

## Application for Member Status in the Consultative Committee for Thermometry (CCT)

### 1. Formal Application Header and Statement of Intent

On behalf of the National Measurement and Calibration Centre of the Saudi Standards, Metrology and Quality Organization (SASO-NMCC), I am pleased to formally submit our application to obtain member status within the Consultative Committee for Thermometry (CCT).

This application is submitted in accordance with the authority and procedures established in document **CIPM-D-01 (Rules of procedure for the Consultative Committees)**, specifically adhering to the Membership criteria detailed in Section 4.2. This submission follows the technical roadmap and guidance provided by the CCT Executive Secretary; Stephane Solve. SASO-NMCC is prepared to demonstrate that its technical advancements, research output, and international engagement align with the requirements for full membership, ensuring we contribute effectively to the committee's global mandate.

### 2. Institutional Mandate and Compliance with Membership Criteria

As required by **CIPM-D-01**, SASO-NMCC maintains full compliance with the primary criteria for CCT membership:

- **National Status:** SASO-NMCC is the national Metrology Institute (NMI) of the Kingdom of Saudi Arabia, legally charged with the establishment, maintenance, and dissemination of national measurement standards in the field of thermometry.
- **Research Record:** The institution maintains a rigorous research program with a consistent record of peer-reviewed publications in international journals of high repute. Our work focuses on advancing primary thermometry and radiation temperature standards.
- **International Competence:** SASO-NMCC has established a high level of technical competence through successful participation in international comparisons organized by the BIPM, the CCT, and the GULFMET Regional Metrology Organization (RMO).

### 3. Laboratory Overview and Mandate

- **Mission Statement:** The SASO-NMCC Temperature Laboratories serve as the Kingdom of Saudi Arabia's primary metrological authority for temperature and relative humidity quantities. Its mandate is to establish, maintain, and disseminate the international temperature scale, ensuring continuous alignment with international standards and providing the foundation for national traceability.
- **Infrastructure Summary:** The core infrastructure comprises primary realization systems, including a full suite of Fixed-Point cells (from the triple point of Argon to the freezing point of silver) and primary humidity generators based on two-pressure/two-temperature principles, figures 1 to 8. The laboratory maintains high-level institutional affiliations as a member of the GULFMET technical committees and participates in the BIPM Consultative Committee for Thermometry (CCT), ensuring that Saudi Arabia's thermal standards are recognized internationally through the BIPM Key Comparison Database (KCDB).
- **Traceability Chain** Traceability is maintained through a continuous chain to the International System of Units (SI). The laboratory utilizes Key Comparisons (KCs) and Supplementary Comparisons (SCs) under the CCT framework. This ensures that the national realization of ITS-

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90 is compared against the world's leading National Metrology Institutes (NMIs), establishing global equivalence for Saudi Arabian standards.



Figure 1. Measuring System of Primary Contact Thermometry

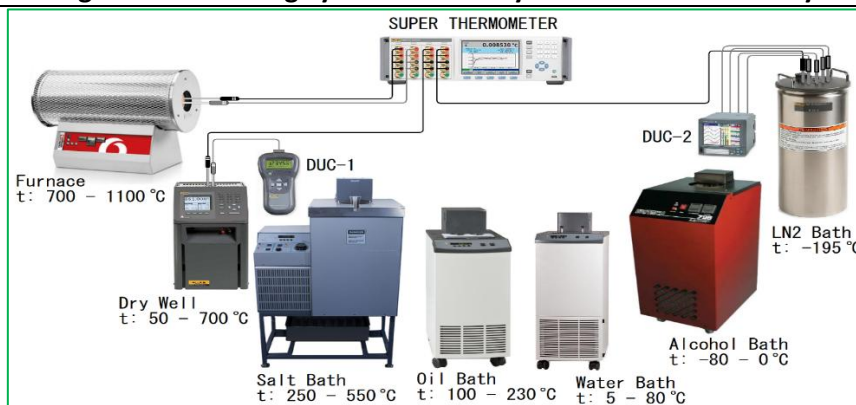


Figure 2. Measuring System of Secondary Contact Thermometry



Figure 3. Humidity Chamber



Figure 4. Two P Generator



Figure 5. Dew point Meter



Figure 6. IR System



Figure 7. Fixed point Furnace

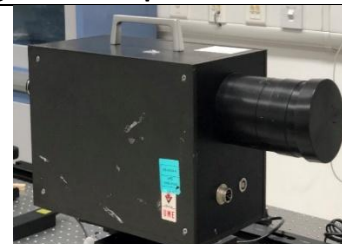


Figure 8. IR Thermometer

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- **Environment:** The facility features specialized environmental controls to maintain ambient stability within  $\pm 0.1$  °C. To prevent interference affecting high-impedance thermometry bridges, the lab utilizes dedicated low-noise shielding.
- **Key Instrumentation:** The lab equipped by sets of Standard Platinum Resistance Thermometers (SPRTs), HTSPRT, CSPRT, set of fixed point closed and open cells, thermostats mediums, tools, connection cables, set of different nominal values standard resistors with maintaining oil bath, high-stability blackbody sources, and chilled mirror hygrometers.
- **Accreditation Scope (ISO/IEC 17025)** The following table represents the laboratory's technical scope as published in the Saudi Accreditation Centre (SAAC).

**Table 1.** Accredited scope of temperature

No.	Measured Parameter or Calibrated Device	Range	(CMC)*, k=2	Equipment /measurements used
<b>Contact Temperature</b>				
1	Water triple point cell	0.01 °C	0.40 mK	Comparison with reference cell(s)
2	SPRTs	(Hg TP to Al FP) -40 °C to 661 °C	(0.40 to 6.00) mK	Calibration at fixed points
3	HTSPRT	(TPW to Ag FP)	(0.40 to 9.00) mK	Calibration at fixed points
4	Thermocouples	(Hg TP to Ag FP)	(0.05 to 0.9) K	Fixed Point, Noble metal thermocouple (type S)
5	Thermocouples	(SnFP – AgFP) to 1200 °C	(0.05 to 2) K	Noble metal thermocouple (type S), Interpolation - Extrapolation
6	Thermocouples	(-198 to 1200) °C	(0.10 to 2.3) K	Calibration by comparison with reference thermometer, Noble metal thermocouple (type S), Base metal thermocouple (type K)
7	Resistance Thermometers (PRT) and (RTD)	(-198 to 660) °C	(0.009 to 0.033) K	Calibration by comparison with reference thermometer
8	Temperature sensor with display unit	(-198 to 1200) °C	(0.01 to 1.60) K	Calibration by comparison with reference thermometer in a bath/furnace
9	Liquid in glass thermometer	(-80 to 550) °C	(0.01 to 0.05) K	Calibration by comparison with reference thermometer in a bath
10	Dry well block calibrators	(-45 to 1200) °C	(0.06 to 0.70) K	Calibration with reference thermometer
11	Calibration of temperature- controlled volumes (Incubator and Ovens)	(-40 to 1200) °C	(0.10 to 2.4) K	Calibration by comparison with reference thermometer
<b>Non-Contact Temperature</b>				
1	Calibration of industrial radiation thermometers	(-20) C to 1600 C	1.10 C to 2.90 C	By comparison with a reference radiation Thermometers. At the wavelength of 8 $\mu$ m to 14 $\mu$ m , 1.57 $\mu$ m and 0.65 $\mu$ m
2	Calibration of variable temperature Black bodies or IR calibrators	(-20) C to 1600 C	1.0 C to 1.99 C	By comparison with a reference radiation Thermometers. At the wavelength of 8 $\mu$ m to 14 $\mu$ m , 1.57 $\mu$ m and 0.65 $\mu$ m
<b>Relative Humidity</b>				

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1	Hygrometers	temperature (0 to 70) °C, Humidity (10 to 95) %RH	temperature (0.09)°C ,Humidity(1.65 %RH)	By comparison in a climatic chamber with hygrometers
2	Dew-Point Hygrometer	temperature (0 to 70) °C, Dew point (-24 to 70)°c	temperature (0.02 °C) , Dew point (0.05 to 0.07) °C	By comparison in a climatic chamber with Dew-Point Hygrometers
3	MOISTURE	2-10%	0.50%	BY COMPARISOM USING STANDARD SAMPLES

### 4. Summary of Research Activities and International Publications

SASO-NMCC actively contributes to the global metrology community through targeted research in thermal radiation and transfer thermometry. We prioritize research that addresses both fundamental accuracy and practical application.

#### Recent Scientific Publications and Research Contributions

Year	Title	Journal/Conference	DOI
2022	Bilateral Comparison of Radiation Temperature Measurements from – 20 to 1600 °C Between TUBITAK-UME and SASO-NMCC	MAPAN (Journal of Metrology Society of India)	<a href="https://doi.org/10.1007/s12647-021-00514-5">https://doi.org/10.1007/s12647-021-00514-5</a>
2023	Exploring the size-of-source effect of transfer radiation thermometers by various methods	14th International Conference on Measurement (IEEE)	<a href="https://doi.org/10.23919/MEASUREMENT59122.2023.10164459">10.23919/MEASUREMENT59122.2023.10164459</a>
2025	Verification of Infrared Forehead Thermometer Readings Using a Blackbody Radiator at NMCC-SASO	MAPAN (Journal of Metrology Society of India)	<a href="https://doi.org/10.1007/s12647-025-00834-w">https://doi.org/10.1007/s12647-025-00834-w</a>
2021	Bilateral Comparison of Radiation Temperature Measurements from – 20 to 1600 °C Between TUBITAK-UME (Turkey) and SASO-NMCC (Kingdom of Saudi Arabia)	MAPAN, Springer)	<a href="https://doi.org/10.1007/s12647-021-00514-5">https://doi.org/10.1007/s12647-021-00514-5</a>
2022	GULFMET.EM.S1 Comparison of Resistance Standards at 100 $\Omega$	iopscience	<a href="https://doi.org/10.1088/0026-1394/59/1A/01002">DOI 10.1088/0026-1394/59/1A/01002</a>
2024	performance analysis of SASO-NMCC's two-pressure (2-P) humidity generator for traceable highly accurate humidity measurements	IMEKO 2024	<a href="https://www.imeko2024.org/webapp">https://www.imeko2024.org/webapp</a>
2024	Supplementary comparison on a platinum resistance thermometer calibration from -70 °C to 250 °C	iopscience	<a href="https://doi.org/10.1088/0026-1394/61/1A/03007">https://doi.org/10.1088/0026-1394/61/1A/03007</a>
2025	SASO-NMCC's two pressure humidity generator: Performance characterization and reference calibration for traceable highly accurate humidity measurements	Measurement: Sensors	<a href="https://www.sciencedirect.com/science/article/pii/S2665917424006160">https://www.sciencedirect.com/science/article/pii/S2665917424006160</a>
2025	SASO Uncertainty Machine" - Advanced Pythonic ML Algorithm for Estimating Uncertainty in General Calibration Services at Saudi Standards, Metrology, and Quality Organization-SASO-KSA	M4DConf2025	<a href="https://doi.org/10.21014/tc6-2025.049">DOI:10.21014/tc6-2025.049</a>
2025	Absolute humidity calibrations using calibrated and assessed 2p humidity generator with validity study and novel uncertainty analysis	Tempmeko	<a href="https://doi.org/10.1016/j.measen.2024.101640">https://doi.org/10.1016/j.measen.2024.101640</a>

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2025	Thermometry Machine Learning Model for Digitized Metrological Calibration of Platinum Resistance Thermometer	2025 IMEKO TC-6 International Conference on Metrology and Digital Transformation	<a href="https://doi.org/10.21014/tc6-2025.023">DOI:10.21014/tc6-2025.023</a>
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Our recent focus on the verification of infrared forehead thermometers (2025) represents a high-impact contribution to the post-pandemic metrology landscape. By utilizing blackbody radiators for medical thermometer verification, SASO-NMCC is directly addressing the CCT's goal of resolving global measurement challenges. Furthermore, our 2021 bilateral comparison with TÜBİTAK UME (Turkey) underscores our ability to harmonize standards with leading international partner laboratories.

### 5. International Comparisons and Published CMCs

SASO-NMCC's measurement infrastructure is validated by a dense portfolio of Calibration and Measurement Capabilities (CMCs) published in the Key Comparison Database (KCDB). Of particular note is the recency of our activities, with our most recent CMC (GULFMET-T-SA-00000Q07-1) published as recently as February 27, 2026.

#### A. Published Calibration and Measurement Capabilities (CMCs)

Instrument/Standard	Quantity/Temperature Range	KCDB Reference
Water triple point cell	0.01 °C	GULFMET-T-SA-00000PZW-1
Platinum Resistance Thermometer	-70 °C to -35 °C	GULFMET-T-SA-00000Q69-1
Platinum Resistance Thermometer	-35 °C to 0 °C	GULFMET-T-SA-00000Q6A-1
Platinum Resistance Thermometer	0 °C to 50 °C	GULFMET-T-SA-00000Q6B-1
Platinum Resistance Thermometer	50 °C to 100 °C	GULFMET-T-SA-00000Q6C-1
Platinum Resistance Thermometer	100 °C to 200 °C	GULFMET-T-SA-00000Q6D-1
Platinum Resistance Thermometer	200 °C to 250 °C	GULFMET-T-SA-00000Q6E-1
Platinum Resistance Thermometer	-70 °C to 10 °C	GULFMET-T-SA-00000Q6F-1
Platinum Resistance Thermometer	10 °C to 80 °C	GULFMET-T-SA-00000Q6G-1
Platinum Resistance Thermometer	200 °C to 250 °C	GULFMET-T-SA-00000Q6I-1
Platinum Resistance Thermometer	80 °C to 200 °C	GULFMET-T-SA-00000Q07-1

As an active member of the **GULFMET** Regional Metrology Organization (RMO), SASO-NMCC has demonstrated the necessary technical density and administrative commitment to uphold the standards of the CIPM MRA.

#### B. List of comparisons

Laboratory	Pilot lab	Code	RMO	Status	Link
Contact	UME	GULFMET.T-K9	GULFMET	Measurements in progress	<a href="https://www.bipm.org/kcdb/comparison?id=690">https://www.bipm.org/kcdb/comparison?id=690</a>
Contact	UME	EURAMET.T-K7.4	EURAMET	Published	<a href="https://www.bipm.org/kcdb/comparison?id=1607">https://www.bipm.org/kcdb/comparison?id=1607</a>
Contact	EMI	GULFMET.T-S3	GULFMET	Approved	<a href="https://www.bipm.org/kcdb/comparison?id=1652">https://www.bipm.org/kcdb/comparison?id=1652</a>
Non-Contact	UME	GULFMET.T-S2	GULFMET	Measurements completed	<a href="https://www.bipm.org/kcdb/comparison?id=1857">https://www.bipm.org/kcdb/comparison?id=1857</a>

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Humidity	UME	GULFMET.T-S1	GULFMET	Report in progress, draft A	<a href="https://www.bipm.org/kcdb/comparison?id=1091">https://www.bipm.org/kcdb/comparison?id=1091</a>
Contact	KRISS	APMP.T-K7.2021	APMP	Measurements completed	<a href="https://www.bipm.org/kcdb/comparison?id=1961">https://www.bipm.org/kcdb/comparison?id=1961</a>
Humidity	SASO-NMCC	GULFMET.T-S1.2024	GULFMET	Measurements in progress	<a href="https://www.bipm.org/kcdb/comparison?id=1967">https://www.bipm.org/kcdb/comparison?id=1967</a>
Humidity	E+E	CCT-K6.2021	CCs	Planned	<a href="https://www.bipm.org/kcdb/comparison?id=1884">https://www.bipm.org/kcdb/comparison?id=1884</a>
Contact	SASO-NMCC	GULFMET.T-S4	GULFMET	Planned	<a href="https://www.bipm.org/kcdb/comparison?id=2091">https://www.bipm.org/kcdb/comparison?id=2091</a>
Contact	SASO-NMCC	GULFMET.T-S5	GULFMET	Planned	<a href="https://www.bipm.org/kcdb/comparison?id=2092">https://www.bipm.org/kcdb/comparison?id=2092</a>
Contact	SASO-NMCC	GULFMET.T-S6	GULFMET	Planned	<a href="https://www.bipm.org/kcdb/comparison?id=2093">https://www.bipm.org/kcdb/comparison?id=2093</a>

### 6. Participation in CCT Activities and Strategic Engagement

Through ongoing dialogue with CCT Executive Secretary Stephane Solve and CCT President **Dr. Dolores del Campo Maldonado**, SASO-NMCC has remained aligned with the strategic objectives of the committee.

We are eager to deepen our engagement and hereby express our intent to deliver a 10-minute presentation at the next CCT meeting. This presentation will highlight the activities within our specialized facilities- specifically the Temperature, Humidity and Thermal Radiation labs- linking our recent research output to the broader initiatives of the CCT. Our laboratory's capabilities accurately reflect the requirements for Member status, and we are committed to contributing our expertise to CCT Working Groups and the advancement of temperature metrology globally.

### 7. Conclusion and Formal Request for Approval

Based on our established national mandate, our active international research record, and the successful publication of our CMCs within the KCDB, SASO-NMCC respectfully requests that the CCT President, Dr. Dolores del Campo Maldonado, and the BIPM Director support this application for Member status. We look forward to the formal review of this application at the upcoming CCT meeting and CIPM meeting.

#### Formal Sign-off:

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