



**Asia Pacific Laboratory Accreditation Cooperation**

## **APLAC M023 - RELATIVE HUMIDITY**

**CALIBRATION OF  
RELATIVE HUMIDITY 10 %rh TO 90 %rh AT NOMINAL  
TEMPERATURE OF 23 °C**

## **MEASUREMENT INSTRUCTIONS**

**June 2008**

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## APLAC M023

### APLAC M023 CALIBRATION OF RELATIVE HUMIDITY 10 %rh TO 90 %rh AT NOMINAL TEMPERATURE OF 23 °C

#### 1. Introduction

The purpose of APLAC M023 Relative Humidity Measurement Proficiency Testing Programme is to compare the calibration results of accredited laboratories within APLAC in the field of Relative Humidity measurement. Two different relative humidity and temperature sensor of the same model will be used in a circulation, among the accredited laboratories of the APLAC members.

#### 2. Coordinator

The coordinator of this PT Programme is the Department of Standards Malaysia. The complete information is as follows:

STANDARDS MALAYSIA  
Century Square,  
Level 1 & 2, Block 2300,  
Jalan Usahawan,  
63000 Cyberjaya, Selangor  
MALAYSIA

**Contact person for**  
Department of Standards Malaysia

Ms. Siti Mariam Mohd Din  
Tel: +60 3 8319 1308  
Fax : +60 3 8318 9339  
E-mail: [mariam@standardsmalaysia.gov.my](mailto:mariam@standardsmalaysia.gov.my)

**Alternative contact person**

Mr. Ahmad Razif Bin Abd. Rahim  
Tel : +60 3 8319 1400  
Fax : +60 3 8318 9339  
E-mail : [razif@standardsmalaysia.gov.my](mailto:razif@standardsmalaysia.gov.my)

### 3. Reference Laboratory

The reference values for the Relative Humidity measurement will be provided by the National Metrology Laboratory, SIRIM Berhad, (NML-SIRIM), Malaysia. Complete information on NML-SIRIM is as follows:

National Metrology Laboratory  
SIRIM Berhad  
Lot PT 4803, Bandar Baru Salak Tinggi  
43900 Sepang  
MALAYSIA

#### *Contact person for NML-SIRIM*

Ms. Faridah Hussain  
Tel: +60 3 8778 1735  
Fax : +60 3 8778 1661  
E-mail: faridah\_hussain@sirim.my

### 4. Artefact

Each accredited laboratories will be provided with one relative humidity and temperature transmitter with digital indicator. Each device comes with one sensor, each measuring temperature and relative humidity. It will be shipped together with an operation manual. Details of the artefact are as below:

Artefact	Measurement Temperature (°C)	Manufacturer	Model	Serial Number
A	23 °C	Vaisala	HMT330	C4510044
B	23 °C	Vaisala	HMT330	C4510045
C	23 °C	Vaisala	HMT330	C4510046
D	23 °C	Vaisala	HMT330	C4510047

### 5. Calibration Procedure

During the calibration, the artefacts should be supplied with 240 V  $\pm$  10%, 50 Hz. Measurements will be performed using the Laboratory's own procedures, within the following constraints:

All laboratories should refer to the operating manuals for instructions and precautions for using the artefacts. These instructions shall be read in full and if in doubt on any of the aspects, the laboratory shall contact the reference laboratory. In the case of any unexpected instrument failure at a participant laboratory, the reference laboratory should be informed in order to revise the schedule, if necessary, as early as possible.

- Measurements shall be performed for increasing values of relative humidity.
- No adjustments shall be performed on the artefacts.
- The artefact used in this comparison must **not be** modified, adjusted, or used for any purpose other than described in this document, nor given to any party other than the participants in the comparison.

## 5.1 Measurement at 23 °C

### Equipment:

- Artefact A,B,C,D
  - Laboratory relative humidity and temperature standard
  - Laboratory relative humidity and temperature calibration chamber
1. The artefact shall be left in the nominal ambient conditions of the laboratory for a minimum period of 3 hours before taking any measurement.
  2. Place the sensor of the artefact in a relative humidity and temperature calibration chamber together with the laboratory relative humidity and temperature standards. Refer to Set-up diagram in Figure 1.

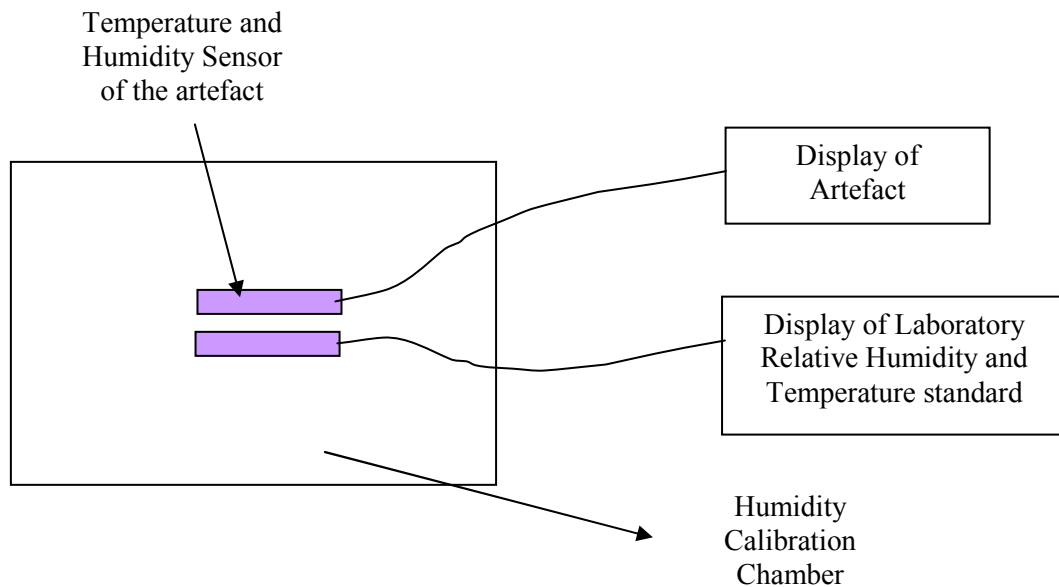


Figure 1: Schematic diagram set-up for calibration

3. For checking purposes of the artefact before calibration, set the relative humidity and temperature calibration chamber to **50 %rh** at **23 °C**. Take the measured data for standard used and the artefact using **Appendix F1**.
4. Then perform measurement at the nominal value within the Laboratory's scope of accreditation at nominal temperature of **23 °C**.

5. Nominal values to be measured: **10 %rh, 30 %rh, 50 %rh, 70 %rh and 90 %rh**. Measurement should be made in **rising order** of relative humidity.
6. At each generated condition a time of not less than 60 minutes should be allowed for the relative humidity to equilibrate. A set of **10** readings at **1 minute interval** should be recorded from the laboratory standard and artefact.
6. Once again after completed all measurement points, set the relative humidity and temperature calibration chamber to **50 %rh at 23 °C**. Take the measured data for standard used and the artefact using **Appendix F2**.

## 6. Environmental Conditions

Assure that the calibration ambient temperature is stable and within 18 °C to 28 °C and the ambient relative humidity is less than 80 %.

The actual environmental conditions during calibration should be reported.

## 7. Reporting of calibration results

Please refer to the table below for the details of results submission.

Document	When to be submitted	Submitted to whom
Completed proforma result sheets (Appendix F1-7)	<b>Within 2 weeks after completing the calibration</b>	Participating Laboratory Accreditation Body (AB) for forwarding to STANDARDS MALAYSIA
Completed laboratory's budgets for estimating the uncertainty of measurement. Please refer to Appendix G for the template of estimating uncertainty of measurement.		

## 8. Analysis of results

The reference laboratory will analyze the results and produce interim and final reports in consultation with the STANDARDS MALAYSIA.

## **Appendix A**

### **Instructions to Accreditation Bodies**

#### **APLAC PROFICIENCY TESTING PROGRAMME M023 – RELATIVE HUMIDITY MEASUREMENT**

**1. EQUIPMENT**

On receipt, unpack the audit pack and inspect the artefact for any defects. *List other specific checks.*

Complete the attached "*RECEIPT FORM*" and fax to STANDARDS MALAYSIA.

Please note, these instructions and attached *Result Sheet* are master copies and must remain in the box from country to country. The national 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 means of transportation considered as safe.

**3. CUSTOMS**

**NO** ATA Carnet is provided with these artefacts. A *Declaration to Customs Officials and Shipping Agents* is enclosed in the plastic envelope attached to the outside of the box. Please make sure 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 *TECHNICAL INSTRUCTIONS TO LABORATORIES* enclosed. If necessary, these should be translated into the appropriate language by the accreditation body.

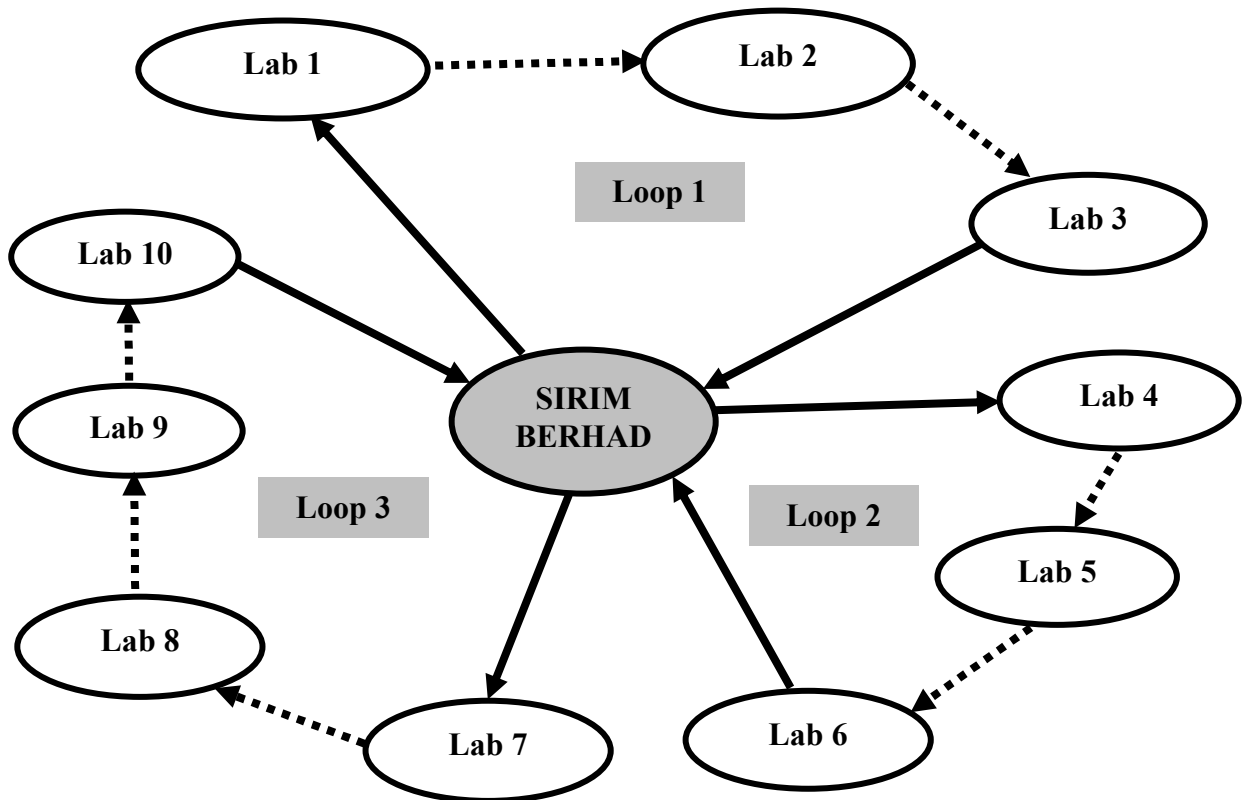
**5. CIRCULATION SCHEME**

At the beginning, middle and at the end of the circulation scheme, measurements will be performed by the reference laboratory, National Metrology Laboratory, Malaysia. Four units of artefact; A, B, C, D will be used to cover four (4) parallel scheme.

Each laboratory will be given 1(one) weeks to perform measurement. It is the responsibility of the accreditation body to make sure that the artefact is 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 artefact leave by the scheduled date. When ready for dispatch, fill in the attached *DISPATCH FORM* and fax to the next participant and to Department of Standards Malaysia.

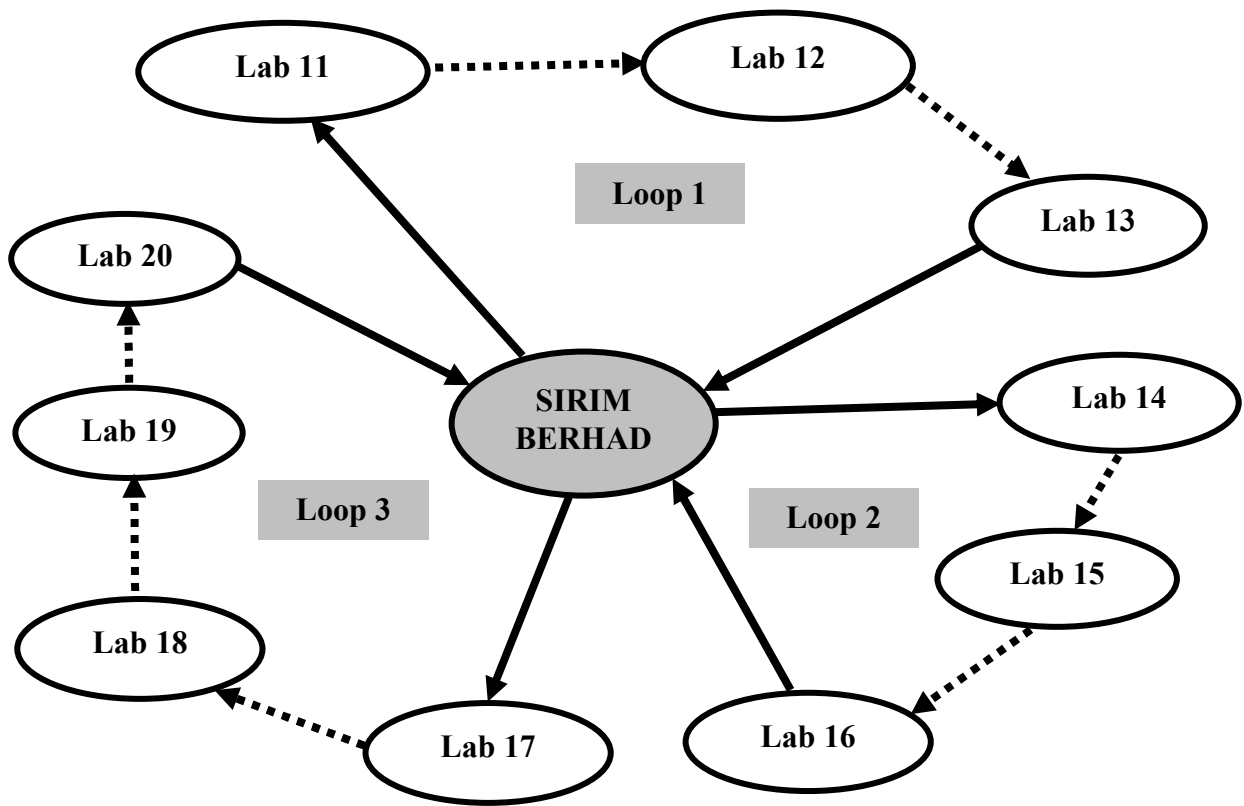
CIRCULATION SCHEME FOR TRAVELLING ARTEFACT

SCHEME A  
ARTEFACT A

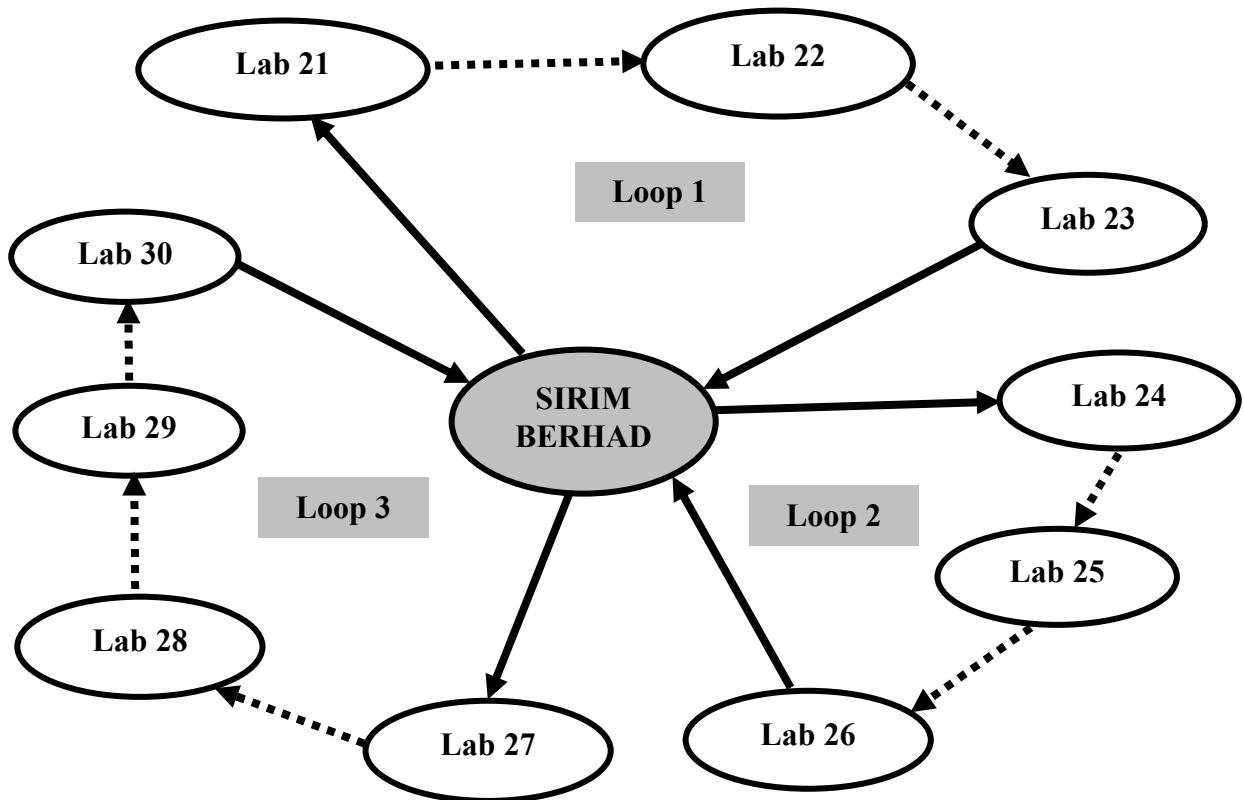




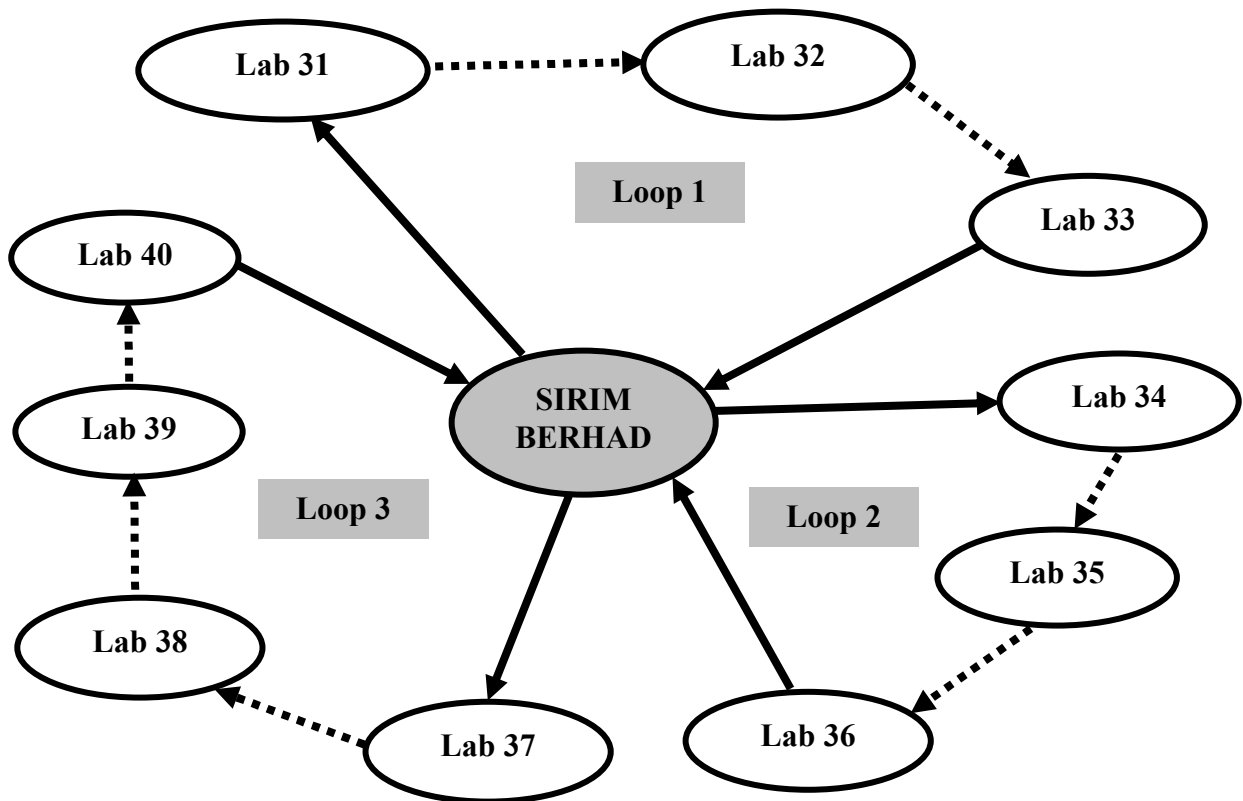
**SCHEME B**  
**ARTEFACT B**



**SCHEME C**  
**ARTEFACT C**



**SCHEME D**  
**ARTEFACT D**



## 6. DOCUMENTS TO BE SUBMITTED

Within two week of the completion of the measurements, participating laboratories are required to fax or send the *Result Sheet* together with their formal calibration report to their accreditation body. 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 fax the documentation to the organising body within two weeks of dispatching the artefact.

On receipt of the information, the organising body for this APLAC proficiency testing programme will prepare interim reports on each laboratory which are then sent back to the national 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:

STANDARDS MALAYSIA  
Century Square,  
Level 1 & 2, Block 2300,  
Jalan Usahawan,  
63000 Cyberjaya, Selangor  
MALAYSIA

Attention: Ms. Siti Mariam Mohd Din  
Tel: +60 3 8319 1308  
Fax : +60 3 8318 9339  
E-mail: [mariam@standardsmalaysia.gov.my](mailto:mariam@standardsmalaysia.gov.my)

Alternative contact person :

Mr. Ahmad Razif Bin Abd. Rahim  
Tel : +60 3 8319 1400  
Fax : +60 3 8318 9339  
E-mail : [razif@standardsmalaysia.gov.my](mailto:razif@standardsmalaysia.gov.my)

## Appendix B Receipt Form

### APLAC PROFICIENCY TESTING PROGRAMME M023 – RELATIVE HUMIDITY MEASUREMENT

In order to monitor the progress of the PT Programme, we kindly ask each accreditation body, on receipt of the artefact, to fill in this RECEIPT FORM and fax it to:

STANDARDS MALAYSIA  
Century Square,  
Level 1 & 2, Block 2300,  
Jalan Usahawan,  
63000 Cyberjaya, Selangor  
MALAYSIA

**Attention:** Ms. Siti Mariam Mohd Din  
Fax : +60 3 8318 9339  
e-mail: [mariam@standardsmalaysia.gov.my](mailto:mariam@standardsmalaysia.gov.my)

**Alternative contact person :**  
Mr. Ahmad Razif Bin Abd. Rahim  
Fax : +60 3 8318 9339  
E-mail : [razif@standardsmalaysia.gov.my](mailto:razif@standardsmalaysia.gov.my)

Thank you in advance for your cooperation.

The M023 artefact, serial number \_\_\_\_\_ was 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: \_\_\_\_\_

e-mail: \_\_\_\_\_ Tel: \_\_\_\_\_

## Appendix C Dispatch Form

### APLAC PROFICIENCY TESTING PROGRAMME M023 – RELATIVE HUMIDITY MEASUREMENT

In order to monitor the progress of the PT Programme, we kindly ask each accreditation body, on dispatch of the artefact, to fill in this DISPATCH FORM and fax it to:

STANDARDS MALAYSIA  
Century Square,  
Level 1 & 2, Block 2300,  
Jalan Usahawan,  
63000 Cyberjaya, Selangor  
MALAYSIA

***Attention:***

Ms. Siti Mariam Mohd Din  
Fax : +60 3 8318 9339  
e-mail: mariam@standardsmalaysia.gov.my

***Alternative contact person :***

Mr. Ahmad Razif Bin Abd. Rahim  
Fax : +60 3 8318 9339  
E-mail : razif@standardsmalaysia.gov.my

and **also** fax it to the next participating accreditation body :-

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 M023 artefact, serial number \_\_\_\_\_ was dispatched on: \_\_\_\_\_ (*date*)

The artefact has been inspected after return from our laboratories and were found to be in good condition. \_\_\_\_\_ (*yes/no*)

Please give details of any problems:-

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Shipping agent: \_\_\_\_\_ Phone: \_\_\_\_\_ Fax: \_\_\_\_\_

Airwaybill no. (or consignment note no.): \_\_\_\_\_

Your accreditation body: \_\_\_\_\_

Contact person: \_\_\_\_\_ Fax: \_\_\_\_\_

e-mail: \_\_\_\_\_ Tel: \_\_\_\_\_

## Appendix D Instructions to Laboratories

### APLAC PROFICIENCY TESTING PROGRAMME M023 – RELATIVE HUMIDITY MEASUREMENT

#### 1. Equipment

The contents of the audit pack are as follows:

Item No.	Unit	Description
1.	1	Temperature and Humidity Transmitter, Brand Vaisala, Model HMT330, S/No.C4510044 or C4510045 or C4510046 or C4510047
3.	1	User's Guide
4.	1	Circulation Schedule
5.	1	Measurement Instructions, consisting of the following: <ul style="list-style-type: none"><li>a) Technical Instruction to laboratories</li><li>b) Result sheets</li><li>c) Instructions to laboratories</li></ul>



**Figure 2:** Photo of the artefact

## 2. On Receipt

On receipt, unpack the audit pack and inspect the artefact for any defects.

Read the following instructions before starting the measurement.

1. Please handle artefact with care.
2. Do not tamper with or adjust the test artefact.
3. Notify the local AB of any damage or erratic operation of the test artefact as soon as possible.

## 3. Measurement Considerations for the Artefact

Power up the artefact using 240 VAC, 50 Hz supply from the mains.

Refer to **Technical Instruction to Laboratories** for the details of measurement to be performed.

## 4. Completion of measurements

Upon completion of required measurement, the laboratories are required to inform the respective accreditation body in the country.

## 5. Documents to be submitted

Within two weeks of the completion of the measurements, participating laboratories are required to send the attached *Result Sheet* (**Appendix A, B, C, D, E, F1 to F7, G**) and the calibration report to the respective accreditation body. Laboratories are strongly advised to make a copy of the *Result Sheet* for record keeping and future reference purposes.

In addition to the above, participating laboratories are required to submit uncertainty budgets which are prepared in accordance with the ISO *Guide to the Expression of Uncertainty in Measurement*. See **Appendix G** for the template of the uncertainty budget table. **Participating laboratories are required to prepare uncertainty budget table for each calibration point.**

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



## 6. General Information

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

STANDARDS MALAYSIA  
Century Square,  
Level 1 & 2, Block 2300,  
Jalan Usahawan,  
63000 Cyberjaya, Selangor  
MALAYSIA

Attention: Ms. Siti Mariam Mohd Din  
Tel: +60 3 8319 1308  
Fax : +60 3 8318 9339  
E-mail: [mariam@standardsmalaysia.gov.my](mailto:mariam@standardsmalaysia.gov.my)

Alternative contact person :

Mr. Ahmad Razif Bin Abd. Rahim  
Tel : +60 3 8319 1400  
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E-mail : [razif@standardsmalaysia.gov.my](mailto:razif@standardsmalaysia.gov.my)

## Appendix E

### LABORATORY DETAILS

M023 

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For official use only

Name of laboratory	
Measurement Date	From _____ to _____
Mains Power Supply	_____ VAC $\pm$ _____ VAC, _____ Hz
Ambient Temperature ( $^{\circ}$ C)	_____ $^{\circ}$ C $\pm$ _____ $^{\circ}$ C
Ambient Relative Humidity (%)	_____ % $\pm$ _____ %
Laboratory Reference Standard	Description: Maker: Model: Serial no.: Calibration due date :
Laboratory Humidity calibration chamber	Description: Maker: Model: Serial no.:

**Appendix F1**

**RESULT SHEET**

**Measurement point: 50 %rh at 23 °C**

**BEFORE CALIBRATION**

	Corrected value of Laboratory Standard (%rh)	Corrected value of Laboratory Standard t, (°C)	Indicated value of Artefact ———— (%rh)	Indicated value of Artefact ———— t, (°C)
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
Average				
Std dev.				

Name of the Laboratory : \_\_\_\_\_

Date of Measurement : \_\_\_\_\_

Environment of the Laboratory : Temperature : (\_\_\_\_ ± \_\_\_\_ ) °C

Humidity : (\_\_\_\_ ± \_\_\_\_ ) %rh

## Appendix F2

### RESULT SHEET

Measurement point: 50 %rh at 23 °C

#### AFTER CALIBRATION

	Corrected value of Laboratory Standard (%rh)	Corrected value of Laboratory Standard t, (°C)	Indicated value of Artefact ———— (%rh)	Indicated value of Artefact ———— t, (°C)
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
Average				
Std dev.				

Name of the Laboratory : \_\_\_\_\_

Date of Measurement : \_\_\_\_\_

Environment of the Laboratory : Temperature : (\_\_\_\_ ± \_\_\_\_ ) °C

Humidity : (\_\_\_\_ ± \_\_\_\_ ) %rh

### Appendix F3

#### RESULT SHEET

ARTEFACT \_\_\_\_\_

Measurement point: 10 %rh at 23 °C

Nominal value 10%	Corrected value of Laboratory Standard (%rh)	Corrected value of Laboratory Standard t, (°C)	Indicated value of Artefact (%rh)	Indicated value of Artefact t, (°C)
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
Average				
Std dev				

Calibrated By:

Checked By:

Date:

Date:

**Appendix F4**

**RESULT SHEET**

**ARTEFACT \_\_\_\_\_**

**Measurement point: 30 %rh at 23 °C**

Nominal value 30%	Corrected value of Laboratory Standard (%rh)	Corrected value of Laboratory Standard t, (°C)	Indicated value of Artefact (%rh)	Indicated value of Artefact t, (°C)
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
Average				
Std dev				

Calibrated By:

Checked By:

Date:

Date:

**Appendix F5**

**RESULT SHEET**

**ARTEFACT \_\_\_\_\_**

**Measurement point: 50 %rh at 23 °C**

Nominal value 50%	Corrected value of Laboratory Standard (%rh)	Corrected value of Laboratory Standard t, (°C)	Indicated value of Artefact (%rh)	Indicated value of Artefact t, (°C)
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
Average				
Std dev				

Calibrated By:

Checked By:

Date:

Date:

## Appendix F6

### RESULT SHEET

ARTEFACT \_\_\_\_\_

Measurement point: 70 %rh at 23 °C

Nominal value 70%	Corrected value of Laboratory Standard (%rh)	Corrected value of Laboratory Standard t, (°C)	Indicated value of Artefact (%rh)	Indicated value of Artefact t, (°C)
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
Average				
Std dev				

Calibrated By:

Checked By:

Date:

Date:



**Appendix F7**

**RESULT SHEET**

**ARTEFACT \_\_\_\_\_**

**Measurement point: 90 %rh at 23 °C**

Nominal value 90%	Corrected value of Laboratory Standard (%rh)	Corrected value of Laboratory Standard t, (°C)	Indicated value of Artefact (%rh)	Indicated value of Artefact t, (°C)
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
Average				
Std dev				

Calibrated By:

Checked By:

Date:

Date:

## Appendix G

### Template for Uncertainty Budget Table

Calibration Point: .....

Quantity	Value	Divisor	Standard Uncertainty	Probability Distribution	Degree of Freedom	Sensitivity Coefficient	Uncertainty Contribution
$X_i$	$x_i$		$u(x_i)$		$\nu_i$	$c_i$	$u_i(y)$

#### Result

Average Value = \_\_\_\_\_ %rh

Relative Combined Uncertainty,  $u_c(y)$  = \_\_\_\_\_ %rh

Effective degrees of freedom,  $\nu_{\text{eff}}$  = \_\_\_\_\_

Coverage factor,  $k$  = \_\_\_\_\_

Relative Expanded Uncertainty,  $k \times u_c(y)$  = \_\_\_\_\_ %rh

Notes:

- (Add any comments here)