AG Metrology S.r.l.
Strada San Faustino, 155/N
41124 Modena Italy
Tel. +39 059 3970648
lab@agmetrology.com
www.agmetrology.it, www.agmetrology.com

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Accreditation # 108949

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SEQUENTIAL COMPARISON RESULTS
PT2023_017 - 17043T_02_EX

for Standard platinum resistance thermometer

1. REFERENCE LABORATORY

Accredited according to ISO / IEC 17025:2017 by Certificate of accreditation n° LK-002 Slovenska Akreditacija ILAC MRA Signatory

LMK - UNIVERZA V LJUBLJANI, FAKULTETA ZA ELEKTROTEHNIKO
Tržaška cesta 25
SI-1000 Ljubljana - Slovenija

2. DATE OF INTERCOMPARISON

The measurements for this intercomparison were carried out in the period from 10-2023 to 01-2024 with 6 participating laboratories, who performed measurements on the traveling sample Hart Scientific 5628 sn. 0501 .The reference laboratory specified above, accredited according to ISO IEC 17025:2017 by Certificate of accreditation n° LK-002 Slovenska Akreditacija ILAC MRA Signatory, performed measurements before first participanting laboratory and after last participanting laboratory.

3. CONFIDENTIALITY STATEMENT

AG Metrology keeps all data regarding the performance of individual participants, or groups of participants, strictly confidential. Data is accordingly protected and stored in areas on networks with restricted access. The relationship between results and the laboratories that submitted them will never be disclosed. Only the laboratory is granted access to its performance through the assigned code number.

4. POLICY STATEMENT

The evaluation reports of AG Metrology's proficiency testing schemes are provided for the purpose of communicating the proficiency demonstrated by participants on specific calibrations. The reports are intended to be used in support of demonstrating competence in calibration, fulfilling quality control requirements as stipulated in written standards on showing such competence, and claims of calibration and measurement capabilities.

APPROVED BY:

Giorgia Calzolari
Coordinator

Giorgia Calzolari

We welcome your questions, complaints and suggestions for improvement of this test and our operations in general

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5. ORGANISATION

This interlaboratory comparison was organized by AG Metrology S.r.l.
AG Metrology S.r.l. is an Italian PTP accredited in accordance with the requirements of the ISO/IEC-17043:2010 by PJLA, signatory of the ILAC MRA mutual recognition agreements, with accreditation n° 108949 and certificate n° L22-398.

6. PARTICIPANTS

Participants list, contact information and events calendar are shown in the attached document 'PT2023_017 - 17043T_02_EX Partecipanti - participants Annex A rev.02'.
The comparison was performed according to the expected schedule.

7. PROFICIENCY TESTING SCHEME

A Sequential scheme was adopted for the comparison.

8. TRAVELLING STANDARD

A Hart Scientific 5628 sn. 0501 Standard platinum resistance thermometer was used as travelling standard.

9. QUANTITY TO BE MEASURED

The error from the nominal value.

10. MEASUREMENT INSTRUCTIONS

The measurement instructions and those for traveling sample transporting and storing are given in the attached document 'Istruzioni tecniche - technical instructions 17043T_02_EX ' and were provided to the Participants via e-mail.

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11. FEEDBACK CONTROL OF THE MEASUREMENT RESULTS

After completion of the measurements of all ILC participants and of the reference laboratory the pre-evaluation of the measurement results was performed consisting in En-numbers calculation at each measurement point.

Consequently, each ILC participant received a table with its measured values and stated uncertainties, taken from its calibration certificate and used for such pre-evaluation, for the purposes of a feedback control.
If a participant has detected any disagreement (any spelling mistakes in its calibration certificate, any incorrectly entered values to the table, etc.) he was supposed to respond by 5 working days from riceivement of the mail and to deliver new corrected documents with, in case of measurement values, an evidence that it was really just a mistake (a copy of the corresponding measurement record).

If a participant had not responded by a given date the original measurement values were used for the final evaluation and are presented in this Report.

12. CORRECTIVE ACTIONS ADOPTED

No corrective actions have been adopted.

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13. DETERMINATION OF REFERENCE VALUES

The reference values were calculated by AG Metrology as the average of the calibration results reported in the certificates

- LMK0321P187
- LMK0322P220
- LMK0323P238
- LMK0224P214

issued by LMK - UNIVERZA V LJUBLJANI, FAKULTETA ZA ELEKTROTEHNIKO by applying the following equation:

$$x_{refM} = \frac{\sum_{i=1}^{n} x_{refi}}{n}$$

Where:

x_{refM}	is the average reference value
x_{refi}	is the result of the i calibration
n	is number of calibration performed

The obtained results are approximated according to the indications reported in the documents [3], [4], [5].

14. STABILITY ASSESMENT

The decision was to evaluate the stability of the traveling standard for each single measurement point, according to the equation:

$$x_{refS} = \frac{\sum_{i=1}^{n} \left(x_{refi} - x_{refM}\right)}{n}$$

Where:

u_{refS}	is the standard uncertainty of stability
x_{refi}	is the result of the i calibration
x_{refM}	is the average reference value
n	is number of calibration performed

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15. DETERMINATION OF MEASUREMENT UNCERTAINTY OF REFERENCE VALUES

The measurement uncertainty associated with the reference values is calculated as the maximum uncertainty value detected according to equation:

$$U_{refM} = Max\left(U_{refI}; U_{refF}\right)$$

Where:

U_{refM}	is the maximum extended uncertainty
U_{refI}	is the extended uncertainty on initial calibration
U_{refF}	is the extended uncertainty on final calibration

Then it was summed quadratically with the expanded stability uncertainty, applying the formula:

$$U_{refMS} = \sqrt{U_{refM}^2 + U_{refS}^2}$$

Where:

U_{refMS}	is the reference expanded uncertainty inclusive of the stability contribution
U_{refM}	is the maximum extended uncertainty
U_{refS}	is the extende uncertainty of stability

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16. RESULTS OF INTERLABORATORY COMPARISON REFERENCE VALUES

TABLE A1: Reference values with associated uncertainties

NOMINAL VALUE	ERROR (Measured - Reference)	EXPANDED UNCERTAINTY (K=2) UrefM	EXPANDED UNCERTAINTY (K=2) UrefMS
-196.000 °C	0.110 °C	0.020 °C	0.026 °C
-80.000 °C	0.403 °C	0.008 °C	0.039 °C
-40.000 °C	0.495 °C	0.005 °C	0.025 °C
0.000 °C	0.585 °C	0.005 °C	0.010 °C
100.000 °C	0.838 °C	0.005 °C	0.023 °C
250.000 °C	1.231 °C	0.005 °C	0.035 °C
400.000 °C	1.633 °C	0.012 °C	0.056 °C
550.000 °C	2.043 °C	0.012 °C	0.091 °C
580.00 °C	2.13 °C	0.02 °C	0.10 °C
600.00 °C	2.18 °C	0.02 °C	0.11 °C

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17. EVALUATION CRITERIA

Participants were asked to report their measurements in an excel sheet prepared by AG Metrology S.r.l. or in a calibration report / certificate.
Section 19 contains the overview of the results of the participants, including the errors and the associated extended uncertainties.
Normalized error (En) was calculated to allow evaluation of the results.
The En number is calculated according to:

$$En = \frac{x_{lab} - x_{refM}}{\sqrt{U_{lab}^2 + U_{refMS}^2}}$$

Where:

x_{lab}	is the result (error) of participant laboratory
x_{refM}	is the result (error) of refrence laboratory
U_{lab}	is the expanded uncertainty (k=2) given by participant laboratory
U_{refMS}	is the expanded uncertainty (k=2) given by refrence laboratory, including stability

Criteria for performance evaluation will be based on statistical determination for En number:

$|En| \leq 1$ Satisfactory result

$|En| > 1$ Unsatisfactory result

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18. DETERMINATION OF CORRESPONDING TEMPERATURE VALUES OF PARTICIPANT LABORATORIES

UUT resistance values measured by participating laboratories were converted to temperature, according to indication reported on document "Measurement Standard Laboratory of New Zealand Technical Guide 21 Using SPRT Calibration Certificates".

We used standard coefficients of reference function reported in table 1 of the document and 25.5 Ω as R(273.16 K) nominal one provided by manufacturer of traveling standard.
For the measuring range from 13.8033 K to 273.15 K we used the function

$$T_{90}(W_r) = 273.16\left\{B_0 + \sum_{i=1}^{15} B_i\left[\frac{W_r(T_{90})^{\frac{1}{6}} - 0.65}{0.35}\right]^i\right\}$$

For the measuring range from 0.01 °C to 961.78 °C we used the function

$$T_{90}(W_r) = 273.15 + D_0 + \sum_{i=1}^{9} D_i\left[\frac{W_r(T_{90}) - 2.64}{1.64}\right]^i$$

Below the calculated values, approximated according to the indications reported in the documents [3], [4], [5].

LAB01

UUT RESISTANCE READING	UUT CALCULATED TEMPERATURE
17.3341 Ω	-79.27 °C
21.4908 Ω	-39.17 °C
25.5592 Ω	0.60 °C
35.6045 Ω	100.90 °C
50.0869 Ω	251.22 °C
63.9074 Ω	401.63 °C
81.2817 Ω	602.17 °C

LAB02

UUT RESISTANCE READING	UUT CALCULATED TEMPERATURE
17.307 Ω	-79.53 °C
21.475 Ω	-39.33 °C
25.559 Ω	0.59 °C
35.656 Ω	101.42 °C
50.087 Ω	251.22 °C
63.874 Ω	401.26 °C
77.017 Ω	551.60 °C

LAB03

UUT RESISTANCE READING	UUT CALCULATED TEMPERATURE
4.7885 Ω	-195.820 °C
17.3008 Ω	-79.592 °C
21.4579 Ω	-39.492 °C
25.5593 Ω	0.593 °C
35.5946 Ω	100.800 °C
50.0867 Ω	251.214 °C
63.857 Ω	401.07 °C
81.126 Ω	600.30 °C

LAB04

UUT RESISTANCE READING	UUT CALCULATED TEMPERATURE
17.3018 Ω	-79.58 °C
21.4684 Ω	-39.39 °C
25.5587 Ω	0.59 °C
35.5777 Ω	100.63 °C
50.0701 Ω	251.04 °C
63.8968 Ω	401.51 °C
79.5867 Ω	581.96 °C

LAB05

UUT RESISTANCE READING	UUT CALCULATED TEMPERATURE
17.3147 Ω	-79.458 °C
21.4639 Ω	-39.434 °C
25.5590 Ω	0.590 °C
35.6001 Ω	100.855 °C
50.0768 Ω	251.109 °C
63.9033 Ω	401.584 °C
81.2789 Ω	602.13 °C

LAB06

UUT RESISTANCE READING	UUT CALCULATED TEMPERATURE
17.2999 Ω	-79.600 °C
21.4549 Ω	-39.522 °C
25.5595 Ω	0.595 °C
35.6006 Ω	100.860 °C
50.0912 Ω	251.262 °C
63.9229 Ω	401.802 °C
81.2483 Ω	601.764 °C

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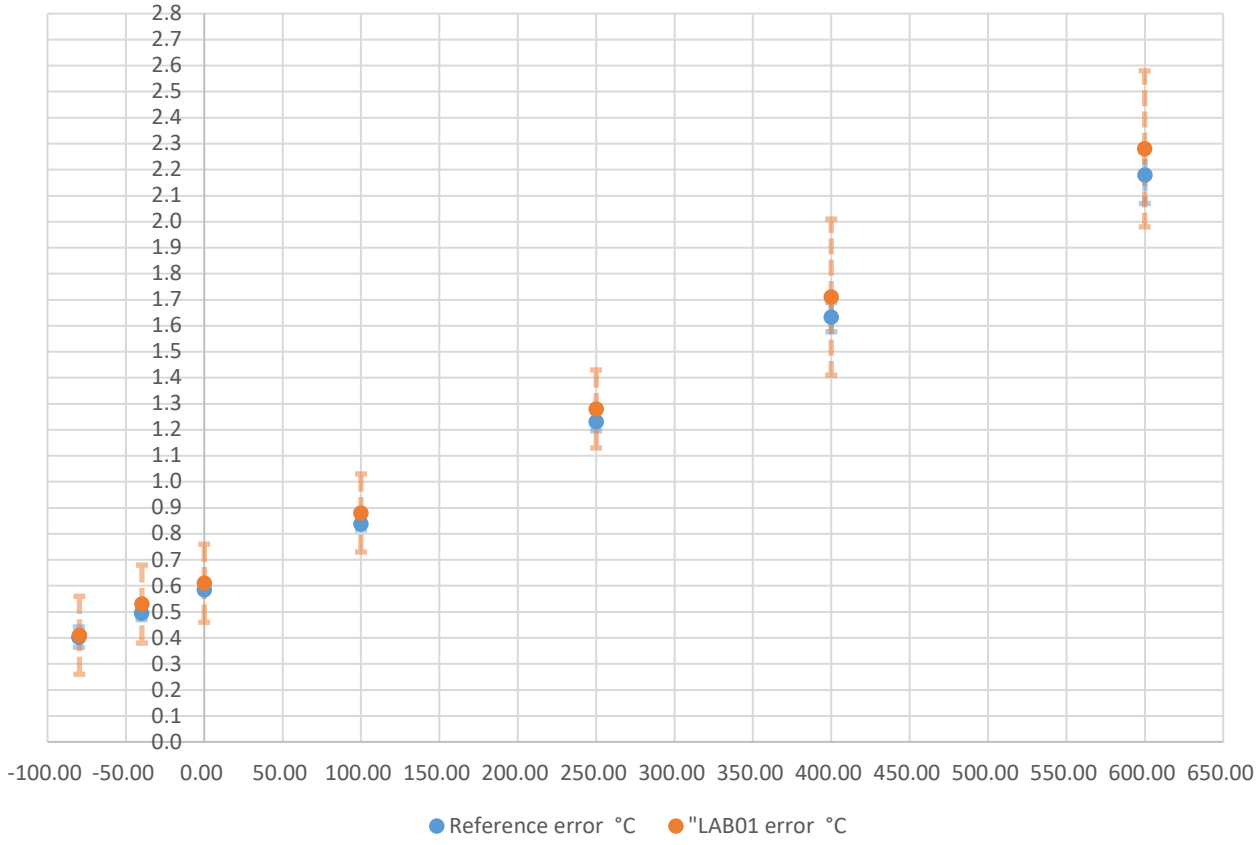
19. RESULTS OF INTERLABORATORY COMPARISON, PARTICIPANT LABS VALUES

the following tables show the results of the participants, approximated according to the indications reported in the documents [3], [4], [5], together with the normalized errors (En). En values greater than 1 are displayed in red characters.

TABLE A1A: LAB01 results

REFERENCE VALUE PARTICIPANT LAB	UUT READING PARTICIPANT LAB	ERROR	EXPANDED UNCERTAINTY (K=2) Ulab	NORMALIZED ERROR En
-79.68 °C	17.3341 Ω	0.41 °C	0.15 °C	0.05
-39.70 °C	21.4908 Ω	0.53 °C	0.15 °C	0.23
-0.01 °C	25.5592 Ω	0.61 °C	0.15 °C	0.17
100.02 °C	35.6045 Ω	0.88 °C	0.15 °C	0.28
249.94 °C	50.0869 Ω	1.28 °C	0.15 °C	0.32
399.92 °C	63.9074 Ω	1.71 °C	0.30 °C	0.25
599.89 °C	81.2817 Ω	2.28 °C	0.30 °C	0.31

GRAPHICAL PRESENTATION RESULTS LAB01



AG Metrology S.r.l.
Strada San Faustino, 155/N
41124 Modena Italy
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lab@agmetrology.com
www.agmetrology.it, www.agmetrology.com

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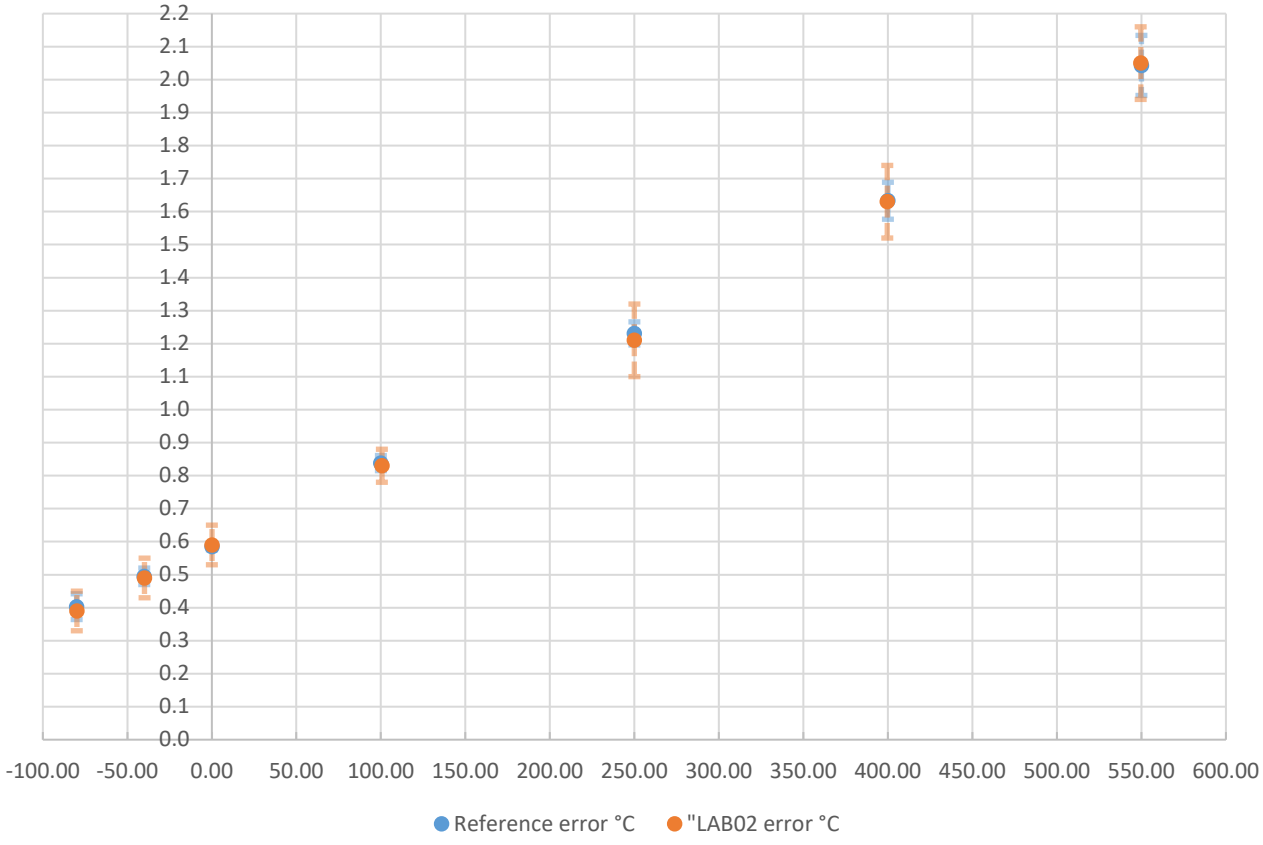
the following tables show the results of the participants, approximated according to the indications reported in the documents [3], [4], [5], together with the normalized errors (En). En values greater than 1 are displayed in red characters.

TABLE A1B: LAB02 results

REFERENCE VALUE PARTICIPANT LAB	UUT READING PARTICIPANT LAB	ERROR	EXPANDED UNCERTAINTY (K=2) Ulab	NORMALIZED ERROR En
-79.92 °C	17.307 Ω	0.39 °C	0.06 °C	-0.18
-39.82 °C	21.475 Ω	0.49 °C	0.06 °C	-0.08
0.00 °C	25.559 Ω	0.59 °C	0.06 °C	0.08
100.59 °C	35.656 Ω	0.83 °C	0.05 °C	-0.15
250.01 °C	50.087 Ω	1.21 °C	0.11 °C	-0.18
399.63 °C	63.874 Ω	1.63 °C	0.11 °C	-0.02
549.55 °C	77.017 Ω	2.05 °C	0.11 °C	0.05

GRAPHICAL PRESENTATION RESULTS LAB02



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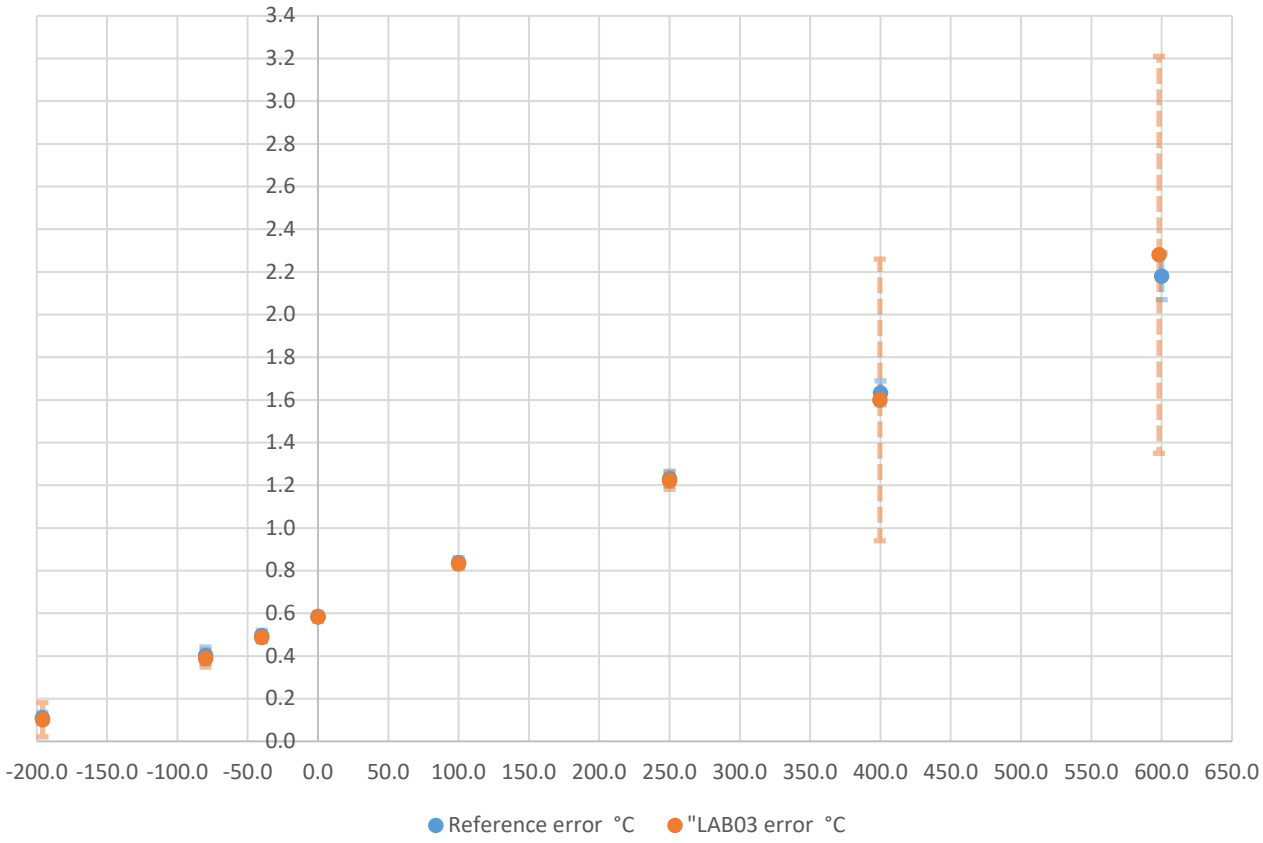
the following tables show the results of the participants, approximated according to the indications reported in the documents [3], [4], [5], together with the normalized errors (En). En values greater than 1 are displayed in red characters.

TABLE A1C: LAB03 results

REFERENCE VALUE PARTICIPANT LAB	UUT READING PARTICIPANT LAB	ERROR	EXPANDED UNCERTAINTY (K=2) Ulab	NORMALIZED ERROR En
-195.921 °C	4.7885 Ω	0.101 °C	0.080 °C	-0.11
-79.980 °C	17.3008 Ω	0.388 °C	0.040 °C	-0.27
-39.979 °C	21.4579 Ω	0.487 °C	0.020 °C	-0.25
0.010 °C	25.5593 Ω	0.583 °C	0.020 °C	-0.09
99.968 °C	35.5946 Ω	0.832 °C	0.020 °C	-0.20
249.993 °C	50.0867 Ω	1.221 °C	0.040 °C	-0.19
399.47 °C	63.857 Ω	1.60 °C	0.66 °C	-0.05
598.02 °C	81.126 Ω	2.28 °C	0.93 °C	0.11

GRAPHICAL PRESENTATION RESULTS LAB03



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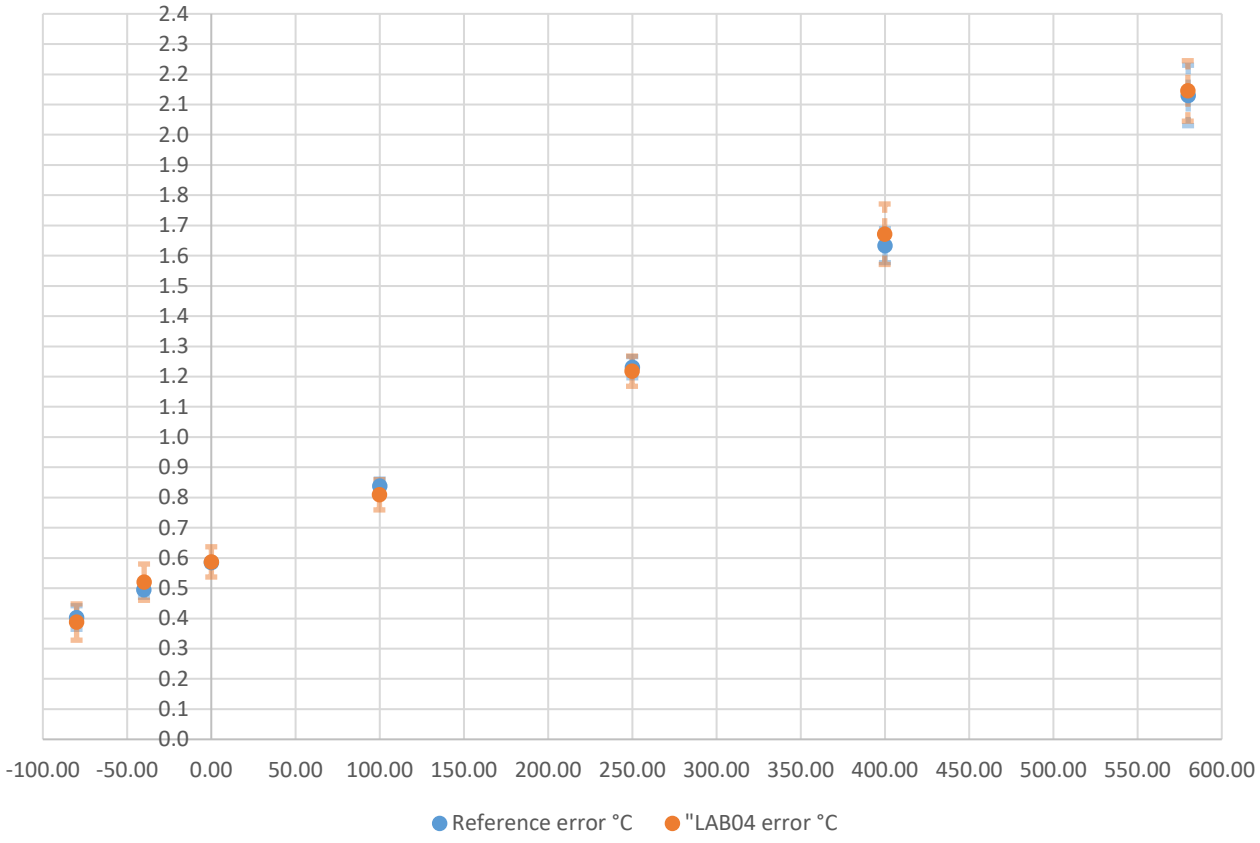
the following tables show the results of the participants, approximated according to the indications reported in the documents [3], [4], [5], together with the normalized errors (En). En values greater than 1 are displayed in red characters.

TABLE A1D: LAB04 results

REFERENCE VALUE PARTICIPANT LAB	UUT READING PARTICIPANT LAB	ERROR	EXPANDED UNCERTAINTY (K=2) Ulab	NORMALIZED ERROR En
-79.97 °C	17.3018 Ω	0.39 °C	0.06 °C	-0.18
-39.91 °C	21.4684 Ω	0.52 °C	0.06 °C	0.38
0.00 °C	25.5587 Ω	0.59 °C	0.05 °C	0.10
99.82 °C	35.5777 Ω	0.81 °C	0.05 °C	-0.51
249.82 °C	50.0701 Ω	1.22 °C	0.05 °C	-0.18
399.84 °C	63.8968 Ω	1.67 °C	0.10 °C	0.32
579.81 °C	79.5867 Ω	2.15 °C	0.10 °C	0.14

GRAPHICAL PRESENTATION RESULTS LAB04



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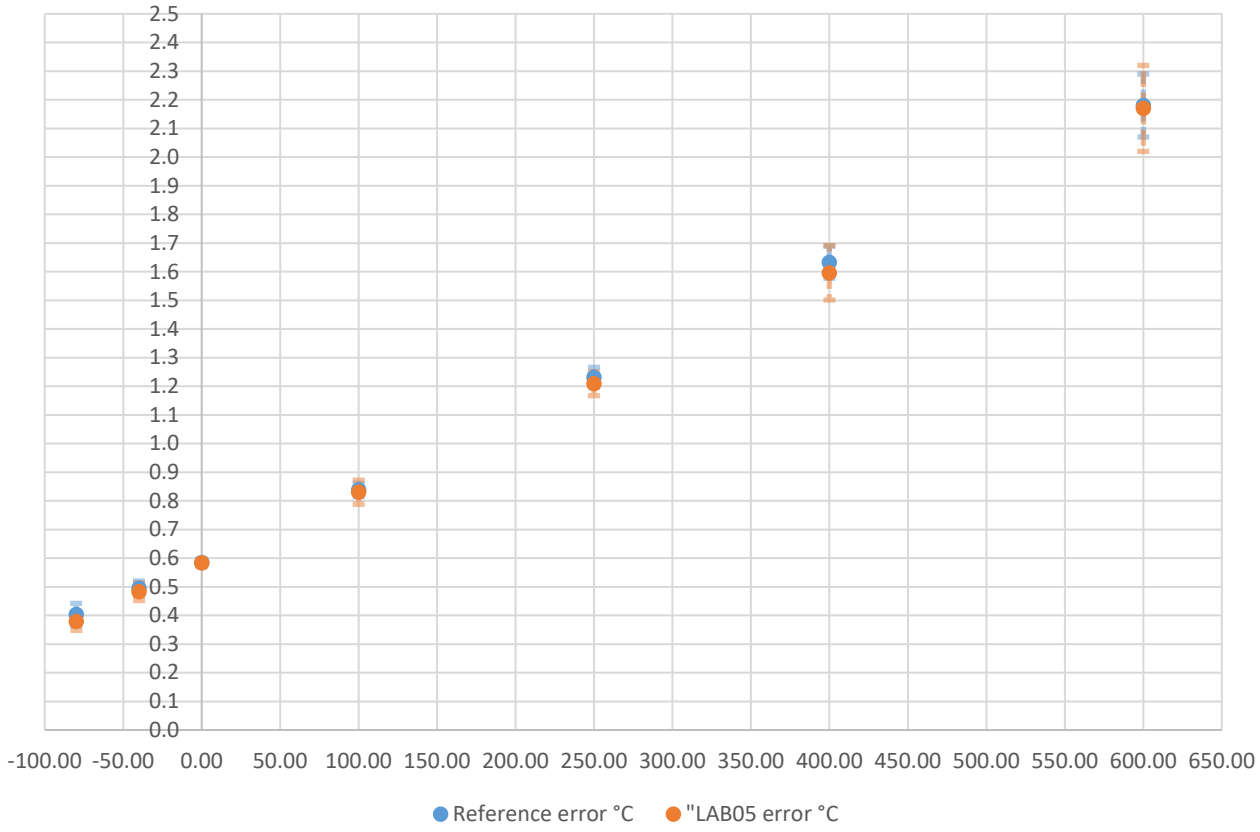
the following tables show the results of the participants, approximated according to the indications reported in the documents [3], [4], [5], together with the normalized errors (En). En values greater than 1 are displayed in red characters.

TABLE A1E: LAB05 results

REFERENCE VALUE PARTICIPANT LAB	UUT READING PARTICIPANT LAB	ERROR	EXPANDED UNCERTAINTY (K=2) Ulab	NORMALIZED ERROR En
-79.837 °C	17.3147 Ω	0.379 °C	0.031 °C	-0.48
-39.917 °C	21.4639 Ω	0.483 °C	0.031 °C	-0.30
0.007 °C	25.5590 Ω	0.583 °C	0.013 °C	-0.13
100.025 °C	35.6001 Ω	0.830 °C	0.042 °C	-0.17
249.900 °C	50.0768 Ω	1.209 °C	0.042 °C	-0.41
399.988 °C	63.9033 Ω	1.596 °C	0.095 °C	-0.34
599.96 °C	81.2789 Ω	2.17 °C	0.15 °C	-0.08

GRAPHICAL PRESENTATION RESULTS LAB05



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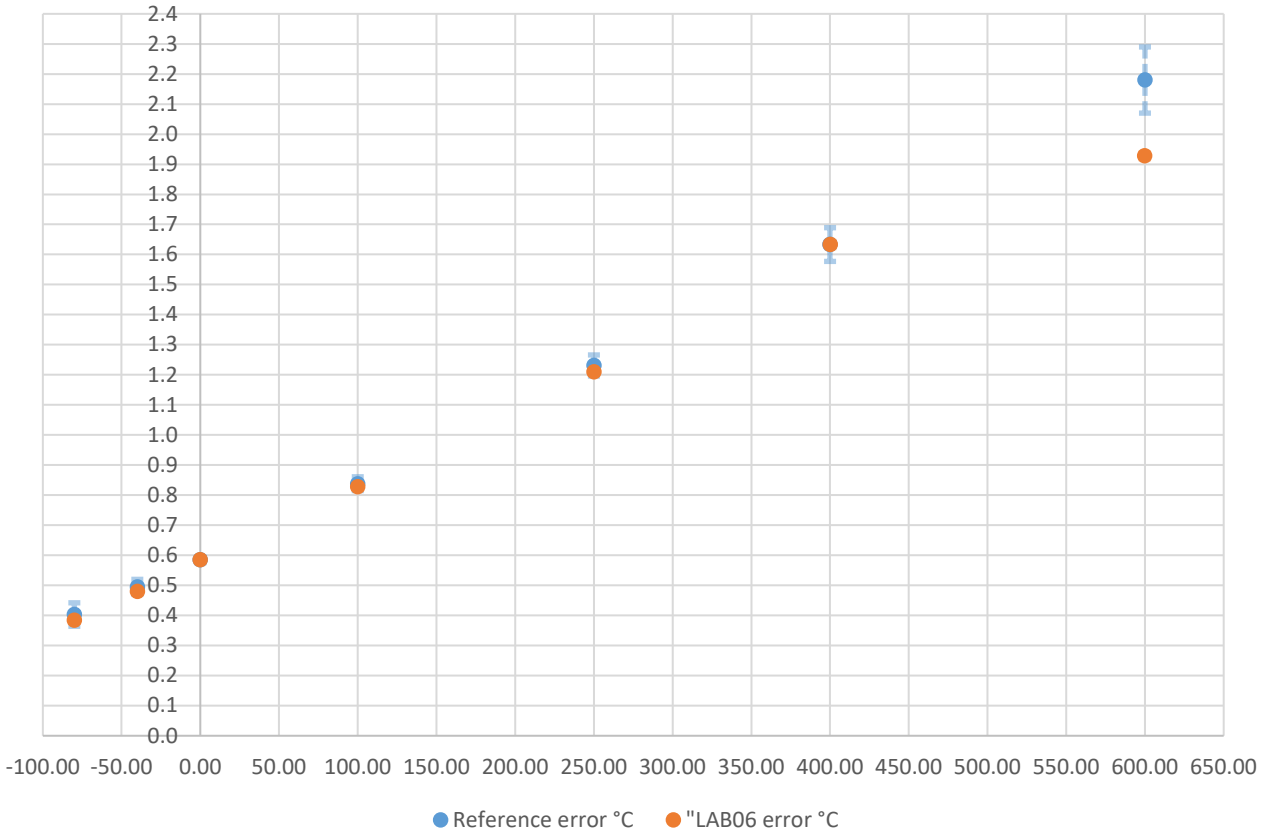
the following tables show the results of the participants, approximated according to the indications reported in the documents [3], [4], [5], together with the normalized errors (En). En values greater than 1 are displayed in red characters.

TABLE A1F: LAB06 results

REFERENCE VALUE PARTICIPANT LAB	UUT READING PARTICIPANT LAB	ERROR	EXPANDED UNCERTAINTY (K=2) Ulab	NORMALIZED ERROR En
-79.984 °C	17.2999 Ω	0.384 °C	0.005 °C	-0.48
-40.002 °C	21.4549 Ω	0.480 °C	0.004 °C	-0.59
0.010 °C	25.5595 Ω	0.585 °C	0.006 °C	0.00
100.032 °C	35.6006 Ω	0.828 °C	0.007 °C	-0.42
250.052 °C	50.0912 Ω	1.210 °C	0.008 °C	-0.58
400.169 °C	63.9229 Ω	1.633 °C	0.010 °C	0.00
599.836 °C	81.2483 Ω	1.928 °C	0.010 °C	**-2.3**

GRAPHICAL PRESENTATION RESULTS LAB06



AG Metrology S.r.l.
Strada San Faustino, 155/N
41124 Modena Italy
Tel. +39 059 3970648
lab@agmetrology.com
www.agmetrology.it, www.agmetrology.com

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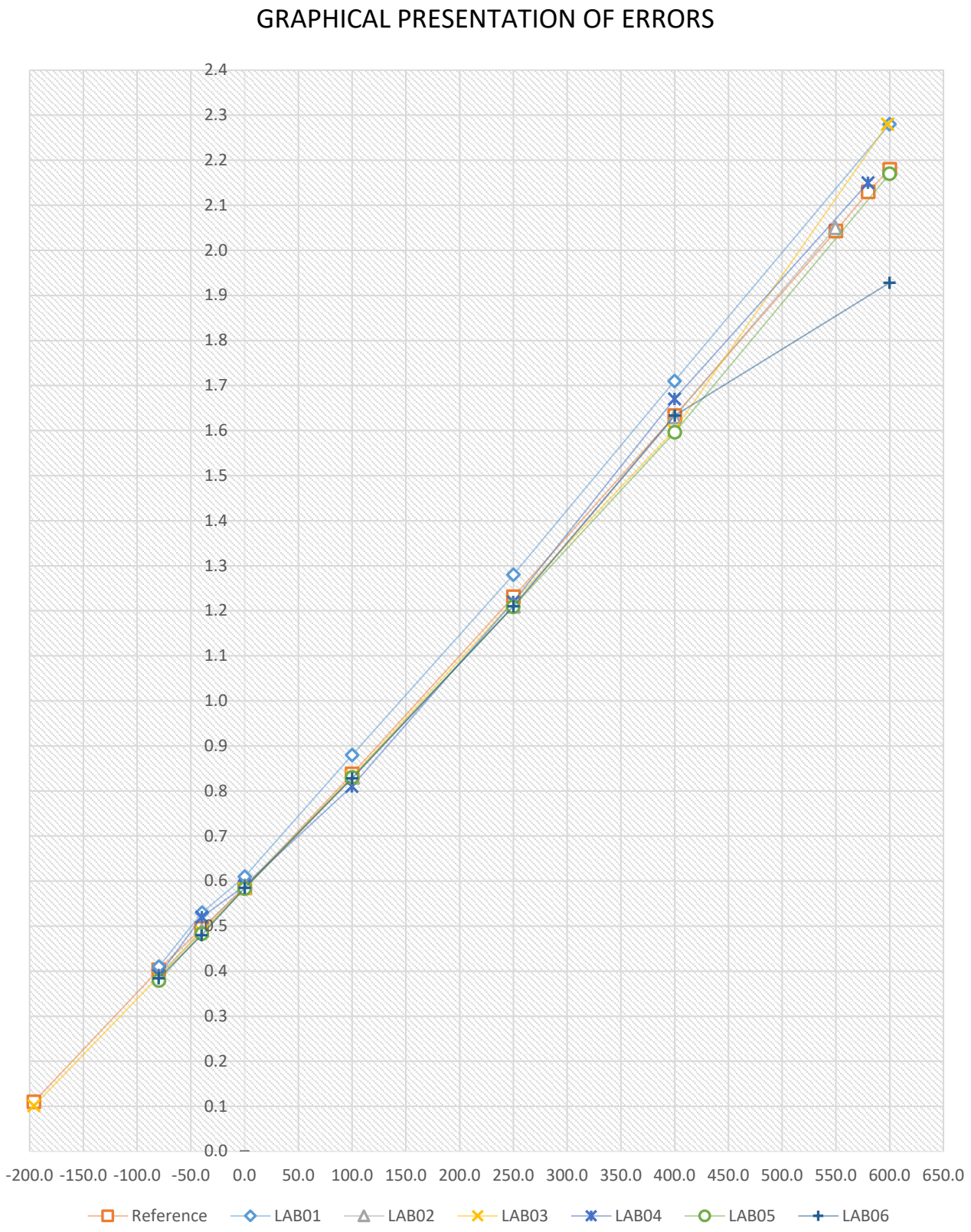
20. GRAPHICAL PRESENTATION OF ERRORS

The following graph provide a quick overview of the errors (xLab) in comparison with the other participants for kind of measurements.



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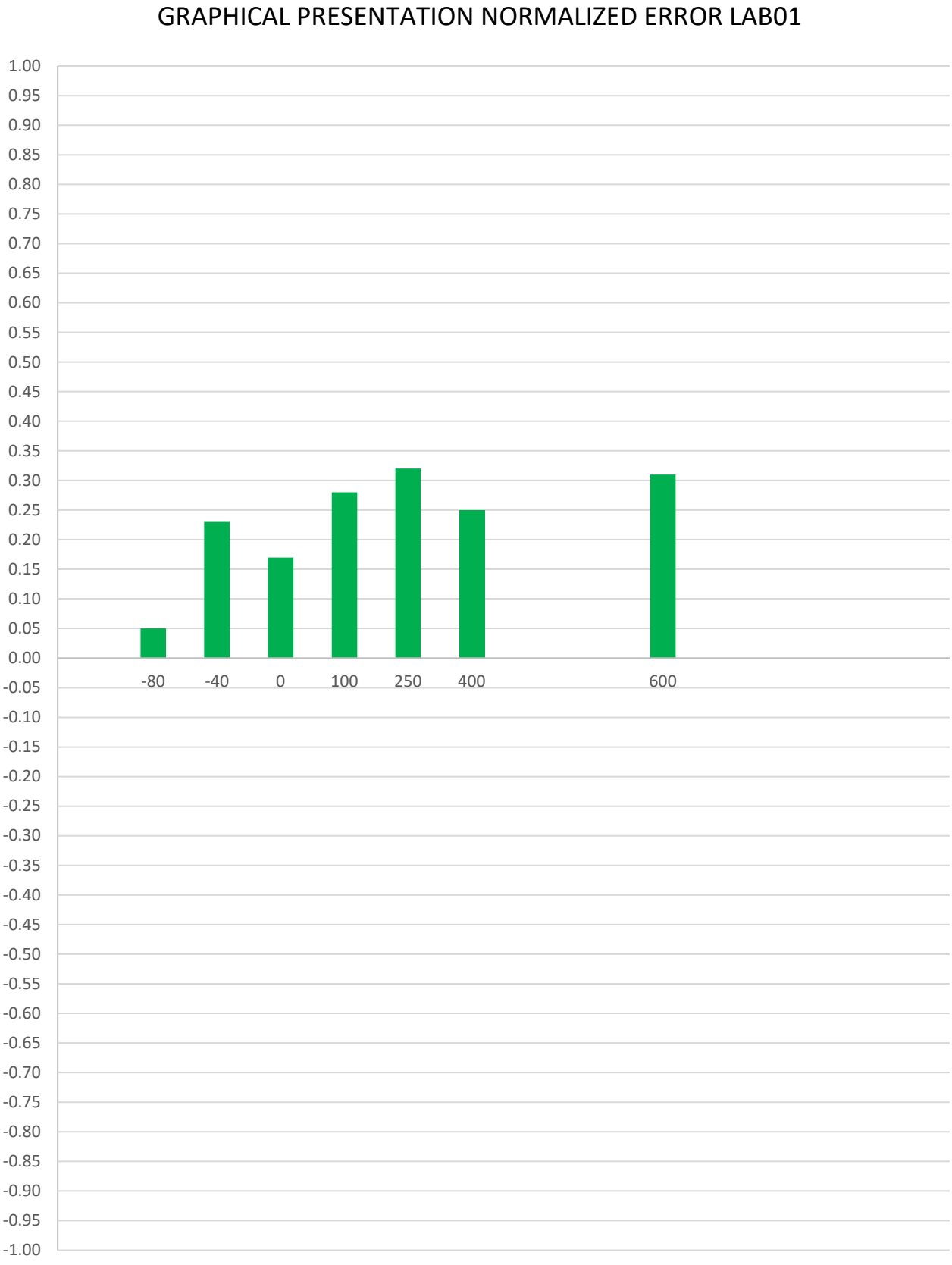
21. GRAPHICAL PRESENTATION OF THE NORMALIZED ERROR



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GRAPHICAL PRESENTATION NORMALIZED ERROR LAB02

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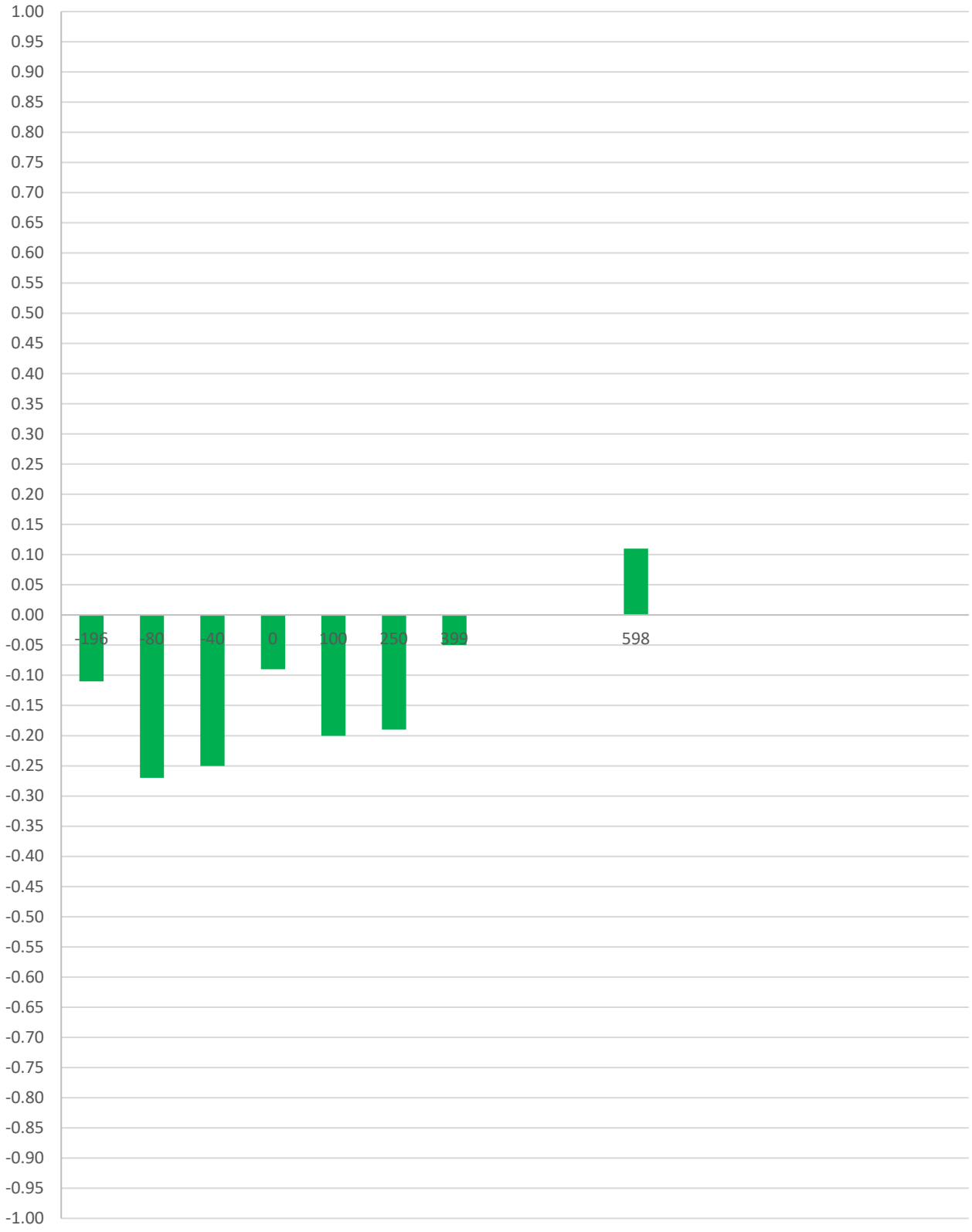
GRAPHICAL PRESENTATION NORMALIZED ERROR LAB03



AG Metrology S.r.l.
Strada San Faustino, 155/N
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GRAPHICAL PRESENTATION NORMALIZED ERROR LAB04

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GRAPHICAL PRESENTATION NORMALIZED ERROR LAB05

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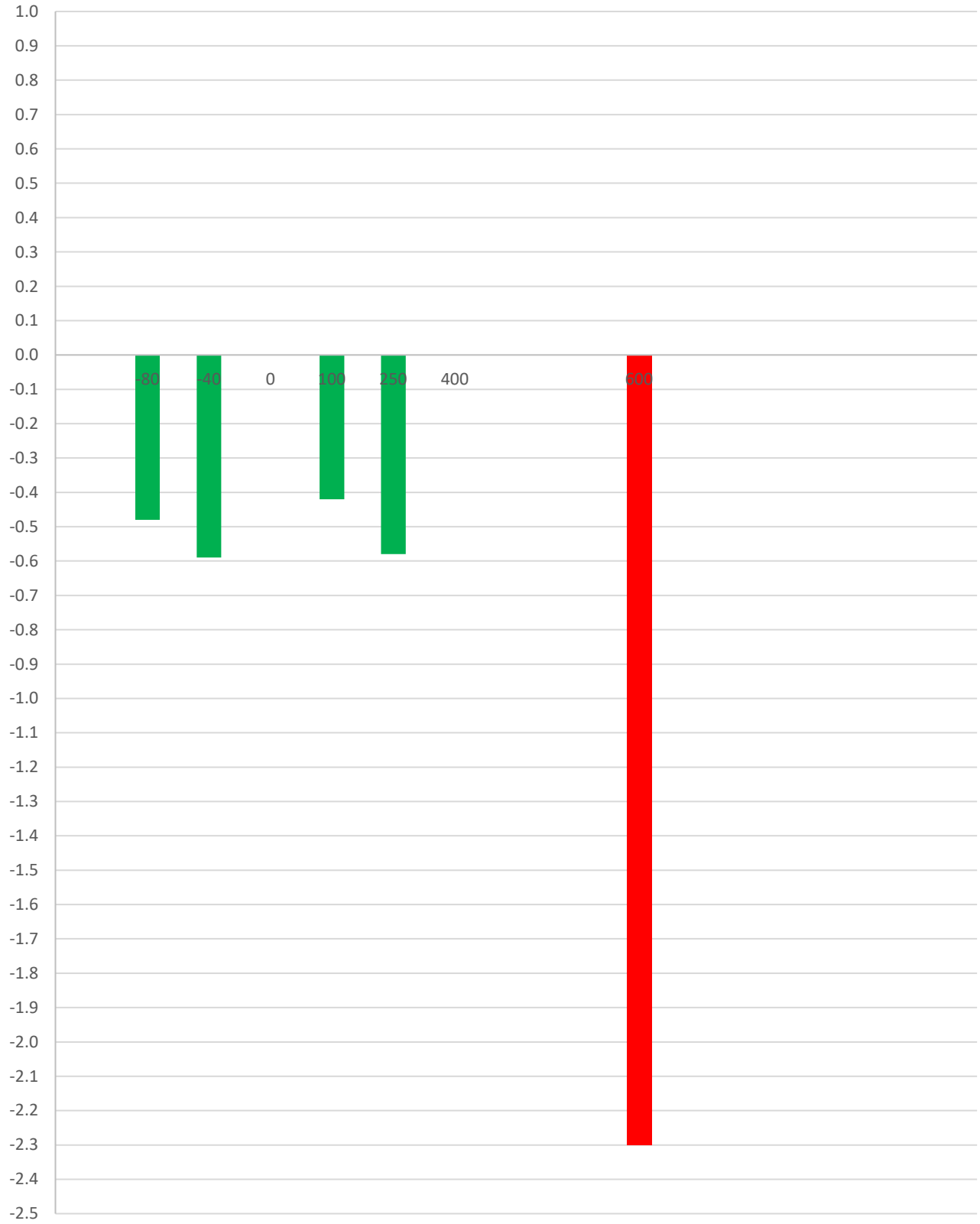
GRAPHICAL PRESENTATION NORMALIZED ERROR LAB06



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41124 Modena Italy
Tel. +39 059 3970648
lab@agmetrology.com
www.agmetrology.it, www.agmetrology.com

PJLA Proficiency Testing Provider
Accreditation # 108949

FINAL REPORT N° AG_2024_R_0014 EN

22. COMMENTS AND CONCLUSIONS

The PT2023_017 - 17043T_02_EX comparison was performed with 6 participating laboratories.
1 of 6 laboratories having one or more unsatisfactory results.

23. DISCUSSION, COMPLAINS AND APPEAL ON THE RESULTS

There is an opportunity for each participant to discuss its own results after presenting the Preliminary Report.
The participant has the opportunity to file a complaint during the PT activities or to make an appeal after the final report is issued by leaving your contact details at ilc@agmetrology.com

24. REFERECES

[1] "ISO/IEC 17025:2017 General requirements for the competence of testing and calibration laboratories"

[2] "ISO/IEC 17043:2010 Conformity assessment — General requirements for proficiency testing"

[3] "JCGM 100:2008 GUM 1995 with minor corrections
Evaluation of measurement data — Guide to the expression of uncertainty in measurement"

[4] "DKD-L 13-3 Rounding of Results and Measurement Uncertainties in Calibration Certificates"

[5] "NIST GLP 9 Good Laboratory Practice for Rounding Expanded Uncertainties and Calibration Values"

[6] "ISO 13528:2022 Statistical methods for use in proficiency testing by interlaboratory comparison"

[7] "Measurement Standard Laboratory of New Zealand Technical Guide 21 Using SPRT Calibration Certificates"

[8] Istruzioni tecniche - technical instructions 17043T_02_EX

[9] PT2023_017 - 17043T_02_EX Partecipanti - participants Annex A rev.02

25. AMENDMENT RECORD

Rev.	Subject of change	Data	Redatto da
00	First issue	17/05/2024	G. Calzolari

AG Metrology S.r.l.
Strada San Faustino, 155/N
41124 Modena Italy
Tel. +39 059 3970648
ilc@agmetrology.com
www.agmetrology.it, www.agmetrology.com

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Istruzioni al partecipante del Proficiency Testing	***Measuring instructions for participant of Proficiency Testing***

PT2023_017 - 17043T_02_EX

Oggetto del confronto interlaboratorio	***Proficiency testing object***
Termometro a resistenza di platino industriale	*Industrial platinum resistance thermometer*

Campione viaggiante	***Traveler measurement sample***
'Hart Scientific 5628 sn. 0501	'''Hart Scientific 5628 sn. 0501

Laboratorio di riferimento	***Reference laboratory***

LMK - UNIVERZA V LJUBLJANI, FAKULTETA ZA ELEKTROTEHNIKO
Tržaška cesta 25
SI-1000 Ljubljana - Slovenija
Certificate of accreditation n° LK-002 Slovenska Akreditacija ILAC MRA Signatory

Coordinatore	***Coordinator***

Responsabile del confronto e segreteria tecnica: *Contact person :*

dr.ssa Giorgia Calzolari
email : giorgia.calzolari@agmetrology.com
Tel +39 335 7054933

Referente tecnico: *Contact persons in case of technical questions:*

Andrea Meda
email : andrea.meda@agmetrology.com
Tel +39 340 4917966

Introduzione	***Introduction***

Lo scopo della prova valutativa è il confronto dei risultati dei laboratori partecipanti alla taratura di un Termometro a resistenza di platino industriale. Si raccomanda ai partecipanti di utilizzare la proprima procedura standard durante la taratura e, se possibile, di evitare misurazioni extra. Lo strumento deve essere utilizzato dal laboratorio partecipante esclusivamente per eseguire questo protocollo, ogni altro utilizzo è assolutamente vietato.

The purpose of the proficiency test is to compare the results of the participating laboratories during calibration for measurements on a Industrial platinum resistance thermometer. It is recommended that the participants use their standard procedure during the calibration and if possible, avoid making extra time-consuming measurements.The instrument must also be used by the participating Laboratory exclusively to carry out the calibration protocol present within this document. Any other use is absolutely prohibited.

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Partecipanti e pianificazione

Per la lista dei partecipanti ed il calendario di partecipazione fare riferimento all'allegato A "PT2023_017 - 17043T_02_EX Pianificazione - Planning"

Se il partecipante prevede difficoltà nel rispettare le scadenze, il coordinatore deve essere contattato immediatamente. Il termine per la comunicazione dei risultati è di 5 giorni dopo che l'apparecchiatura ha lasciato il laboratorio. In caso di problemi o dubbi sui risultati del laboratorio partecipante, il laboratorio verrà immediatamente contattato. Qualsiasi sospetto che l'attrezzatura sia difettosa o derivata, porterà alla restituzione dell'attrezzatura al laboratorio di riferimento, che quindi effettuerà un ulteriore controllo e intraprenderà le azioni appropriate.

Participants and planning

For participants list and calendar participation , refer to attachment A "PT2023_017 - 17043T_02_EX Pianificazione - Planning"

If the participant anticipates difficulties in keeping the deadlines, the coordinator must be contacted immediately.
Deadline for reporting the results is 5 days after the equipment has left the laboratory. If there are any problems or doubt regarding the results of the participant laboratory, the laboratory will be contacted immediately. Any suspicion that the equipment is defect or drifted, will lead to return of the equipment to the reference laboratory, which then will make an extra check and take an appropriate action.

Trasporto dell'attrezzatura

Lo strumento per il confronto viaggerà riposto in una scatola di trasporto e all'interno di una custodia protettiva adeguatamente rivestita con materiale di imballaggio antiurto. Il laboratorio partecipante dovrà restituire lo strumento dopo aver riconfezionato fedelmente l'imballo originale (condizioni di arrivo). Non appena il laboratorio partecipante riceve l'attrezzatura, il coordinatore deve essere informato (ad esempio tramite e-mail). Il Laboratorio deve aprire l'imballo ed ispezionare l'attrezzatura: se l'apparecchiatura presenta danni visibili dovuti al trasporto, è necessario segnalarlo al coordinatore prima dell'inizio della taratura. Ogni laboratorio partecipante provvede ad organizzare a proprie spese e cura il trasporto al laboratorio successivo secondo lo schema riportato al paragrafo "Partecipanti e Pianificazione".

Transport of equipment

The equipment for comparison will travel stored in transportation box and inside a protective case suitably covered with shockproof packaging material. The participating laboratory will have to return the instrument after having faithfully repacked the original packaging (arrival conditions). As soon as the participating laboratory receives the equipment the coordinator shall be informed (e.g. by e-mail). The equipment is then unpacked, and an inspection carried out. If the equipment has any visible damage due to transportation, this must be reported to the coordinator before the calibration begins. Each participating laboratory arranges to organize at its own expense and take care of the transport to the next laboratory according to the scheme reported in the paragraph "Participants and Planning".

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Istruzioni al partecipante del Proficiency Testing	*Measuring instructions for participant of Proficiency Testing*

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Descrizione della strumentazione

Il Laboratorio riceverà il seguente strumento: 'Hart Scientific 5628 sn. 0501.

Description of equipment

The laboratory will receive the following equipment: 'Hart Scientific 5628 sn. 0501.

Condizioni ambientali

La taratura viene eseguita a temperatura e umidità relativa in conformità con le procedure di taratura del laboratorio partecipante e devono essere riportate. Se applicabile, prima di eseguire la taratura, lo strumento deve essere posto in equilibrio termoigrometrico con l'ambiente secondo le procedure di taratura del laboratorio partecipante.

Environmental conditions

Calibration is carried out at an ambient temperature and relative humidity in accordance with the calibration procedures of the participating laboratory, and they shall be reported.
If applicable before performing the calibration, the instrument must be placed in a thermo-hygrometric equilibrium with the environment in accordance with the calibration procedures of the participating laboratory

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Imballaggio e disimballaggio / *Packing and unpacking*

La procedura per il disimballaggio è la seguente:

1) Ispezionare la scatola di trasporto per rilevare eventuali danni. Se la scatola è danneggiata, contattare il coordinatore prima di continuare

2) Disimballare l'apparecchiatura e verificare che tutte le apparecchiature menzionate nella sezione "Descrizione dell'apparecchiatura" siano presenti

3) Nel caso mancasse qualche componente dell'attrezzatura, contattare il coordinatore

4) Ispezionare l'apparecchiatura. Se una qualsiasi delle attrezzature mostra segni visibili di danneggiamento, contattare il coordinatore

Procedure for unpacking is as follows:

1) Inspect the transportation box for damage. If the box is damaged, the coordinator shall be contacted before continuing

2) Unpack the equipment and check that all equipment mentioned in the section "Description of equipment" is present

3) *If any equipment is missing, the coordinator or the participant shall be contacted.*

4) *Inspect the equipment. If any of the equipment shows visible signs of damage, the coordinator or the participant shall be contacted*

La procedura di imballaggio è la seguente:

1) Posizionare l'apparecchiatura nella scatola di trasporto

2) Verificare che tutta l'attrezzatura menzionata nella sezione "Descrizione dell'attrezzatura" sia imballata prima del trasporto dell'attrezzatura

The packing procedure is as follows:

1) Place the equipment in the transportation box

2) Check that all equipment mentioned in the section "Description of equipment" is packed before the equipment is transported

Preparazione e configurazione UUT / *UUT preparation and configuration*

Consentire allo strumento di equilibrarsi nell'ambiente secondo le procedure previste dal Laboratorio, ma per almeno 2 ore. Ciò è particolarmente necessario dopo il trasporto. Seguire attentamente le istruzioni contenute nel manuale d'uso allegato. Evitare vibrazioni o urti alla sonda. Quando lo strumento non è utilizzato conservarlo in un luogo sicuro nella sua scatola. In caso di dubbi consultare il manuale o chiamare il coordinatore.

Instrument stabilization (warm-up) before measurements should have been made according to the common laboratory practice, but at least for 2 hours in the laboratory environment. Follow the manufacturer's care instructions for the instrument. Avoid vibration and mechanical shock. When not in use, it should be stored in a safe place in the provided transport boxes. Refer to the manual or contact the coordinator in a case of doubt about the above-mentioned precautions.

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Istruzioni al partecipante del Proficiency Testing	*Measuring instructions for participant of Proficiency Testing*

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Preparazione e configurazione UUT

Posizionare con cura il termometro nel mezzo di comparatore (bagno, blocco a secco, camera climatica). Evitare vibrazioni o urti alla sonda. Quando la sonda non è utilizzata conservarla in un luogo sicuro nella sua scatola. Verificare che la sonda sia pulita e asciutta prima di inserirla nei mezzi comparatori. Assicurarsi che la sonda sia pulita e fredda prima di inserirla nella sua custodia. In caso di dubbi consultare il coordinatore

UUT preparation and configuration

Probe is carefully placed in the calibration media (bath, dry block, climatic chamber). Avoid vibration and mechanical shock. When not in use, it should be stored in a safe place in the provided transport boxes. Check that the probe are completely clean and dry before placing them in the calibration media. Ensure that the probe are cooled down and cleaned with alcohol, if necessary, before placing them in the transportation box. Refer to the the coordinator in a case of doubt about the above-mentioned precautions.

Taratura

Si consiglia al partecipante di utilizzare la procedura accreditata durante la taratura ed evitare di effettuare misurazioni che richiedono tempo extra, se possibile. I dettagli sulla procedura applicata possono essere indicati nel modulo di raccolta dati.
I partecipanti non devono eseguire alcun trattamento termico (annealing) alla termocoppia. Per mantenere una maggiore stabilità deve essere tenuta il minor tempo possibile ad elevate temperature.

L'incertezza estesa associata a ciascuna misurazione deve includere tutti i contributi associati allo strumento in prova, valutati secondo le modalità operative approvate dal laboratorio partecipante.

Calibration

It is recommended that the participant uses their standard procedure during calibration and avoid making extra time-consuming measurements, if possible. Details about the applied procedure can be stated in the report form.
The participants will not perform any heat treatment to the thermocouples. To maintain their thermoelectric stability, they have to be exposed as short as possible to high temperatures.

The extended uncertainty associated with each measurement must include all the contributions associated with the instrument under test, evaluated according to the operating procedures approved by the participating laboratory.

Punti di misura

L'UUT è da tarare ai seguenti punti, in accordo alle proprie procedure interne:

Masuring points

The equipment is calibrated in the following points, according to each internal procedures:

(-196, -80, -40, 0, 100, 250, 400, 600) °C

Report dei risultati

I risultati sono da riportare elettronicamente compilando il foglio di calcolo Excel inoltrato nei campi disponibili. I partecipanti sono anche invitati a compilare i dettagli sul metodo applicato, le attrezzature e la riferibilità, se queste informazioni non risultano da un certificato di taratura emesso. I laboratori che normalmente rilasciano certificati di taratura (ad esempio i laboratori accreditati), devono inviare un certificato standard al coordinatore. I risultati devono essere inviati al coordinatore entro e non oltre 5 giorni dopo aver terminato la taratura, tramite e-mail.

Reporting of results

The results are reported electronically in the forwarded Excel spreadsheet. In the report form, the participants are also asked to fill in details about the applied method, equipment and traceability, if this information does not appear from an issued calibration certificate. The laboratories which normally issue calibration certificates (e.g. the accredited laboratories), should send a standard certificate to the coordinator. The results shall be sent to the coordinator no later than 5 days after having finalized the calibration. Electronic reporting by e-mail is preferred.

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Informazioni da restituire ai partecipanti	*Informations to be returned to participants*

I partecipanti riceveranno un riepilogo di tutte le misurazioni, i valori assegnati, le incertezze dei valori assegnati e la valutazione delle prestazioni. La valutazione dei risultati delle misurazioni sarà effettuata sulla base del numero En:

The participants will receive summary of all measurements, assigned values and uncertainties of assigned values, and evaluation of the performance. The evaluation of measurement results will be made on the basis of En number:

$$En = \frac{x_{lab} - x_{ref}}{\sqrt{U_{lab}^2 + U_{ref}^2}}$$

dove — *where*

il risultato del partecipante è	x_{lab}	*is the participant's result*
il valore assegnato è	x_{ref}	*is the assigned value*
l'incertezza estesa (k=2) del risultato del partecipante è	U_{lab}	*is the expanded (k=2) uncertainty of a participant's result*
l'incertezza estesa (k=2) del valore assegnato dal laboratorio di riferimento è	U_{ref}	*is the expanded (k=2) uncertainty of the reference laboratory's assigned value*

I criteri per la valutazione delle prestazioni sono basati sulla determinazione statistica per il numero En:

Criteria for performance evaluation will be based on statistical determination for En number:

soddisfacente	$\|En\| \leq 1$	*satisfactory*
insoddisfacente	$\|En\| > 1$	*unsatisfactory*

Revisione	*Amendment Record*

Rev.	Motivo della modifica	Data	Compilato da
00	Prima emissione	07/10/2023	G. Calzolari

Rev.	*Subject of change*	*Date*	*Compiled by*
00	*first issue*	*07/10/2023*	*G. Calzolari*

17043T_02_EX: dati del confronto interlaboratorio su un termometro a resistenza Hart Scientific 5628

17043T_02_EX: Results for intercomparison for measurements on a resistance thermometer Hart Scientific 5628

Nome del Laboratorio:
Name of Laboratory:

Data esecuzione misure UUT
UUT date of measurements

Descrizione dell'attrezzatura utilizzata - Description of equipment used
Dettagli relativi alle procedure di taratura utilizzate -Details concerning used calibration procedure

Campioni di riferimento (intervallo) - *Reference standards (range)*	**Catena di riferibilità -** *Traceability*

Attrezzatura di riferimento (intervallo) - *Auxiliary measurement equipment (range)*	**Catena di riferibilità -** *Traceability*

17043T_02_EX: dati del confronto interlaboratorio su un termometro a resistenza Hart Scientific 5628

17043T_02_EX: Results for intercomparison for measurements on a resistance thermometer Hart Scientific 5628

Valore nominale	**Resistenza media del riferimento**	**resistenza media sperimentale UUT**	**Temperatura di riferimento calcolata**	**Temperatura calcolata UUT**	**Error = temperature uut - reference temperature**	***Incertezza estesa di taratura***	***Capacità di taratura e misura (CMC)***	
Set value	*Reference resistance*	*UUT resistance*	*Reference calculated temperature*	*Calculated temperature UUT*	*Error = temperature uut - reference temperature*	*Expanded uncertainty of calibration*	*Calibration and measurement capability (CMC)*	
°C	Ω	Ω	**°C**	**°C**	**°C**	**°C**		
0								Verifica stabilità 0 °C iniziale *0 °C initial stability check*
-196								
-80								
-40								
0								
100								
250								
400								
600								
0								Verifica stabilità 0 °C finale *0 °C Final stability check*

Indicare la norma di riferimento utilizzata per la conversione resistemza - temperatura / temperatura - resistenza
Indicate the reference standard used for conversion resistance - temperature / temperature - resistance

Temperatura Ambiente (ambient temperature): °C

Umidità relativa (Ambient relative humidity): RH

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Istruzioni al partecipante del Proficiency Testing - Allegato A	***Measuring instructions for participant of Proficiency Testing - Annex A***

PT2023_017 - 17043T_02_EX

Partecipanti e pianificazione		***Participants and planning***
Indirizzo di spedizione	**T.E.S.I. S.r.l.** Zona Ind.le Castelnuovo, 242/b 52010 Subbiano (AR), Italy	*Shipping address*
Referente e recapiti	Marco Porpora marco.porpora@tesi101.com +39 348 7273923	*contact person and contact details*
Data ricevimento	**16/10/2023**	*date of receipt*
Data spedizione	**20/10/2023**	*shipping date*
Indirizzo di spedizione	**ARC Brasov** Strada Fantanii, 17 500482 Brasov, Romania	*Shipping address*
Referente e recapiti	Dragos Rotaru dragos.rotaru@arc.ro 00731025893	*contact person and contact details*
Data ricevimento	**30/10/2023**	*date of receipt*
Data spedizione	**08/11/2023**	*shipping date*
Indirizzo di spedizione	**AS Metrosert** Teaduspargi 8 12618 Tallinn, Estonia	*Shipping address*
Referente e recapiti	Indrek Odrats indrek.odrats@metrosert.ee +37256477492	*contact person and contact details*
Data ricevimento	**27/11/2023**	*date of receipt*
Data spedizione	**01/12/2023**	*shipping date*
Indirizzo di spedizione	**Galdabini Cesare S.p.A.** Via Giovanni XXIII, 183 21010 Cardano al Campo (VA), Italia	*Shipping address*
Referente e recapiti	Stefano Porzio stefano.porzio@galdabini.it (+39) 0331 732757	*contact person and contact details*
Data ricevimento	**11/12/2023**	*date of receipt*
Data spedizione	**15/12/2023**	*shipping date*
Indirizzo di spedizione	**AG Metrology S.r.l.** Strada San Faustino, 155/N 41124 Modena, Italy	*Shipping address*
Indirizzo di spedizione	**SET Y GAD S.A.S.** Carrera 48 # 101 A - 69 111111 Bogotá D.C., Colombia	*Shipping address*
Referente e recapiti	Felipe Uribe felipe.uribe@setgad.com +57 320 3048352	*contact person and contact details*
Data ricevimento	**02/01/2023** **09/01/2023**	*date of receipt*
Indirizzo di spedizione	**AG Metrology S.r.l.** Strada San Faustino, 155/N 41124 Modena, Italy	*Shipping address*
Referente e recapiti	Andrea Meda andrea.meda@agmetrology.com +39 059 3970648	*contact person and contact details*
Data ricevimento	**18/01/2024** **24/01/2024**	*date of receipt*