loop. The results are given in Table 1 and 2 for Loop A and Loop B respectively.

The measured conventional mass differences of each artifact given in Table 1 and Table 2 was used to estimate the uncertainty associated with each artifact due its stability, u_d, during the comparison. Assuming a rectangular distribution, u_d is calculated from the equation:

$$u_d = \sqrt{\frac{\Delta m^2}{12}}$$

where Δm is the peak to peak difference of the three measurement of conventional mass.

The artifacts behave almost in similar fashion during all the three calibration. The changes in conventional mass values of all the artifacts were found to be small and well within their measurement uncertainties. This concludes that the artifact remained stable during the whole interlaboratory comparison programme.

Table 1: Conventional mass change of the artifacts at the beginning, at the middle and at the end of the Loop A circulation.

Artifact	Conventional mass			U_{ref} (mg)	Maximum change in conventional mass (g)	u_d (mg)
	Initial (g)	Middle (g)	Final (g)			
20 g	20.000012	20.000011	20.000015	0.007	0.0000040	0.0012
2 g	2.0000085	2.0000086	2.0000087	0.0030	0.0000002	0.00006
0.1 g	0.1000046	0.1000050	0.1000041	0.0013	0.0000009	0.00026

Table 2: Conventional mass change of the artifacts at the beginning, at the middle and at the end of the Loop B circulation.

Artifact	Conventional mass			U_{ref} (mg)	Maximum change in conventional mass (g)	u_d (mg)
	Initial (g)	Middle (g)	Final (g)			
20 g	20.000013	20.000015	20.000017	0.007	0.0000040	0.0012
2 g	2.0000092	2.0000091	2.0000088	0.0030	0.0000004	0.00012
0.1 g	0.1000039	0.1000044	0.1000038	0.0013	0.0000006	0.00017

7. Reference Values

The reference values and the uncertainty of the reference values of the artifacts are derived from the mean of a set of calibrations carried out by P2M LIPI before, the middle of and the end of circulation of the artifacts.

The reference values and the uncertainty of the reference values of the artifacts are given in the table 3.

Table 3: The reference values and the uncertainty of the reference values

Artifact	Loop A		Loop B	
	Conventional mass	Uncertainty	Conventional mass	Uncertainty
	(g)	(mg)	(g)	(mg)
20 g	20.000013	0.007	20.000015	0.007
2 g	2.0000086	0.0030	2.0000090	0.0030
0.1 g	0.1000046	0.0013	0.1000040	0.0013

The uncertainty budget for measurements performed on the artifact is given in the table 4, 5, 6.

Table 4: Uncertainty budget for artifact with conventional mass of 0.1 g

Component	*Units*	*Dist.*	*U*	*Div.*	u_i	C_i	v_i	u_iC_i	$(u_iC_i)^2$	$(u_iC_i)^2/v_i$
Mass Std.	mg	Normal	0.0011	2.00	0.00055	1	60	0.00055	3.03E-07	1.53E-15
Comp.Repeat	mg	Normal	0.00016	2.00	0.00008	1	36	0.00008	6.4E-09	1.14E-18
Scale Resolution	mg	Rect.	0.00005	1.732	4.08E-05	1	50	4.08E-05	1.67E-09	5.56E-20
Drift	mg	Rect.	0.000011	1.732	0.00006	1	4	0.00006	3.6E-09	3.24E-18
Buoyancy	mg	Normal	0.015	1	0.015	2.08E-08	59	3.12E-04	9.77E-08	1.62E-16
Sums									4.12E-07	1.69E-15
Combined Standard uncertainty, uc,			*mg*						6.42E-04	
Effective degree of freedom									100	
Coverage factor, k, for for CL 95 %									1.98	
Expanded uncertainty, U = k uc,			*mg*						0.0013	

Table 5: Uncertainty budget for artifact with conventional mass of 2 g

Component	*Units*	*Dist.*	*U*	*Div.*	u_i	C_i	v_i	u_iC_i	$(u_iC_i)^2$	$(u_iC_i)^2/v_i$
Mass Std.	mg	Normal	0.0016	2.00	0.0008	1	60	0.0008	6.4E-07	6.83E-15
Comp.Repeat	mg	Normal	0.0002	2.00	0.0001	1	36	0.0001	1E-07	2.78E-18
Scale Resolution	mg	Rect.	0.00005	1.732	4.08E-05	1	50	4.08E-05	1.67E-09	5.56E-20
Drift	mg	Rect.	0.000012	1.732	0.00009	1	4	0.00009	8.1E-09	1.64E-17
Buoyancy	mg	Normal	0.015	1	0.015	8.33E-08	59	0.00125	1.56E-06	4.14E-14
Sums									2.22E-06	4.82E-14
Combined Standard uncertainty, uc,			*mg*						1.49E-03	
Effective degree of freedom									102	
Coverage factor, k, for for CL 95 %									1.98	
Expanded uncertainty, U = k uc,			*mg*						0.003	

Table 6: Uncertainty budget for artifact with conventional mass of 20 g

Component	*Units*	*Dist.*	*U*	*Div.*	u_i	C_i	v_i	u_iC_i	$(u_iC_i)^2$	$(u_iC_i)^2/v_i$
Mass Std.	mg	Normal	0.005	2.00	0.0025	1	60	0.0025	6.25E-06	6.51E-13
Comp.Repeat	mg	Normal	2.81E-03	2.00	1.41E-03	1	36	1.41E-03	1.98E-06	1.08E-13
Scale Resolution	mg	Rect.	0.0005	1.732	4.08E-04	1	50	4.08E-04	1.67E-07	5.56E-16
Drift	mg	Rect.	0.00026	1.732	0.00015	1	4	0.00015	2.25E-08	1.27E-16
Buoyancy	mg	Normal	0.015	1	0.015	1.20E-07	59	0.0018	3.24E-06	1.78E-13
Sums									1.17E-05	9.38E-13
Combined Standard uncertainty, uc,			*mg*						3.41E-03	
Effective degree of freedom									145	
Coverage factor, k, for for CL 95 %									1.98	
Expanded uncertainty, U = k uc,			*mg*						0.007	

8. Summary of Results

A summary of the result returned by the participating laboratories, compared to the reference values, for Loop A are given in Table 7, 8, and 9 while a summary of the result returned by the participating laboratories Loop B are given in Table 10, 11, 12.

The graph plots the difference between each laboratory's result and the reference values (LAB – REF) is given in the Appendix B.

In accordance with international practice, participant's performance is assessed on the basis of E_n number for each measurement. The E_n number is calculated using equation:

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

where

U_{lab} is the expanded uncertainty of participant's result; and
U_{ref} is the expanded uncertainty of reference value.

$|E_n| \leq 1$ indicates "satisfactory" performance, while $|E_n| > 1$ indicates "unsatisfactory" performance. When participant's performance indicates "unsatisfactory", they need to investigate and make necessary corrective action in accordance with accreditation body policy.

Table 7: Summary of result of APM 027 for Loop A – 20g

NO	CODE	LAB	U_{lab}	LAB-REF	E_n
		g	g	g	
1	A1	20.000016	0.000015	0.000003	0.18
2	B1	20.000015	0.000011	0.000002	0.15
3	C1	20.000018	0.000025	0.000005	0.19
4	D1	20.000010	0.000011	- 0.000003	-0.23
5	E1	20.000018	0.000025	0.000005	0.19
6	F1	20.000016	0.000010	0.000003	0.25
7	G1	20.000011	1.08E-05	- 0.000002	-0.16
8	H1	20.0000	0.00011	- 0.000013	-0.12
9	I1	20.00005	0.00007	0.000037	0.53
10	J1	20.000014	0.000025	0.000001	0.04
11	K1	20.000005	0.000008	- 0.000008	-0.75
12	L1	19.999870	0.000027	- 0.000143	-5.13
13	M1	20.000028	0.000026	0.000015	0.56
14	N1	20.0000082	0.000040	-0.000005	-0.12

Figure 1: Deviation (LAB-REF) of 20 g of Loop A circulation

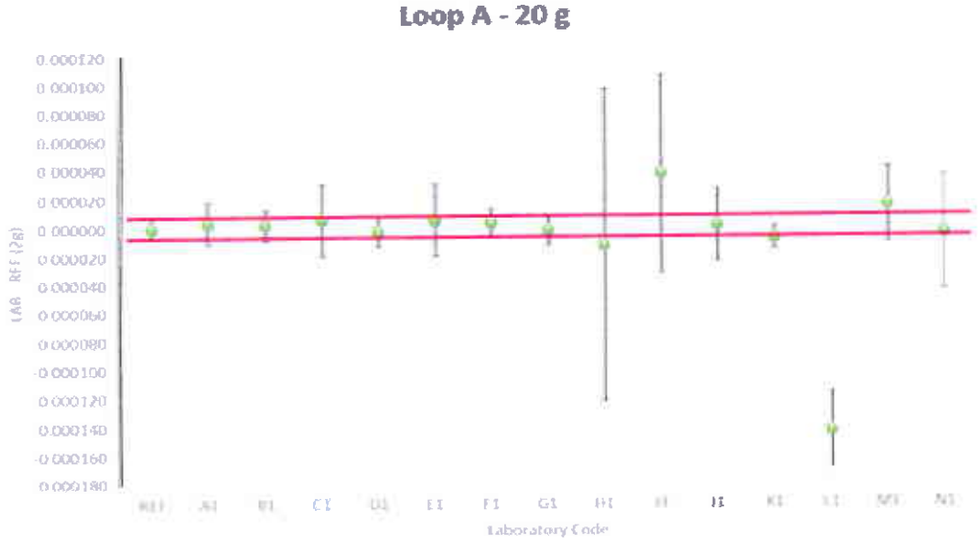


Table 8: Summary of result of APM 027 for Loop A – 2g

NO	CODE	LAB	U_{lab}	LAB-REF	E_n
		g	g	g	
1	A1	2.000013	0.000009	0.0000044	0.46
2	B1	2.000004	0.0000046	- 0.0000045	-0.82
3	C1	2.000005	0.000012	- 0.0000036	-0.29
4	D1	2.000005	0.0000035	- 0.0000032	-0.69
5	E1	2.000006	0.000012	- 0.0000026	-0.21
6	F1	2.000007	0.0000042	- 0.0000021	-0.41
7	G1	2.000003	0.0000049	- 0.0000056	-0.97
8	H1	2.0000	0.00010	- 0.0000086	-0.09
9	I1	2.00000	0.00003	- 0.0000086	-0.29
10	J1	2.000008	0.000012	- 0.0000003	-0.02
11	K1	2.000006	0.0000030	- 0.0000026	-0.61
12	L1	1.999985	0.000013	- 0.0000236	-1.77
13	M1	2.000008	0.000013	- 0.0000006	-0.04
14	N1	1.9999909	0.000020	-0.0000177	-0.88

Figure 2: Deviation (LAB-REF) of 2 g of Loop A circulation

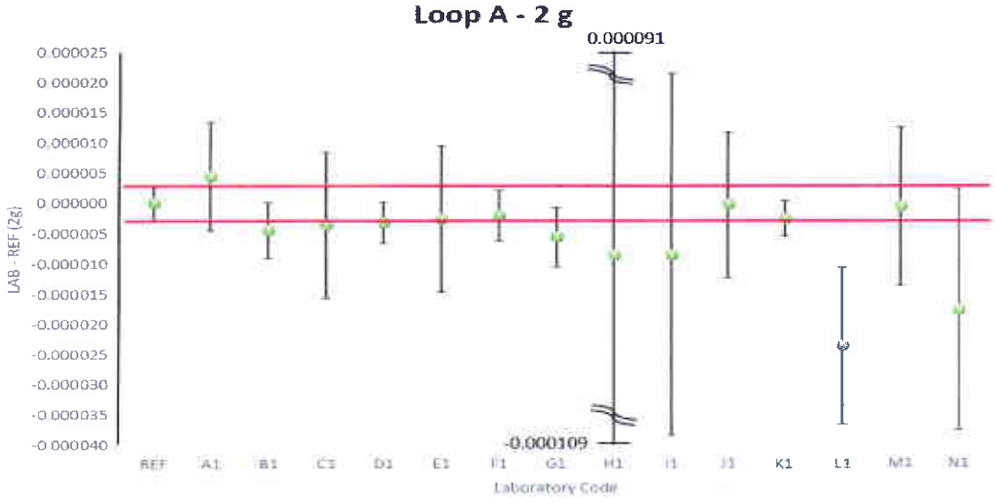


Table 9: Summary of result of APM 027 for Loop A – 0.1g

NO	CODE	LAB	U_{lab}	LAB-REF	E_n
		g	g	g	
1	A1	0.100004	0.000005	- 0.0000006	-0.12
2	B1	0.100004	0.0000015	- 0.0000008	-0.40
3	C1	0.100003	0.000005	- 0.0000016	-0.31
4	D1	0.100004	0.0000014	- 0.0000011	-0.58
5	E1	0.100003	0.000005	- 0.0000016	-0.31
6	F1	0.100004	0.0000019	- 0.0000008	-0.35
7	G1	0.1	0.0000025	- 0.0000049	-1.74
8	H1	0.10000	0.00010	- 0.0000046	-0.05
9	I1	0.10000	0.00002	- 0.0000046	-0.23
10	J1	0.100004	0.0000050	- 0.0000005	-0.10
11	K1	0.100005	0.0000020	- 0.0000001	-0.04
12	L1	0.099999	0.000005	- 0.0000056	-1.08
13	M1	0.100003	0.000005	- 0.0000015	-0.29
14	N1	0.1000014	0.000020	-0.0000032	-0.16

Figure 3: Deviation (LAB-REF) of 0.1 g of Loop A circulation

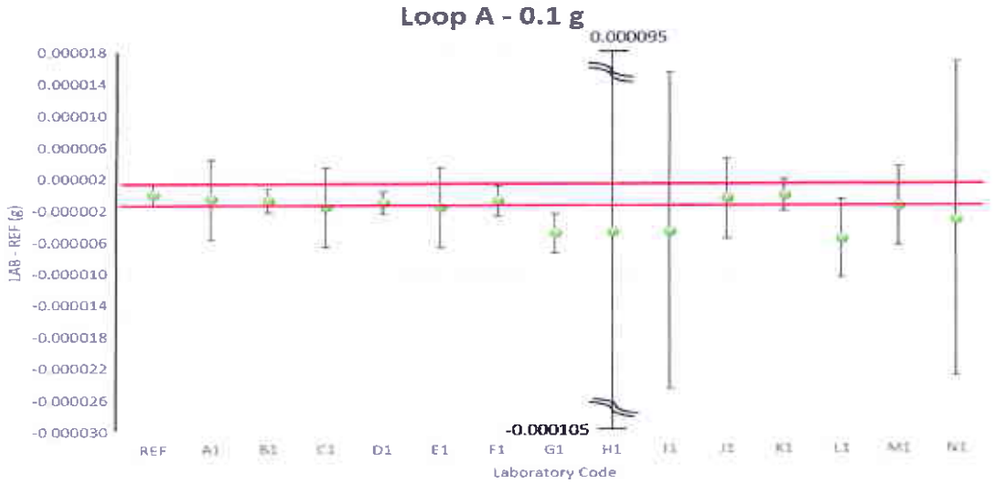


Table 10: Summary of result of APM 027 for Loop B – 20g

NO	CODE	LAB	U_{lab}	LAB-REF	E_n
		g	g	g	
1	A2	20	0.0855	- 0.000015	0.00
2	B2	20.0000183	0.00001322	0.000003	0.22
3	C2	20.0000181	0.0000013	0.000003	0.44
4	D2	20.000013	0.000012	- 0.000002	-0.14
5	E2	19.999999	0.000018	- 0.000016	-0.83
6	F2	20.000014	0.000200	- 0.000001	0.00
7	G2	20.000024	0.000014	0.000009	0.57
8	H2	20.000017	0.000009	0.000002	0.18
9	I2	20.000018	0.000015	0.000003	0.18
10	J2	20.0000169	0.0000087	0.000002	0.17
11	K2	20.000021	0.000026	0.000006	0.22
12	L2	20.0000175	0.0000043	0.000002	0.30
13	M2	20.000019	0.000010	0.000004	0.33
14	N2	20.000022	0.00012	0.000007	0.06

Figure 4: Deviation (LAB-REF) of 20 g of Loop B circulation

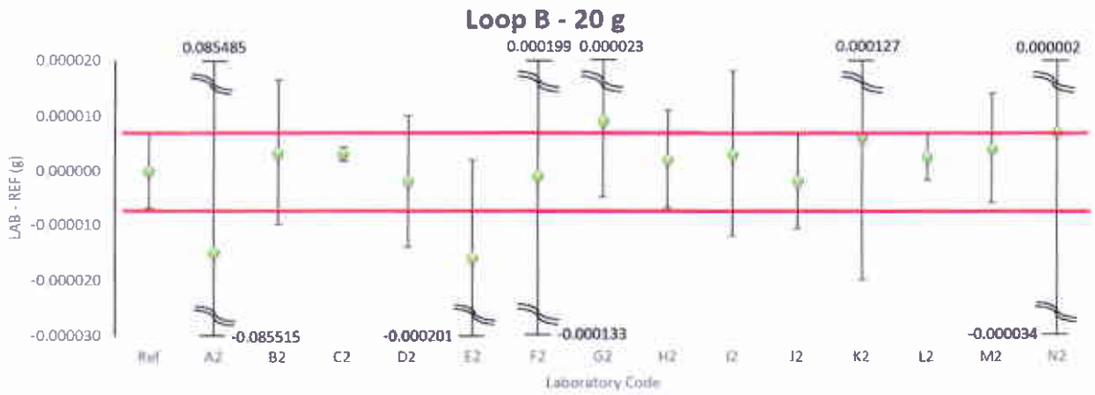


Table 11: Summary of result of APM 027 for Loop B – 2g

NO	CODE	LAB	U_{lab}	LAB-REF	E_n
		g	g	g	
1	A2	2	0.0855	- 0.0000090	0.00
2	B2	2.000011	0.000003262	0.0000020	0.45
3	C2	2.0000070	0.00000075	- 0.0000020	-0.65
4	D2	2.0000057	0.0000050	- 0.0000033	-0.57
5	E2	2.000000	0.000010	- 0.0000090	-0.86
6	F2	2.000014	0.000200	0.0000050	0.02
7	G2	2.0000119	0.0000059	0.0000029	0.44
8	H2	2.0000069	0.0000049	- 0.0000021	-0.37
9	I2	2.000006	0.000008	- 0.0000030	-0.35
10	J2	2.0000069	0.0000043	- 0.0000021	-0.40
11	K2	2.000005	0.000011	- 0.0000040	-0.35
12	L2	2.00000605	0.00000072	- 0.0000029	-0.96
13	M2	2.0000061	0.0000047	- 0.0000029	-0.52
14	N2	2.000057	0.00012	0.0000480	0.40

Figure 5: Deviation (LAB-REF) of 2 g of Loop B circulation

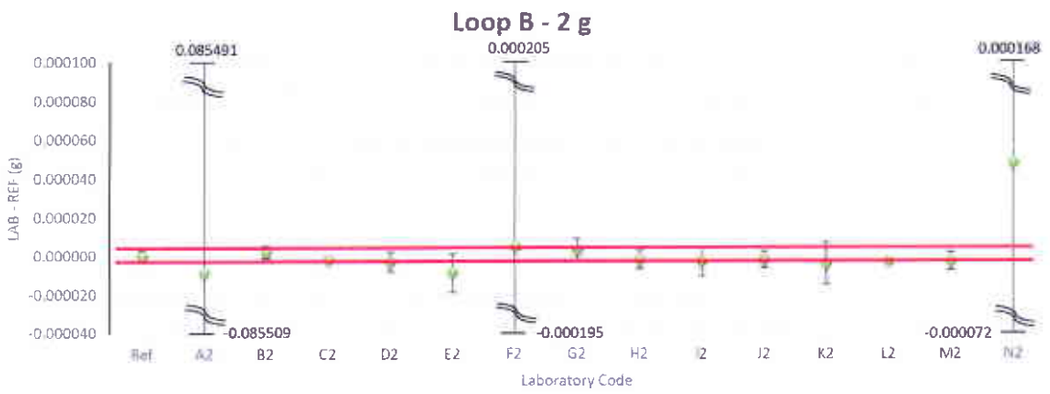
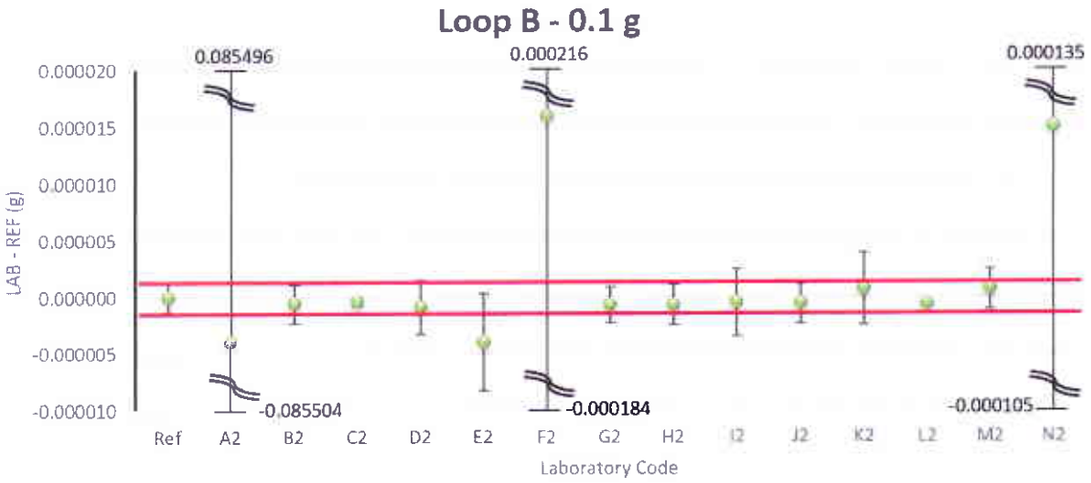


Table 12: Summary of result of APM 027 for Loop B – 0.1g

NO	CODE	LAB	U_{lab}	LAB-REF	E_n
		g	g	g	
1	A2	0.1000	0.0855	- 0.0000040	0.00
2	B2	0.1000034	0.000001715	- 0.0000006	-0.28
3	C2	0.1000036	0.00000040	- 0.0000004	-0.29
4	D2	0.1000031	0.0000024	- 0.0000009	-0.33
5	E2	0.100000	0.0000043	- 0.0000040	-0.89
6	F2	0.100020	0.000200	0.0000160	0.08
7	G2	0.1000033	0.0000016	- 0.0000007	-0.34
8	H2	0.1000033	0.0000018	- 0.0000007	-0.32
9	I2	0.1000035	0.0000030	- 0.0000005	-0.15
10	J2	0.1000034	0.0000018	- 0.0000006	-0.27
11	K2	0.1000047	0.0000032	0.0000007	0.20
12	L2	0.10000337	0.00000026	- 0.0000006	-0.48
13	M2	0.1000047	0.0000018	0.0000007	0.32
14	N2	0.100019	0.00012	0.0000150	0.12

Figure 6: Deviation (LAB-REF) of 0.1 g of Loop B circulation



9. Performance of participants

The table 7 to 12 of E_n number shows an overall good performance by the majority of participating laboratories. In this interlaboratory comparisons program, a total of 84 measurement results were reported by 28 participants.

The data from the reference laboratory and the participant laboratories do not show any problem which might affect the overall evaluation of the result. Therefore, it is assumed that circulation of artifacts has been appropriately completed and the stability of artifacts during circulation was acceptable.

Circulation Loop A
Fourteen laboratories participate in this loop. Two laboratories get "unsatisfactory" performance with detail as follows:

- laboratory code L1 has $|E_n| > 1$ for all nominal values
- laboratory code G1 has $|E_n| > 1$ for 0.1 g

Those laboratories are encouraged to review their procedures.

Circulation Loop B
Fourteen laboratories participate in this loop. None of them get "unsatisfactory" performance.

There are some laboratories, even though get "satisfactory" performance either in loop A or loop B, reported relatively high uncertainty for all nominal values e.g H1, A2, F2, N2.

10. Corrective Actions

In general, details of corrective action were not requested for this interlaboratory comparison. Values of $|E_n| > 1$ require investigation and corrective action by the participating laboratory. The Laboratory's accreditation body needs to ensure that the problem has been rectified and procedures have been put in place to prevent a recurrence.

11. References

(1) APLAC PT 001: APLAC Calibration Interlaboratory Comparisons, 2008.

(2) ISO 13528: Statistical Methods for Use in Proficiency Testing by Interlaboratory Comparisons, 2015.

(3) ISO/IEC 17043: Conformity assessment — General requirements for proficiency testing, 2010.

(4) ISO/IEC Guide 98-3:Uncertainty of measurement - Part 3: Guide to the expression of uncertainty in measurement, 2008.

(5) OIML R 111-1: Weights of Classes E_1, E_2, F_1, F_2, M_1, M_{1-2}, M_2, M_{2-3} and M_3, Part 1: Metrological and technical requirements, 2004.

APPENDIX A

APLAC INTERLABORATORY COMPARISON M027 – Calibration of E2 Weights

INSTRUCTIONS TO ACCREDITATION BODIES

1. EQUIPMENT

On receipt, unpack the artefacts and inspect them for any defects. *List other specific checks.*

Complete the attached "*RECEIPT FORM*" and fax to the organising body.

Please note, these instructions and attached *Result Sheet* are master copies and must remain in the box from country to country. The participating accreditation body should make copies for distribution to the participating laboratories in their country.

2. TRANSPORT

The artefacts can be carried by hand, car or by plane, whatever is considered the safest way.

3. CUSTOMS

NO ATA Carnet is provided with these artifacts. A *Declaration to Customs Officials and Shipping Agents* is enclosed in the plastic envelope attached to the outside of the box. Please make it is in place before dispatching to the next country otherwise it will not pass through their Customs authorities. Please attach 3 extra photocopies of the *Declaration*.

4. MEASUREMENTS TO BE CARRIED OUT

Please refer to *INSTRUCTIONS TO LABORATORIES* enclosed. If necessary, these should be translated into the appropriate language by the accreditation body.

5. CIRCULATION SCHEME

At the beginning and at the end of the circulation scheme, measurements will be performed by The Research Center for Calibration, Instrumentation and Metrology – The Indonesian Institute of Sciences (Puslit KIM-LIPI) asthe reference laboratory.

It is the responsibility of the accreditation body to make sure that the artifacts are dispatched to the next participant by the date specified. Two weeks have been allowed for each international transport and customs clearance. If a delay occurs with one laboratory then the number of participating laboratories in that country will have to be reduced so that the artifacts leave by the scheduled date. When ready for dispatch, fill in the attached *DISPATCH FORM* and email to the next participant and to The National Accreditation Body of Indonesia (KAN).

6. DOCUMENTS TO BE SUBMITTED

Within one week of the completion of the measurements, participating laboratories are required to email the *Result Sheet* to their accreditation body. No other documentation is required. The accreditation body is required to ensure that the *Result Sheet* has been filled in correctly and completely. The accreditation body should provide details of any problems that their laboratories had. The accreditation body is required to email the documentation to the organizing body within two weeks of dispatching the artifacts.

On receipt of the information, the organizing body for this APLAC interlaboratorycomparison, will prepare interim reports on each laboratory which are then sent back to the participating accreditation body. A final report will be issued at the end of the program with each laboratory only identified by a **confidential** code number.

7. GENERAL INFORMATION

For general queries, please contact:

Anang Wahyu Setiawan (Mr)
National Accreditation Body, Indonesia (KAN) Manggala Wanabakti Building Block IV – 4th floor Jl. Jendral Gatot Subroto, Senayan – Jakarta Indonesia; tel +62 21 5747043; facs +62 21 5747045 ;email : anang@bsn.go.id cc: anangws@gmail.com

APLAC INTERLABORATORY COMPARISON
M027 – Calibration of E2 Weights
INSTRUCTIONS TO LABORATORIES

1. EQUIPMENT

A metal case containing :

1. A stainless steel mass standard marked 20 g
2. A stainless steel mass standard marked 2 g
3. A stainless steel mass standard marked 100 mg
4. A pair of plastic tweezers
5. A pair of gloves

On receipt, unpack the artefacts and inspect them for any defects.

Contact your accreditation body if there is any damage.

The standards should only be manipulated with the supplied tools. They should not be touched with bare hands

A visual inspection of the surfaces of all weights should be made and observations noted on the corresponding paper sheet. The participating laboratory should be informed after the arrival of the set of masses and the results of the visual inspection of the weights and the other relevant items as soon as possible by e-mail or fax message.

The weights should be stored in well-controlled environmental conditions and they should be protected from dust, aerosols and vapors whenever they are not inside the balance before use.

2. MEASUREMENTS TO BE CARRIED OUT

The participating laboratory shall determine the mass of every weight in the set. Before determining the mass of each weight, dust particles should be removed from the surface of the weight using a soft brush. No washing or wiping should be performed.

The participating laboratory are asked to carry out the calibration of these artifacts (determination of conventional mass of weights) by comparison method or by their documented procedures. Please also provide descriptions of the procedures used for the calibration.

Measurement of density of these artifacts is not required. All artifacts are assumed to fulfill the density range of OIML R111 E2 class.

3. DOCUMENTS TO BE SUBMITTED

Within one week of the completion of the measurements, participating laboratories are required to send the attached Result Sheet. No other documents are required. Laboratories should make a copy of the *Result Sheet* for their own records.

Uncertainties shall be calculated using the method in the ISO *Guide to the Expression of Uncertainty in Measurement. Uncertainties shall be reported in the expanded uncertainties with the level of confidence of approximately 95 %.*

A final report will be issued at the end of the program with each laboratory only identified by a **confidential** code number.

4. GENERAL INFORMATION

For general queries, please contact your accreditation body. Additional information may be obtained from:

Anang Wahyu Setiawan (Mr)
National Accreditation Body, Indonesia (KAN)
Manggala Wanabakti Building Block IV – 4th floor
Jl. Jendral Gatot Subroto, Senayan – Jakarta
Indonesia; tel +62 21 5747043; facs +62 21 5747045; email: anang@bsn.go.id cc : anangws@gmail.com

APLAC INTERLABORATORY COMPARISON
M027 – Calibration of E2 Weights

RESULT SHEET

Laboratory name : _____

Date of measurement : _____

Name of accreditation body : _____

1. Calibration Results

Measurement results :

20 g, 2 g, 100 mg – conventional only as density is assumed to be 8000 kg/m^3

Nominal value	Conventional mass *m*	Expanded Uncertainty in level of confidence of approximately 95% U_{95}	Coverage factor k	Uncertainties in the accredited scope	No. of measurements cycles
20 g					
2 g					
100 mg					

If the reported uncertainty is different from the uncertainties in the accredited scope, please explain the reason below.

Environmental data during calibration (state the maximum and minimum values of temperature, humidity and pressure during measurements)

	Temperature (°C)	Pressure (Pa)	Relative humidity (%)	Air density (kg·m^{-3}).
max				
min				

2. Uncertainty Budget

The uncertainty shall be estimated and combined following the JCGM 100 (2008).

Example :

Component	Uncertainty Contribution (in mg)		
	20 g	2 g	100 mg
Reference standard			
Instability of reference standards			
Weighing process (repeatability)			
Resolution of mass comparator			
Sensitivity of balance			
Bouyancy			
.....			
u_c			
Effective degrees of freedom			

3. Details of Balances Used for Calibration

Manufacturer	Type	Maximum load	Resolution	Standard Deviation	Manual/Automatic

4. Details of instruments used for air density determination

	Manufacturer	Type	Range	Resolution	Expanded Uncertainty (95 %)
Temperature					
Humidity					
Pressure					

5. Traceability

Insert the standards including additional weights used for thecalibration and their traceability.

Identification	Mass *m*	Uncertainty $U_{95\%}$	Volume *V*	Uncertainty U_V	Calibration date

6. Record of the surface of the artifacts

Top Surface 

Rolled out side 

Base Surface 

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RECEIPT FORM
APLAC INTERLABORATORY COMPARISON
M027 – Calibration of E2 Weights

In order to monitor the progress of the interlaboratory comparison, we kindly ask each accreditation body, on receipt of the artifacts, to fill in this RECEIPT FORM and email it to:

Sugeng Raharjo (Mr)
National Accreditation Body, Indonesia (KAN)
BPPT I Building, Jl. MH Thamrin No. 8 – Jakarta Pusat
Indonesia; tel +62 21 3927422; fax +62 21 3927528; email: sugeng@bsn.go.id cc : anangws@gmail.com , ahmad_fahmi@bsn.go.id

Thank you in advance for your cooperation.

The M027 – Calibration of E2 Weight artefacts were received on: _____ *(date)*

After inspection, are the contents damaged? _____ *(yes/no)*

If yes, is this serious? _____ *(yes/no)*

Are the contents still suitable for use? _____ *(yes/no)*

Was there a "*Declaration to Customs Officials and Shipping Agents*" enclosed in the plastic envelope attached to the outside of the case? _____ *(yes/no)*

Remarks: _____

_____

_____

_____

Participating accreditation body:

Contact person:

Fax:

DISPATCH FORM
APLAC INTERLABORATORY COMPARISON
M027 – Calibration of E2 Weights

In order to monitor the progress of the interlaboratory comparison, we kindly ask each
accreditation body, on dispatch of the artifacts, to fill in this DISPATCH FORM and email it to:

Anang Wahyu Setiawan (Mr) National Accreditation Body, Indonesia (KAN) ManggalaWanabakti Building Block IV – 4th floor Jl. Jendral Gatot Subroto, Senayan – Jakarta Indonesia; tel +62 21 5747043; facs +62 21 5747045 ; email: anang@bsn.go.id cc: anangws@gmail.com

And **also** email it to the next participating accreditation body :

Name:	*proficiency contact*
Accreditation body:	
Email:	
Fax :	

Please ensure that the "*Declaration to Customs Officials and Shipping Agents*" is attached to
the outside of the case. Thank you in advance for your cooperation.

The M027 – Calibration of E2 Weightartefacts were dispatched on: *(date)* _____

The artefacts have been inspected after return from our laboratories and were found to be in good condition. _____
(yes/no)

Please give details of any problems: _____

_____

_____

Shipping _____ Phone: _____ Fax: _____

agent: _____ _____ _____

Airwaybill no. (or consignment note no.): _____

Your accreditation body: _____

Contact person: _____ Fax: _____