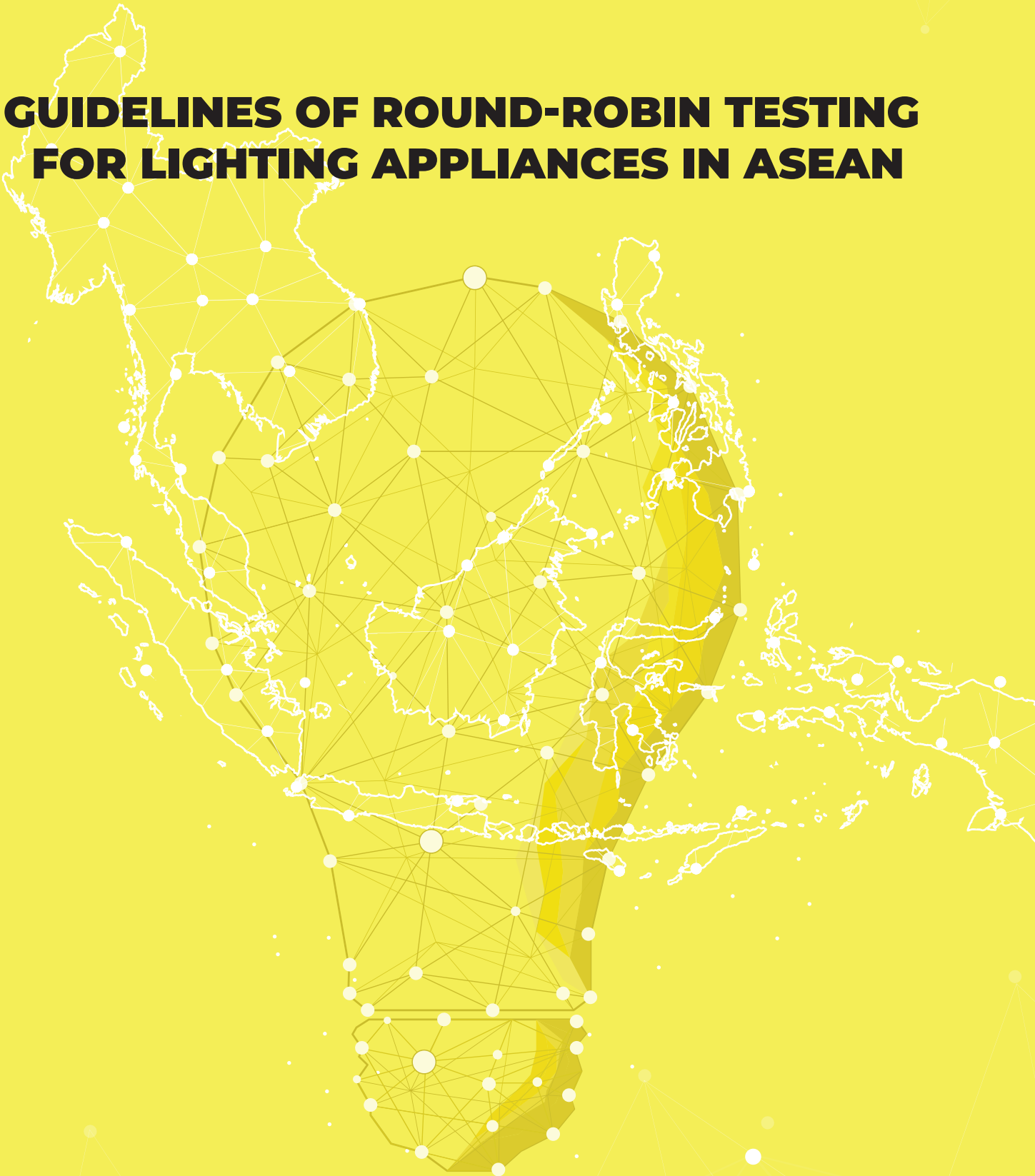
GUIDELINES OF ROUND-ROBIN TESTING FOR LIGHTING APPLIANCES IN ASEAN



2025

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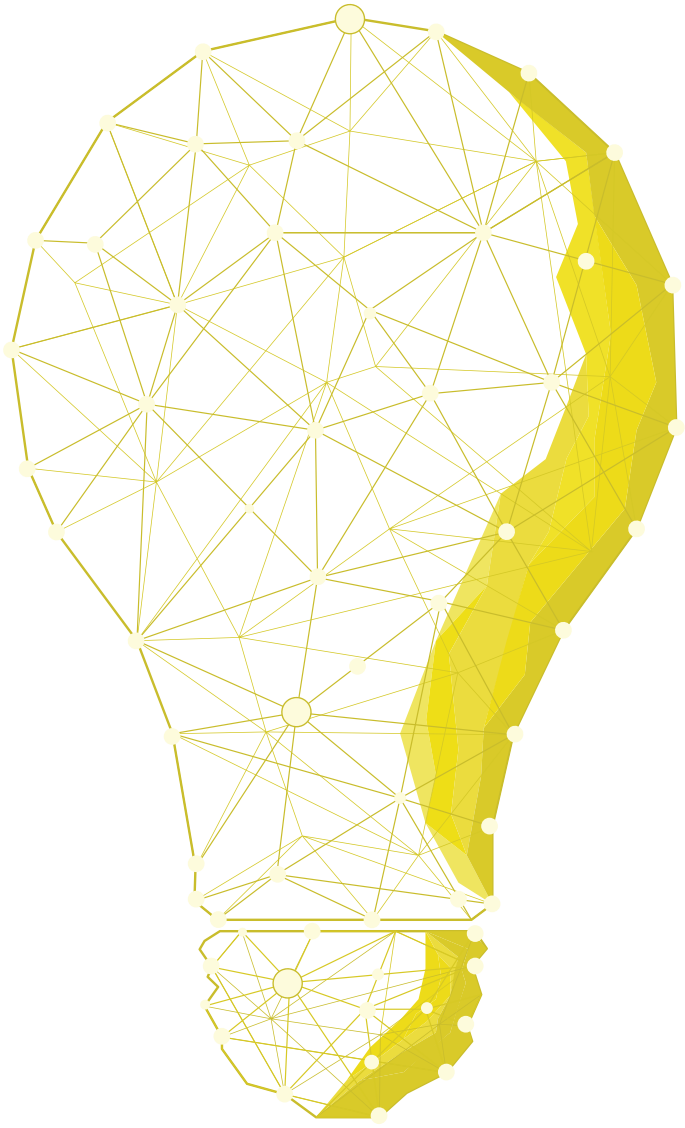

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ASEAN Centre for Energy
May 2025

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Established on 1 January 1999, the ASEAN Centre for Energy (ACE) is an intergovernmental organisation within the Association of Southeast Asian Nations' (ASEAN) structure that represents the 10 ASEAN Member States' (AMS) interests in the energy sector. ACE supports the implementation of the ASEAN Plan of Action for Energy Cooperation (APAEC), a blueprint for better collaboration towards upgrading energy. The Centre is guided by a Governing Council composed of Senior Officials on Energy from each AMS and a representative from the ASEAN Secretariat as an ex-officio member.

The three key roles of the ACE:

- *As a catalyst to unify and strengthen ASEAN energy cooperation and integration by implementing relevant capacity building programmes and projects to assist the AMS develop their energy sector.*
- *As the ASEAN energy data centre and knowledge hub to provide a knowledge repository for the AMS.*
- *As an ASEAN energy think tank to assist the AMS by identifying and surfacing innovative solutions for ASEAN's energy challenges on policies, legal & regulatory frameworks and technologies.*

Keeping the region's energy security, affordability, and sustainability is a fundamental concern of the ASEAN energy sector. Hosted by the Ministry of Energy and Mineral Resources of Indonesia, ACE's office is located in Jakarta, Indonesia. For more information: aseanenergy.org

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This collaborative effort reflects the dedication of a diverse group of organisations and their valuable contributions are truly appreciated.

Forewords

It is with great pleasure to present the Guidelines for Round-Robin Testing (RRT) for Lighting Appliances in ASEAN. These guidelines establish a protocol for the nucleus laboratory and participating laboratories across ASEAN Member States (AMS) to conduct RRT for lighting appliances.

Lighting is a significant contributor to energy consumption in buildings. According to the 8th ASEAN Energy Outlook, the cumulative annual energy costs for lighting in the commercial and residential sectors are projected to surpass USD 58 trillion by 2030. In response, the 42nd ASEAN Ministers on Energy Meeting in 2024 encouraged strengthening national and regional energy efficiency and conservation (EE&C) initiatives, including harmonising appliance standards to help achieve the regional energy intensity target.

As part of the ASEAN Plan of Action for Energy Cooperation (APAEC) Phase II 2016-2025, under the EE&C Programme Area, particularly the Outcome-Based Strategy 1: Expand, Harmonise, and Promote Energy Efficiency Standards and Labelling on Energy-related Products, the harmonisation of MEPS for appliances, including lighting, has been a key priority in advancing our regional energy efficiency goals. Therefore, this RRT aims to support the implementation of the regional policy roadmap for MEPS for lighting by assessing the performance of the testing laboratories.

The ASEAN Centre for Energy (ACE), in collaboration with laboratories across AMS, proudly leads the efforts in conducting RRT for lighting. This guideline, developed with the Center of Industrial Standardisation and Services for Material and Technical Products in Indonesia as the nucleus laboratory, provides a comprehensive framework for the RRT. It outlines the scope of testing parameters, artefact specifications, treatment and circulation methods, testing equipment and procedures, schedules, as well as guidelines for data submission, processing, analysis, confidentiality, and reporting. The guideline aligns with international standards and the Regional Policy Roadmap for MEPS for Lighting, ensuring harmonisation across ASEAN.

I would like to extend my deepest appreciation to the dedicated efforts of our team, the active collaboration of the members of EE&C SSN Working Group on Appliances, and the support from the USAID Smart Power Program. I am confident that this guideline will serve as a cornerstone for future RRT activities, supporting the harmonisation of MEPS policies across ASEAN and ultimately reinforcing our collective goal of creating a more sustainable energy future.

Beni Suryadi
Acting Executive Director
ASEAN Centre for Energy

Table of Content

List of Figure

List of Table

List of Abbreviations

ACE	ASEAN Centre for Energy
APAEC	ASEAN Plan of Action for Energy Cooperation
AMS	ASEAN Member States
ASEAN	Association of Southeast Asian Nations
CIE	*Commission Internationale de l'Eclairage* (International Commission on Illumination)
DUT	Device under Test
EE&C	Energy Efficiency and Conservation
IEC	International Electrotechnical Commission
ISO	International Organization for Standardization
LED	Light-Emitting Diode
OBS	Outcome-Based Strategy
MEPS	Minimum Energy Performance Standards
RRT	Round-Robin Testing
SSN	Sub-Sector Network

1. Background

The implementation of mandatory Minimum Energy Performance Standards (MEPS) for lighting appliances is one of the key priorities for ASEAN countries to promote energy efficiency. The Regional Policy Roadmap for MEPS for Lighting states that by 2023, ASEAN countries aim to implement mandatory MEPS, targeting a minimum efficacy of 80 lm/W for all non-directional Light-Emitting Diode (LED) lamps as well as linear LED and fluorescent lamps within the agreed scope. Aligned with that roadmap, the ASEAN Plan of Action for Energy Cooperation (APAEC) 2016-2025, particularly the Energy Efficiency and Conservation (EE&C) Programme Area under Outcome-Based Strategy (OBS) 1 also aims to harmonise energy efficiency standards and labelling for energy-related products, including lighting appliances. In light of these regional policies, it is essential to conduct Round-Robin Testing (RRT) to harmonise the capabilities of testing laboratories across Southeast Asia.

The RRT is pivotal as it validates the consistency and reliability of established measurement standards. The results of such interlaboratory comparisons are vital for assessing the performance of laboratories in testing lighting products, identifying issues with operations and equipment, evaluating different testing methodologies, and providing educational insights through benchmarking with other facilities.

This guideline serves as a protocol for conducting the RRT for Lighting Appliances in ASEAN. The guidelines outline the scope of testing parameters, participating laboratories, artefact specification, treatment and circulation methods, testing equipment, testing procedure, schedule, data submission, data processing, analysis, reporting, data confidentiality, and contact information. Nucleus laboratory and participating laboratories are required to adhere to this guideline to ensure the conformity of the RRT process. Any deviations or further inquiries should be addressed to the ASEAN Centre for Energy (ACE) and the nucleus laboratory. Adherence to this guideline will ensure a rigorous, standardised approach to testing, fostering improved accuracy and consistency across laboratories in ASEAN.

2. Purpose and Scope

2.1. Objectives

To support the implementation of the regional policy roadmap for MEPS for lighting by assessing the performance of the participating laboratories in testing the energy efficiency parameters for lighting appliances.

2.2. Scope

The testing scope encompasses 3 (three) energy efficiency parameters, as outlined in Table 1, for two variants of lighting appliances, as specified in Table 2.

Table 1. Testing Parameters

No	Testing Parameter	Unit
1.	Luminous flux (Φ)	lumen (lm)
2.	Power consumption (P)	Watt (W)
3.	Luminous efficacy	lm/W

Table 2. Type of Device under Test (DUT)

No.	Device under test (DUT)
1.	Self-ballasted (compact) LED lamps with E27 base and non-directional
2.	Linear (tubular) self-ballasted LED lamps

3. Laboratories

3.1. List of Laboratories

Based on nominations from ASEAN Member States (AMS) and a comprehensive assessment process, 4 (four) testing laboratories have been selected to participate in the RRT for Lighting Appliances in ASEAN, as detailed in Table 3, in accordance with the order of the testing schedule.

Table 3. List of Laboratories

No	Role	Country	Laboratory	Person in Charge
1.	Nucleus Laboratory	Indonesia	Center of Industrial Standardization and Services for Material and Technical Product (B4T)	Dr. Revantino Email: listrik.b4terai@gmail.com
2.	Participating Laboratory	Philippines	Energy Research and Testing Laboratory Services (ERTLS) – Lighting and Appliance Testing Laboratory (LATL)	Mr. Fritz P. Caponong Email: latl@doe.gov.ph
3.	Participating Laboratory	Thailand	Electrical and Electronics Institute (EEI) Foundation for Industrial Development	Mr. Suntipop Janboona Email: suntipopj@thaieei.com
4.	Participating Laboratory	Malaysia	Energy Efficiency Lamp Laboratory, SIRIM QAS International Sdn. Bhd.	Ms. Nor Azlina Muslim Email: zlina@sirim.my

3.2. Roles of Laboratories

3.2.1. Nucleus Laboratory

a) Identify artefacts that are stable (exhibit no performance drift and are robust for transport).
b) Initially determine the known properties of the artefacts from the manufacturer.
c) Prepare the artefacts for testing, ensuring stability and conducting any necessary pre-tests, including the homogenisation and stabilisation tests
d) Conduct pilot testing to assess the applicability of the testing methods.
e) Conduct proficiency testing operations.
f) Distribute the artefacts to the first participating laboratory and receive the artefacts from the last participating laboratory
g) In case of any damage issues, notify the participating laboratories regarding the replacement artefact
h) Process and analyse the testing data submitted by each participating laboratory using appropriate statistical methods.
i) Maintain the confidentiality of the data submitted by each participating laboratory
j) Compare the performance of the participating laboratories
k) Provide technical recommendations to improve
l) Prepare the draft of RRT report

3.2.2. Participating Laboratories

a) Test the artefacts adhering to the Guidelines of RRT for Lighting Appliances in ASEAN
b) Forward the artefacts to the next participating laboratory.
c) Submit the test result to ACE and the nucleus laboratory.
d) Report any arisen disruptions and abnormalities, including artefact damage, to ACE and the nucleus laboratory.

4. Artefact Specification

4.1. Provision of Artefact

The artefacts are provided by a lighting manufacturer capable of producing homogeneous products. Before production, the nucleus laboratory must assess and verify the manufacturer's ability, by following the procedure outlined in the **Clause 6.4 of the ISO/IEC17043:2023 standard**.

4.2. Type of Artefact

4.2.1. Self-Ballasted (Compact) LED Lamps

The nucleus laboratory has prepared 5 (five) identical pieces of self-ballasted (compact) LED lamps with E27 base, each with a nominal power of 10 W, to serve as

the main artefacts and the reserve artefacts. The main artefacts consist of 3 (three) Device under Test (DUT), with the code of **A**, **B**, and **C**.

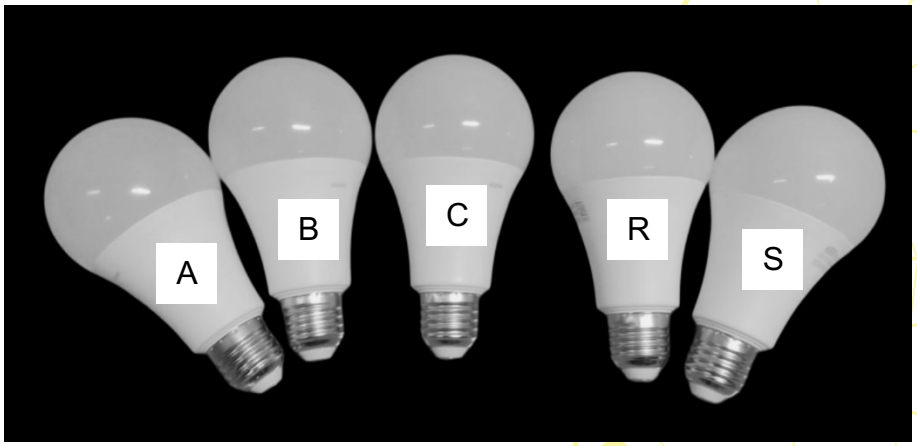

Figure 1. Main Artefacts (A, B, and C) and Reserve Artefacts (R and S)

The reserve artefacts, with the code of **R** and **S**, are to be used only if the main artefact(s) become damaged or malfunctioned, thereby rendering them unsuitable for the RRT activities. In the event of damaged artefact(s), the participating laboratory must report the issue following the procedure detailed in **Section 4.4. Reserve Artefacts.**

4.2.2. Linear (Tubular) Self-Ballasted LED lamps

The nucleus laboratory has prepared 5 (five) identical pieces of linear (tubular) self-ballasted LED lamps, each with a nominal power of 20 W and physical length of 120 cm, to serve as the main artefacts and the reserve artefacts. The main artefacts consist of 3 (three) DUT, with the code of **D**, **E**, and **F**.

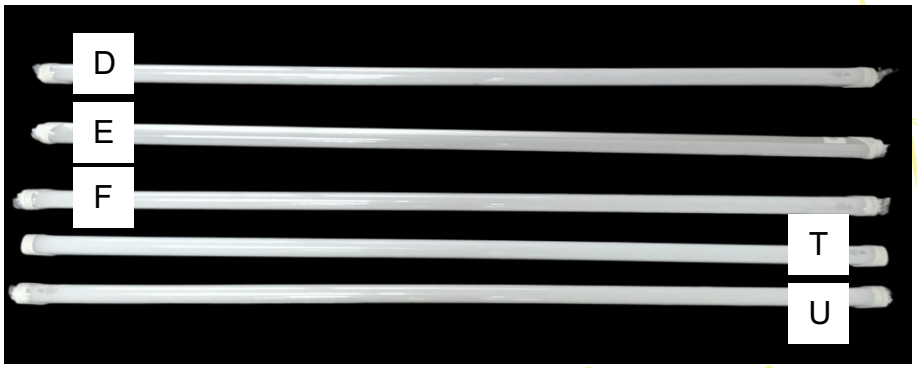

Figure 2. Main Artefacts (D, E, and F) and Reserve Artefacts (T and U)

The reserve artefacts, with the code of **T** and **U**, are to be used only if the main artefact(s) become damaged or malfunctioned, thereby rendering them unsuitable for the RRT activities. In the event of damaged artefact(s), the participating laboratory must report the issue following the procedure detailed in **Section 4.4. Reserve Artefacts.**

4.3. Homogenisation and Stabilisation of Artefact

The nucleus laboratory must conduct a series of tests to ensure the homogenisation and stabilisation of the artefacts before circulating them to participating laboratories. The homogeneity and stability assessment use criteria that ensure that inhomogeneity and instability of proficiency test items do not adversely affect the performance evaluation. The homogenisation and stabilisation procedure must follow the **ISO 13528:2022 standard**.

For the homogenisation test, the nucleus laboratory must analyse 20 (twenty) homogenisation data for both variants of DUT, as outlined in Table 2. The number of proficiency test items included in the homogeneity test may be reduced if suitable data are available from previous homogeneity tests on similar proficiency test items prepared by the same procedures. The homogeneity test result data was processed based on the statistical method stated in the ISO 13528:2022 Annexe C standard "Statistical methods for use in proficiency testing by interlaboratory comparison". The statistical method used in the homogenisation analysis is a robust statistical method. Robust statistical methods can be used to describe the central part of a normally distributed set of results, but without requiring the identification of specific values as outliers and excluding them from subsequent analyses. If the artefacts are declared homogeneous, the next process is to conduct the stabilisation test.

Stabilisation testing aims to ensure that the characteristics of the test object are conveyed to all participants, starting from the test object preparation process to testing in stable conditions. For the stabilisation test, the nucleus laboratory must analyse 6 (six) stabilisation data for both variants of DUT, as outlined in Table 2. Stabilisation analysis is done by calculating the data after the stabilisation test using the equation to calculate the homogenization test. The criteria for the test objects are declared stable according to ISO 13528:2022. If the artefacts are declared homogeneous, the next process is the distribution of the test object to all participants sequentially.

4.4. Reserve Artefacts

If the main artefact(s) becomes damaged or malfunctioned, the participating laboratory must conduct the following steps:

1) Determine which reserve artefact will be used as the replacement.
2) Repeat the test sequence from the start using the replacement artefact
3) Update all data entries in the Appendices to reflect the replacement artefact. For example, if Artefact A is broken and the participating laboratory chooses Artefact S as the substitution, then all data attributes for Artefact A in the Appendices must be revised to Artefact S.
4) Report the issue via email with the subject: ***Use of Reserve Artefact*** to the email addresses provided in **Section 9. Data Submissions** The email must contain the following information:
   a) Identify which artefact is damaged by mentioning the code of the artefact.
   b) Specify when the damage occurred, e.g., during the incoming, testing, or outgoing processes.

c) Determine which reserve artefact will be used as the replacement.
d) Attach the photograph of the damaged artefact and the replacement artecfact, following the format outlined in ***Appendix F***.

5) The nucleus laboratory will notify the next designated participants regarding the damaged artefact and the replacement artefact.

The procedure of using the reserve artefact can be seen in the figure below.

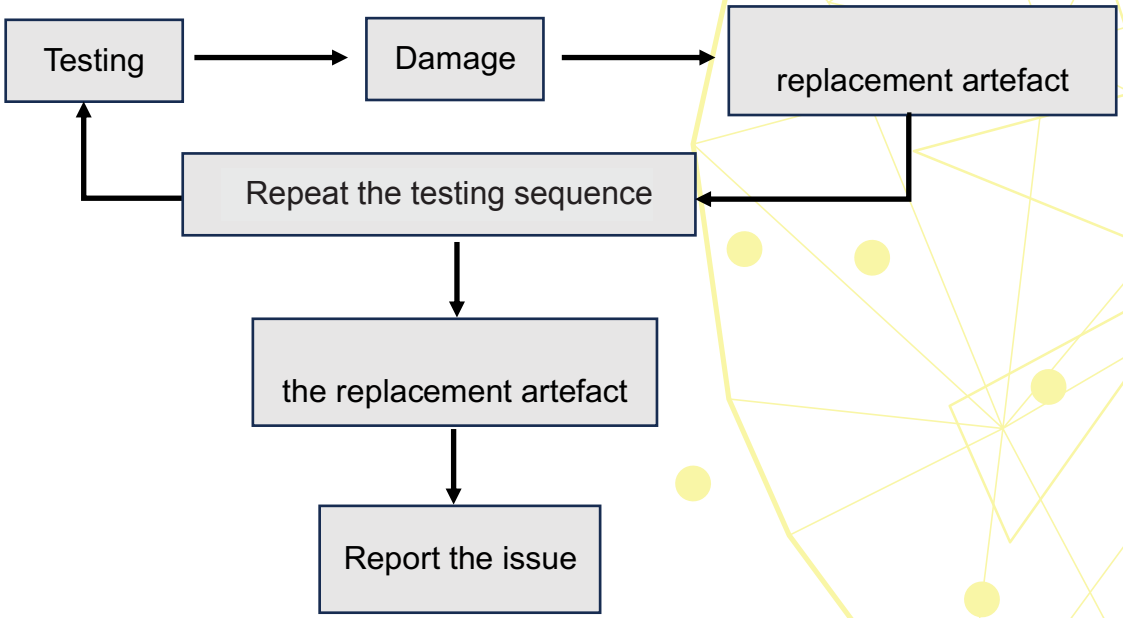

Figure 3. The procedure of Using Reserve Artefact

5. Treatment and Circulation Method

5.1. Treatment of Artefacts

The lighting samples are treated as artefacts for the RRT. The same artefacts will be circulated to the participating laboratory, tested, and then forwarded to the next designated laboratory in the following order: Indonesia, Philippines, Thailand, Malaysia, and back to Indonesia. Each participating laboratory is responsible for handling the artefacts carefully during the process of receiving artefacts, testing, re-packaging the artefacts, and shipping them to the next participating laboratory.

5.2. Packaging of Artefacts

The lighting manufacturer has provided a durable box for artefacts, as seen in Figure 4. The box features a label on the top indicating its dimensions and total weight. The participating laboratories must use this box to store the artefacts, wrap it with bubble wrap (to be provided by each participating laboratory), and ensure that the box is neatly packed. The packed box may be further reinforced in accordance with the guidelines of the designated courier service.

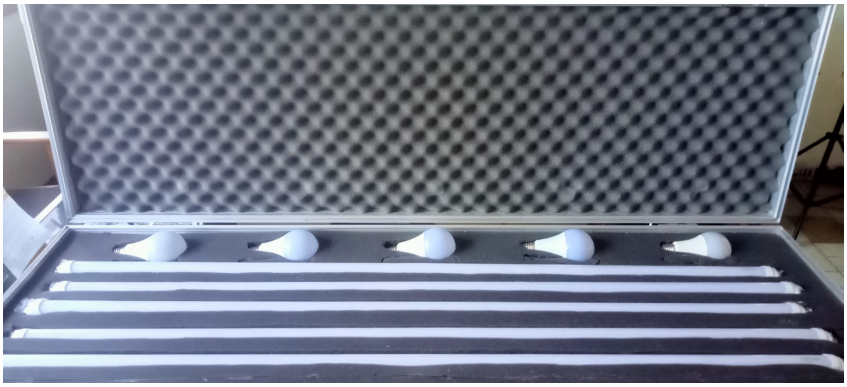

Figure 4. The Box of Artefacts in Opened Condition

Figure 5. The Box of Artefacts in Closed Condition

5.3. Documentation of Artefacts

5.3.1 Report of Incoming Artefact

Upon receiving the package, the participating laboratory must take photographs of each artefact and the box, following the format specified in ***Appendix A***. These photographs must be attached to the form outlined in ***Appendix A***, which must be submitted via email with the subject line: ***Documentation of Artefact Handling (Incoming)*** to the email addresses listed in ***Section 9. Data Submissions.***

5.3.2 Report of Outgoing Artefact

Before sending the artefacts to the next designated participant, the participating laboratory must take photographs of each artefact and the box, following the format specified in ***Appendix B***. These photographs must be attached to the form outlined in ***Appendix B***, which must be submitted via email with the subject line: ***Documentation of Artefact Handling (Outgoing)*** to the email addresses listed in ***Section 9. Data Submissions.***

5.4. Designated Courier Service

The participating laboratory shall use one of the designated courier services: DHL or FedEx. Participants are also required to follow the packaging reinforcement guidelines provided by the courier service. If participants are unable to use one of the designated courier services, they must report this issue via email to the addresses listed in ***Section 9. Data Submissions.***

5.5. Address for Shipment

The shipping addresses for participants are listed in Table 4 in accordance with the shipment schedule.

Table 4. Address for Shipment

No	Laboratory	Address	Person in Charge
1.	Energy Research and Testing Laboratory Services (ERTLS) – Lighting and Appliance Testing Laboratory (LATL)	Department of Energy, Energy Center, 34th St., Rizal Drive, Bonifacio Global City, Taguig City, Philippines 1632	Mr. Fritz P. Caponong Email: latl@doe.gov.ph
2.	Electrical and Electronics Institute Foundation for Industrial Development	975 Moo 4, Bangpoo Industrial Estate Soi 8, Sukhumvit Road Km. 37, Phraek Sa, Mueang, Samut Prakan 10280 Thailand	Mr. Suntipop Janboona Email: suntipopj@thaieei.com
3.	Standard and Industrial Research Institute of Malaysia (SIRIM) Berhad	Lot 20, Jalan Lada Sulah 16/11, Seksyen 16, 40200, Shah Alam, Selangor, Malaysia.	Ms. Nor Azlina Muslim Email: zlina@sirim.my
4.	Center of Industrial Standardization and Services for Material and Technical Product (B4T)	Balai Besar Standardisasi dan Pelayanan Jasa Industri Bahan dan Barang Teknik. Jl. Sangkuriang No. 14 Bandung 40135 West Java Province, Indonesia	Dr. Revantino Email: listrik.b4terai@gmail.com

6. Testing Equipment

6.1. Measurement for Luminous Flux (lm):

Measurement for this parameter is conducted using a Goniophotometer.

6.2. Measurement for Power Consumption (W):

Measurement for this parameter is conducted using a Powermeter.

6.3. Calculation for Luminous Efficacy (lm/W):

This parameter is calculated based on the result of luminous flux divided by power consumption at the same time of each measurement.

6.4. Calibration of Instruments:

All instruments used to measure luminous flux and power consumption must be in a calibrated condition, with traceability to the international metrology system. According to the ISO/IEC 17025, the recommended time interval for calibration is once per year.

Each participating laboratory must ensure that all testing instruments are calibrated, as verified by the calibration certificate, which is still valid during the RRT. Each participating laboratory must ensure that the uncertainty values from the calibration certificate are within the acceptance criteria or tolerance intervals specified in **Clause 4.1.2 of the CIE S 025/E:2015 standard**.

6.5. Implementation for Correction Values of Calibration

Every correction value from the calibration certificate must be applied to each initial measurement result. These corrected values must be recorded in the report, following the format outlined in ***Appendix C***.

6.6. Reporting of Calibration Data

Each participating laboratory must fill in the calibration data from the equipment certificate as reference information, following the format outlined in ***Appendix D***.

7. Testing Procedure

7.1. Reference Standard

The RRT procedure adheres to the **IEC 62612 standard**, which refers to **CIE S 025/E:2015,** i.e., the Test Method for LED Lamps, Luminaires, and Modules. Nevertheless, each step of the process is specified in this guideline and must be followed by all participating laboratories.

7.2. Environmental Conditions

The participating laboratories must adhere to the environmental conditions specified in **Clause 4.2.1, 4.2.2, 4.2.4, and 4.2.5** of the reference standard relating to the test room, ambient temperature, air movement, and operating position.

7.3. Electrical Test Conditions

7.3.1. Test Voltage and Frequency

The set value of the test voltage is AC 220 V with a frequency of 50 Hz, in accordance with **Clause 4.3.1** of the reference standard.

7.3.2. Electrical Measurement

The testing equipment must follow **Clause 4.3.2 and 4.3.3.4** of the reference standard relating to electromagnetic compatibility.

7.4. Stabilisation before Measurement

The DUT must be operated for 30 minutes from an off condition before measuring both electrical and photometric parameters. Participants must record the fluctuations (the relative difference in percentage between maximum and minimum readings) of light output and electrical power using the format provided in **Appendix C.3. Stability Before Measurement** at the moment before starting the measurement.

7.5. Photometric Measurements

Photometric measurements must be conducted using a goniophotometer equipped with a photometer head, which has the spectral responsivity (mismatch index), following the requirements in **Clause 4.5.1** of the reference standard. The measurement must be conducted in the full range of horizontal C-planes (360°) and full vertical Gamma (γ) angles (0° to 180°).

7.6. Ageing and Mounting of DUT

The DUT does not require ageing before the test. Participating laboratories only need to conduct the stabilisation steps, as outlined in the **Stabilisation Before Measurement**. Every DUT must be mounted on the goniophotometer in its operating orientation and photometric centre, as illustrated in Figure .

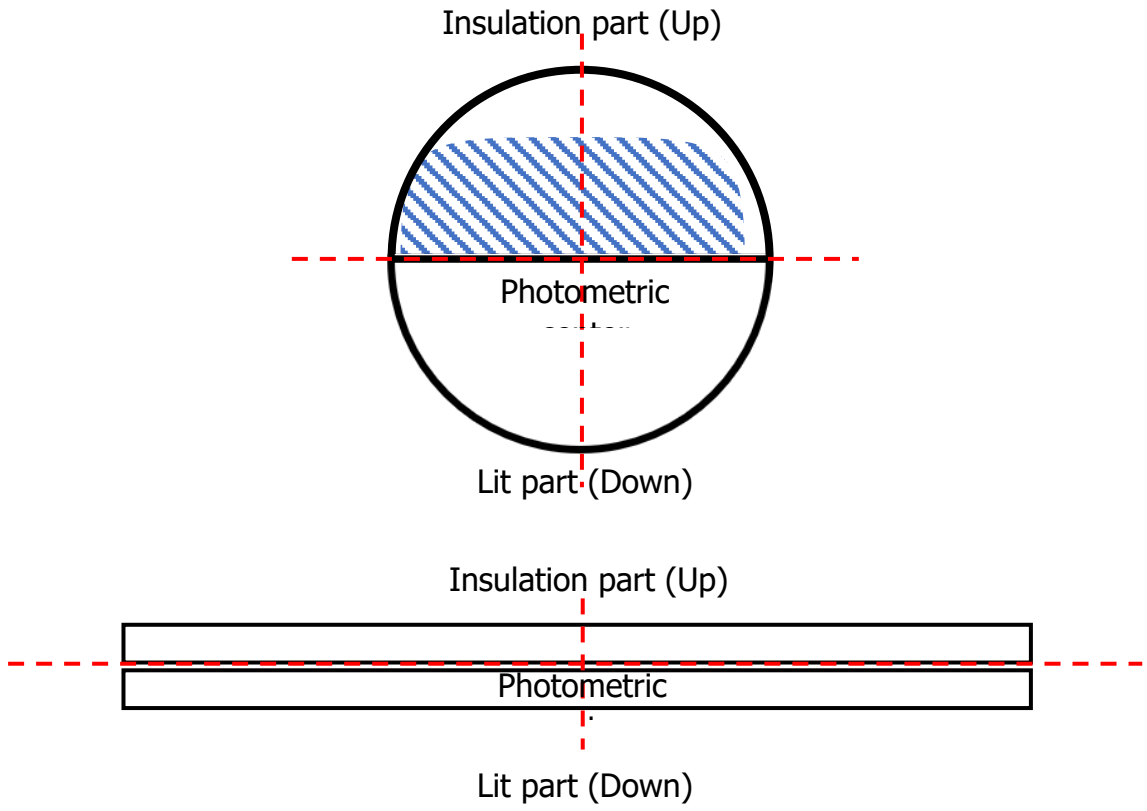

Figure 6. Illustration for the Photometric Centre of DUT

7.7. Sequence, Simultaneous and Repetitive of Measurements

7.7.1. Measurement Steps

Each participating laboratory must conduct the following measurement steps:

a) Mount the DUT on the goniophotometer.
b) Power on the lamp and conduct the stabilisation process as specified in **Section 7.4. Stabilisation Before Measurement.**
c) Measure the luminous flux and power consumption simultaneously.
d) Apply the correction factors as outlined in the **Section 6.5. Implementation for Correction Values of Calibration.**
e) Record and write the corrected results using the designated form provided in **Appendix C.1. Corrected Values.**
f) Take down the DUT from testing equipment.

7.7.2. Testing Sequence

Each participant must conduct a sequence of 18 tests for DUT, as sorted in Table 5, and follow the measurement steps above.

Table 5.The Sequence of Testing for DUT

Sequence	1	2	3	4	5	6
DUT	**A**	**B**	**C**	**D**	**E**	**F**
Parameter to be measured	Φ_{A1}	Φ_{B1}	Φ_{C1}	Φ_{D1}	Φ_{E1}	Φ_{F1}
	P_{A1}	P_{B1}	P_{C1}	P_{D1}	P_{E1}	P_{F1}

Sequence	7	8	9	10	11	12
DUT	**A**	**B**	**C**	**D**	**E**	**F**
Parameter to be measured	Φ_{A2}	Φ_{B2}	Φ_{C2}	Φ_{D2}	Φ_{E2}	Φ_{F2}
	P_{A2}	P_{B2}	P_{C2}	P_{D2}	P_{E2}	P_{F2}

Sequence	13	14	15	16	17	18
DUT	**A**	**B**	**C**	**D**	**E**	**F**
Parameter to be measured	Φ_{A3}	Φ_{B3}	Φ_{C3}	Φ_{D3}	Φ_{E3}	Φ_{F3}
	P_{A3}	P_{B3}	P_{C3}	P_{D3}	P_{E3}	P_{F3}

The symbol Φ_{A1} represents the result of luminous flux from DUT A on the 1st measurement, while P_{B2} represents the result of power consumption from DUT B on the 2nd measurement, and so on.

The corrected value of intended measurement results is indicated by the addition of an apostrophe, for example, Φ'_{A1} is the corrected value of Φ_{A1}.

7.8. Calculation for Luminous Efficacy and Averaging the Data

Luminous efficacy is calculated by dividing the corrected value of luminous flux (symbolised by Φ') by the corrected value of the power consumption (symbolised by P').

Luminous efficacy must be calculated in accordance with the sequence in Table 5. For example, the luminous efficacy of DUT A on the 1st measurement is calculated by dividing Φ'_{A1} by P'_{A1}. Similarly, the luminous efficacy of the DUT B on the 1st measurement is calculated by dividing Φ'_{B1} by P'_{B1}, and so on.

Each participating laboratory must average the corrected data for the same DUT. For example, the average luminous flux of DUT A is derived from Φ'_{A1}, Φ'_{A2}, and Φ'_{A3}, following the procedure outlined in the ***C.2. Average*** Values. This procedure must also be applied for parameters of power consumption and luminous efficacy.

7.9. Measurement Uncertainties

Each participating laboratory must account for measurements uncertainties, in accordance with the guidance in **Clause 8** of the reference standard (**CIES S 025/E:2015**), and then report them using the format provided in the ***C.4. Uncertainty*** Budgets. This procedure applies to the three testing parameters in this RRT for lighting appliances. The report on measurement uncertainties must be submitted via email to the email addresses listed in the **Section 9. Data Submissions.**

7.10. Documentation of Testing

Each participating laboratory must take photographs of the DUT mounted on the testing equipment (goniophotometer) in a lit (turned on) condition for every testing sequence listed in Table 5. These photos must be attached according to the format in ***Appendix E,*** and then the report must be submitted via email to the addresses listed in **Section 9. Data Submissions.**

8. Schedule

The RRT schedule is outlined in Table 6. Each participating laboratory must follow the designated activities in accordance with this schedule.

Table 6.Timeline for Participating Laboratory

No.	Activity	2024								2025			
		November				December				January			
Start of Week		**3rd**	**10th**	**17th**	**24th**	**1st**	**8th**	**15th**	**22nd**	**5th**	**12th**	**19th**	**26th**
End of Week		**9th**	**16th**	**23rd**	**30th**	**7th**	**14th**	**21st**	**28th**	**11th**	**18th**	**25th**	**31st**
1.	The artefact is transported from the B4T laboratory in Indonesia to the ERTLS-LATL Laboratory in Philippines												
2.	The ERTLS-LATL Laboratory conducts the test												
3.	Data submission from the ERTLS-LATL Laboratory												
4.	The artefact is transported from ERTLS-LATL Laboratory in Philippines to the EEI Laboratory in Thailand												
5.	The EEI Laboratory conducts the test												
6.	Data submission from the EEI Laboratory												
7.	The artefact is transported from the EEI Laboratory in Thailand to the SIRIM Laboratory in Malaysia												
8.	The SIRIM Laboratory conduct the test												
9.	Data submission from the SIRIM Laboratory												
10.	The artefact is transported the SIRIM Laboratory in Malaysia to the B4T Laboratory in Indonesia.												

9. Data Submissions

Each participating laboratory must complete the report in accordance with the formats provided in the ***Appendices*** of this guideline. After filling out ***Appendix A, B, C, D, and E***, all completed documents must be submitted via email with the subject line: **Result of the Round-Robin Testing for Lighting Appliances in ASEAN** to the following email addresses:

- lpup.b4t@gmail.com
- cc: cee@aseanenergy.org

10. Data Processing, Analysis, and Reporting

The nucleus laboratory must process and analyse the data submitted by each participating laboratory using appropriate statistical methods in accordance with **ISO 13528:2022 standard**. The testing results will be analysed in consultation with experts in lighting appliance performance. The nucleus laboratory must prepare the RRT report within the specified timeline.

11. Data Confidentiality

The nucleus laboratory and ACE are responsible for maintaining the confidentiality of the data submitted by each participating laboratory, ensuring its use is limited to the RRT activities for lighting appliances in ASEAN.

12. Contact Information

For further communication and any inquiries regarding this RRT activities, participants may contact and cc cee@aseanenergy.org

Appendix

Appendix A

Documentation of Artefact Handling (Incoming)

Artefact A	
PHOTO (One side)	PHOTO (Other side)

Artefact B	
PHOTO (One side)	PHOTO (Other side)

Artefact C	
PHOTO (One side)	PHOTO (Other side)

Artefact D	
PHOTO (One side)	PHOTO (Other side)

Artefact E	
PHOTO (One side)	PHOTO (Other side)

Artefact F	
PHOTO (One side)	PHOTO (Other side)

Appendix B

Documentation of Artefact Handling (Outgoing)

Artefact A	
PHOTO (One side)	PHOTO (Other side)

Artefact B	
PHOTO (One side)	PHOTO (Other side)

Artefact C	
PHOTO (One side)	PHOTO (Other side)

Artefact D	
PHOTO (One side)	PHOTO (Other side)

Artefact E	
PHOTO (One side)	PHOTO (Other side)

Artefact F	
PHOTO (One side)	PHOTO (Other side)

Appendix C
Testing Data

C.1. Corrected Values

Sequence of Testing	1	2	3	4	5	6
Device under test (DUT)	**A**	**B**	**C**	**D**	**E**	**F**
Input voltage (V)	220.00	220.00	220.00	220.00	220.00	220.00
Luminous flux (lm)	Φ'_{A1} (1,000.00)	Φ'_{B1} (1,000.00)	Φ'_{C1} (1,000.00)	Φ'_{D1} (1,000.00)	Φ'_{E1} (1,000.00)	Φ'_{F1} (1,000.00)
Power consumption (W)	P'_{A1} (10.00)	P'_{B1} (10.00)	P'_{C1} (10.00)	P'_{D1} (10.00)	P'_{E1} (10.00)	P'_{F1} (10.00)
Luminous efficacy (lm/W)	Φ'_{A1}/P'_{A1} (100.00)	Φ'_{B1}/P'_{B1} (100.00)	Φ'_{C1}/P'_{C1} (100.00)	Φ'_{D1}/P'_{D1} (100.00)	Φ'_{E1}/P'_{E1} (100.00)	Φ'_{F1}/P'_{F1} (100.00)

- Note that all values are written in two significant digits/decimals.

Sequence of Testing	7	8	9	10	11	12
Device under test (DUT)	**A**	**B**	**C**	**D**	**E**	**F**
Input voltage (V)	220.00	220.00	220.00	220.00	220.00	220.00
Luminous flux (lm)	Φ'_{A2} (1,000.00)	Φ'_{B2} (1,000.00)	Φ'_{C2} (1,000.00)	Φ'_{D2} (1,000.00)	Φ'_{E2} (1,000.00)	Φ'_{F2} (1,000.00)
Power consumption (W)	P'_{A2} (10.00)	P'_{B2} (10.00)	P'_{C2} (10.00)	P'_{D2} (10.00)	P'_{E2} (10.00)	P'_{F2} (10.00)
Luminous efficacy (lm/W)	Φ'_{A2}/P'_{A2} (100.00)	Φ'_{B2}/P'_{B2} (100.00)	Φ'_{C2}/P'_{C2} (100.00)	Φ'_{D2}/P'_{D2} (100.00)	Φ'_{E2}/P'_{E2} (100.00)	Φ'_{F2}/P'_{F2} (100.00)

- Note that all values are written in two significant digits/decimals.

Sequence of Testing	13	14	15	16	17	18
Device under test (DUT)	A	B	C	D	E	F
Input voltage (V)	220.00	220.00	220.00	220.00	220.00	220.00
Luminous flux (lm)	Φ'_{A3} (1,000.00)	Φ'_{B3} (1,000.00)	Φ'_{C3} (1,000.00)	Φ'_{D3} (1,000.00)	Φ'_{E3} (1,000.00)	Φ'_{F3} (1,000.00)
Power consumption (W)	P'_{A3} (10.00)	P'_{B3} (10.00)	P'_{C3} (10.00)	P'_{D3} (10.00)	P'_{E3} (10.00)	P'_{F3} (10.00)
Luminous efficacy (lm/W)	Φ'_{A3}/P'_{A3} (100.00)	Φ'_{B3}/P'_{B3} (100.00)	Φ'_{C3}/P'_{C3} (100.00)	Φ'_{D3}/P'_{D3} (100.00)	Φ'_{E3}/P'_{E3} (100.00)	Φ'_{F3}/P'_{F3} (100.00)

- Note that all values are written in two significant digits/decimals.

C.2. Average Values

Device under test (DUT)	A	B	C	D	E	F
Average of Luminous flux (lm)	1,000.00	1,000.00	1,000.00	1,000.00	1,000.00	1,000.00
Average of Power consumption (W)	10.00	10.00	10.00	10.00	10.00	10.00
Average of Luminous efficacy (lm/W)	100.00	100.00	100.00	100.00	100.00	100.00

- Note that all values are written in two significant digits/decimals.

C.3. Stability Before Measurement

DUT	Sequence	Light output (%)	Electrical power (%)
A	1	0.0	0.0
	7	0.0	0.0
	13	0.0	0.0
B	2	0.0	0.0
	8	0.0	0.0
	14	0.0	0.0
C	3	0.0	0.0
	9	0.0	0.0
	15	0.0	0.0
D	4	0.0	0.0
	10	0.0	0.0
	16	0.0	0.0
E	5	0.0	0.0
	11	0.0	0.0
	17	0.0	0.0
F	6	0.0	0.0
	12	0.0	0.0
	18	0.0	0.0

- The values are written in one significant digits/decimals (*if possible*) and more would be better.

C.4. Uncertainty Budgets

Luminous flux (%)	Power consumption (%)	Luminous efficacy (%)
0.0	0.0	0.0

- The values are written in one significant digits/decimals (*if possible*) and more would be better.

Appendix D

Testing Equipments and Its Calibration Data

D.1. Goniophotometer

Brand	
Type	
Producer	
Photo	IF PERMITTED
Last calibration	
Calibration lab.	
Traceability to	

D.2. Powermeter

Brand	
Type	
Producer	
Photo	IF PERMITTED
Last calibration	
Calibration lab.	
Traceability to	

Appendix E

Documentation of Mounted DUT in On Condition

DUT	Sequence	Photo
A	1	PHOTO
	7	PHOTO
	13	PHOTO

DUT	Sequence	Photo
B	2	PHOTO
	8	PHOTO
	14	PHOTO

DUT	Sequence	Photo
C	3	PHOTO
	9	PHOTO
	15	PHOTO

DUT	Sequence	Photo
D	4	PHOTO
	10	PHOTO
	16	PHOTO

DUT	Sequence	Photo
E	5	PHOTO
	11	PHOTO
	17	PHOTO

DUT	Sequence	Photo
F	6	PHOTO
	12	PHOTO
	18	PHOTO

Appendix F

The Use of Reserve Artefacts

(*If no damages happen, this form can be ignored*)

The Damaged Main Artefact	Replacement Artefact
A, B, or C (*choose one*)	
Condition	
Broken (physical), malfunctioned (internal), or lost	
The time of the damaged detected	
Incoming, testing, or outgoing (*choose one*)	
Photo	
IF BROKEN OR DAMAGED	**R or S** (*choose one*)

The Damaged Main Artefact	Replacement Artefact
D, E, or F (*choose one*)	
Condition	
Broken (physical), damaged (internal), or lost	
The time of the damaged detected	
Incoming, testing, or outgoing (*choose one*)	
Photo	
IF BROKEN OR DAMAGED	**T or U** (*choose one*)

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