



EURAMET Project 1788

Hybrid Comparison Calibration of 50 L Neck Type Proving Tank – Volumetric Method –

Final Report

Applicant NMI	IMBIH – Institute of Metrology of Bosnia and Herzegovina Bosnia and Herzegovina
Issuing NMI	DMDM – Directorate of Measures and Precious Metals Republic of Serbia
Third Party	EURAMET TC-Flow Chair Erik Smits

March, 2026

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1. INTRODUCTION AND PURPOSE

Recently, the only accredited calibration laboratory in Bosnia and Herzegovina capable of calibrating standards used by fuel dispenser verification laboratories was closed. As a consequence, these laboratories are forced to get the traceability abroad, what is expensive and logistically demanding.

IMBIH laboratory for volume and flow has published CMC for gravimetric method up to 50 L but the range is too small and the method is not the best method for this type of work. In the same time, the laboratory has the adequate standards, trained personnel and documented procedures for volumetric method, i.e. the method is part of the QMS system for more than 10 years. The laboratory never confirmed the competence for the volumetric method because the mentioned accredited laboratory was able to cover all the needs in the country. In the past decade IMBIH laboratory performed few calibrations for the clients which are not in accreditation system.

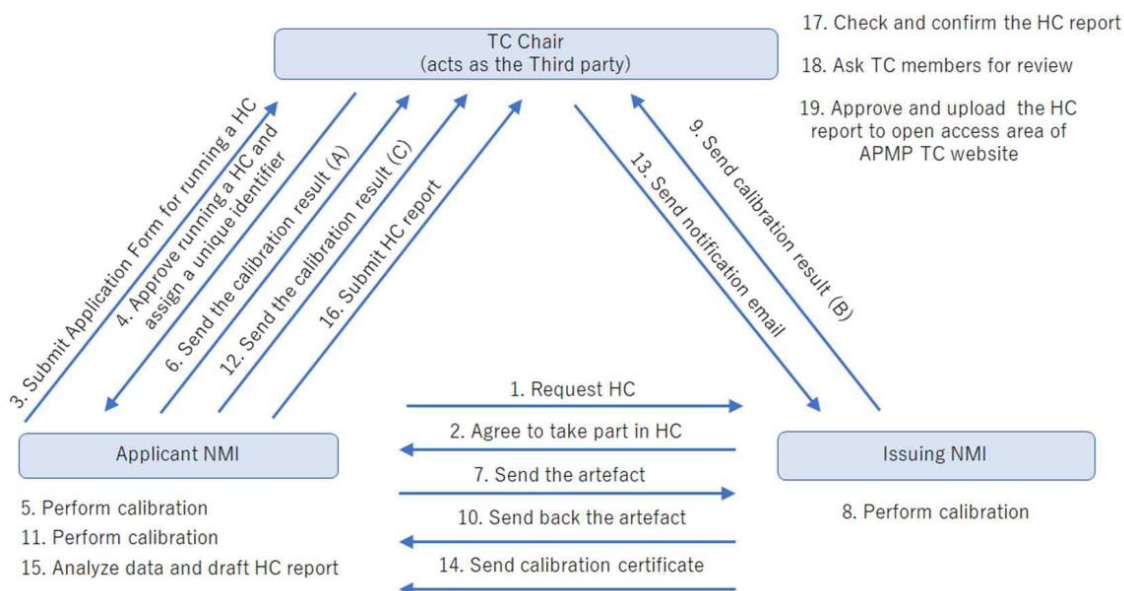
In this moment, the Hybrid Comparison (HC) was considered as the most appropriate to confirm the competence for volumetric method since the key and supplementary comparisons usually last quite long and the bilateral intercomparisons, according to reference documents [1], could be organized only as the subsequent comparisons to already performed key or regional intercomparisons.

The purpose of this HC is to provide supporting evidence for the IMBIH Calibration and Measurement Capabilities (CMC) for the volumetric method through the comparison of measurement results between IMBIH Bosnia and Herzegovina (Applicant NMI) and DMDM Republic of Serbia (Issuing NMI) as the competent NMI with extensive experience and published CMC for volumetric method.

The participants are:

Applicant NMI	IMBIH – Institute of Metrology of Bosnia and Herzegovina Contact: Ernad Borovac (ernad.borovac@met.gov.ba) Head of the Laboratory for Volume and Flow Branilaca Sarajeva 25 71000 Sarajevo Bosnia and Herzegovina
Issuing NMI	DMDM – Directorate of Measures and Precious Metals Contact: Ljiljana Mičić, (ljimicic@dmdm.rs) Metrologist – Coordinator for volume and flow Mike Alasa 14 11000 Belgrade Republic of Serbia
Third Party	EURAMET TC-Flow TC-F Chair: Erik Smits

HC was performed in accordance to APMP guideline for using Hybrid Comparisons as CMC evidences – Transfer Standard provided by applicant with stability check (Figure A2) [2], like it is shown at the following scheme.



Hybrid Comparison Time Schedule:

No	ACTIVITY	DATE
1	Applicant NMI (IMBIH) send Request for HC	24.11.2025
2	Issuing NMI (DMDM) agree to take a part in HC	01.12.2025
3	IMBIH submit Application form for HC to TC-F Chair	04.12.2025
4	TC-F Chair approve running the HC, assign a unique identifier and send the note to IMBIH	15.01.2026
5	IMBIH perform the calibration (volumetric and gravimetric for stability check)	21.01.2026
6	IMBIH send the calibration results to TC-F Chair	26.01.2026
7	IMBIH send the TS to DMDM	27.01.2026
8	DMDM perform the calibration (volumetric)	02.02.2026
9	DMDM send the calibration results to TC-F Chair	13.02.2026
10	DMDM send the TS to IMBIH	13.02.2026
11	IMBIH perform the calibration (gravimetric for stability check)	18.02.2026
12	IMBIH send the calibration results to TC-F Chair	18.02.2026.
13	TC-F Chair send note to DMDM to send the results to IMBIH	19.02.2026
14	DMDM send calibration results to IMBIH	19.02.2026
15	IMBIH analyse results and draft the Report	20.02.2026
16	IMBIH submit the Report to TC-F Chair	23.02.2026
17	TC-F Chair check and confirm the Report	24.02.2026
18	TC-F Chair ask TC members for review	25.02.2026
19	TC-F Chair approve and upload the Report to TC-F website	30.03.2026

All the measurements results reported by the participating laboratories are given in Annexes A and B.

2. TRANSFER STANDARD

The Transfer Standard (TS) package consists of 50 L neck type proving tank with sight glass and gauge scale and thermometer for measuring water temperature. The main characteristics are:



Nominal volume:	50 L
Manufacturer:	Justur (Slovakia)
Model / Serial number:	ON-50 / 120192/1
Scale resolution:	0.05% (4.25 mm / 25 mL)
Coefficient of thermal expansion:	5.18E-5 1/°C
Total time of Draining / Dripping:	60 / 30 seconds
Long term stability:	unknown
Thermometer:	TESTO, resolution (0.001°C)

TS package is provided by IMBIH. The long-term stability of the proving tank is unknown since there is only one calibration certificate (SMU - 2012). The short-term stability check was performed by IMBIH (gravimetric calibration) before and after the transport to and from DMDM.

Calibration certificate for thermometer is provided and the long term stability is considered negligible.

Calibration setups in the laboratories are displayed in the following pictures



IMBIH – Volumetric & Gravimetric



DMDM

3. TRANSPORT

The TS is transported to and from DMDM by the IMBIH car, without problems and visible damages.

4. CALIBRATION PROCEDURE

The laboratories performed their standard (routine) calibration procedures for volumetric method. The formula used for volume calculation is [3]:

$$V_t = NV_0[1 - \gamma_{RS}(t_{ORS} - t_{RS}) + \beta(t_{SCM} - t_{RS}) + \gamma_{SCM}(t - t_{SCM})] + \Delta V \quad (1)$$

The delivered volume at the reference temperature 20°C is determined using 5 repeated measurements.

Due to poor installation and quality of the bottom valve, it was necessary to close and immediately open it after 15 seconds of the dripping time.

The requirements for water temperature(s) and ambient conditions in the laboratory are:

- Humidity: higher than 50 %,
- Ambient temperature: 17°C to 23°C,
- Water temperature: has to be near the ambient temperature and shell not change more than 0.5°C during the calibration.

5. REPORTING MEASUREMENT RESULTS

The participants were obliged to provide:

- Calibration certificates,
- Description of the measurement equipment and environmental conditions records during calibration,
- Short description of calibration method and photos of the calibration setup.

The template (excel file) for reporting was provided. The detailed measurement results reported by the participants are given in Annexes A and B.

Measurement equipment

Equipment	NMI	Manufacturer	Type	Range	Resolution
Volume Standard	IMBIH	JUSTUR	Overflow pipette	50 L	-
	DMDM	Brenner	Overflow pipette	50 L	-
Thermometer Water - TS	IMBIH	TESTO	735-2	(0 - 200) °C	0.001 K
	DMDM	TESTO	735-2	(0 - 200) °C	0.001 K
Thermometer Water - Standard	IMBIH	AHLBORN	FNA30L0250T	(5 - 50) °C	0.01 K
	DMDM	FLUKE	1528-R	(-189 - 960) °C	0.001 K
Thermometer Air	IMBIH	AHLBORN	FHAD 46-41	(-20 - 80) °C	0.01 K
	DMDM	TESTO	176 P1	(-20 - 70) °C	0.1 K
Barometer	IMBIH	AHLBORN	FD A612SA	(700 - 1050) mbar	0.1 mbar
	DMDM	SETRA	370	(800 - 1100) mbar	0.01 mbar
Hygrometer	IMBIH	AHLBORN	FHAD 46-41	(0 - 100) %RH	0.1 %RH
	DMDM	TESTO	176-P1	(0 - 100) %RH	0.001 %RH

Water temperature(s) and ambient conditions

Institute	Standard – Water Temperature (°C)	TS – Water Temperature (°C)	Air		
			Temperature (°C)	Pressure (mbar)	Humidity (%)
IMBIH	16.25	16.40	17.45	948.70	57.00
DMDM	16.55	16.58	17.40	1003.44	48.97

6. EVALUATION OF MEASUREMENT DATA

The comparison evaluation is based on the reported measurement results from IMBIH and DMDM, where DMDM results are considered as Hybrid Comparison Reference Values (HCRV).

The normalized deviation from reference value [4], i.e. the "En" score [5] is used for assessment of IMBIH performance in this HC.

$$En_{IMBIH} = \frac{|d_{IMBIH}|}{U(d_{IMBIH})} \quad (2)$$

where:

d_{IMBIH} - IMBIH Degree of Equivalence (DoE),

$U(d_{IMBIH})$ - Expanded uncertainty of IMBIH DoE

The IMBIH Degree of Equivalence:

$$d_{IMBIH} = x_{IMBIH} - x_{HCRV} \quad (3)$$

where:

x_{IMBIH} - IMBIH result

x_{HCRV} - Hybrid Comparison Reference Value (DMDM result)

The expanded uncertainty of IMBIH Degree of Equivalence:

$$U(d_{IMBIH}) = 2\sqrt{u_{IMBIH}^2 + u_{HCRV}^2 + u_{ST}^2} \quad (4)$$

where:

u_{IMBIH}^2 - IMBIH standard measurement uncertainty

u_{HCRV}^2 - HCRV standard measurement uncertainty

u_{ST}^2 - Stability of Transfer Standard

For the purpose of stability check, IMBIH performed the gravimetric calibration of the TS before and after DMDM calibration, what is supported by IMBIH CMC. As mentioned before, the long term stability of the TS is not documented.

The standard uncertainty of TS stability is:

$$u_{ST} = \frac{\Delta V}{2\sqrt{3}} \quad (5)$$

where:

ΔV - Volume difference between two gravimetric calibrations

The Applicant NMI, i.e. IMBIH is considered successful if $En \leq 1$.

7. RESULTS OF HYBRID COMPARISON

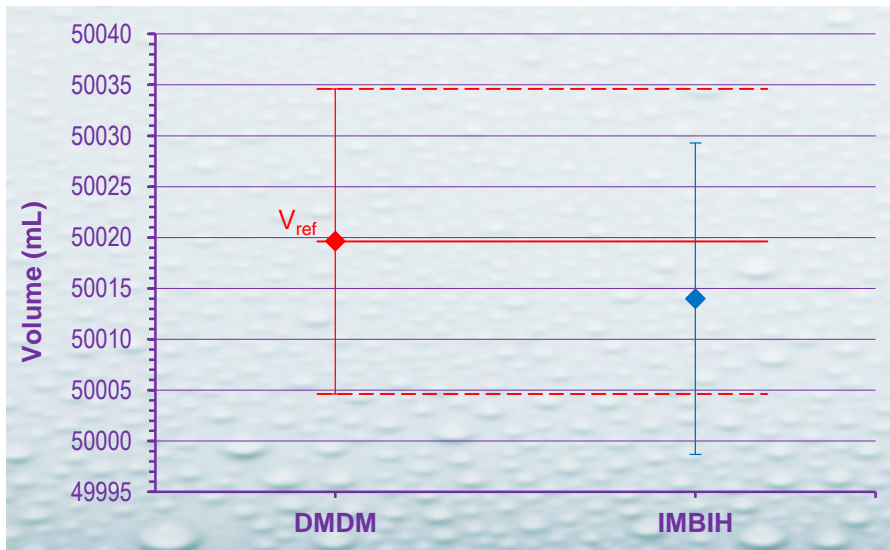
The following table contains the results of the HC

Institute	Volume V_i (mL)	Uncertainty U_i (mL)	u_{ST} (mL)	d_{IMBIH} (mL)	$U(d_{IMBIH})$ (mL)	En Score
IMBIH-g1 ^(a)	50017.08	10.00	–	–	–	–
IMBIH	50013.99	15.31	0.79 ^(b)	5.63	21.49	0.26
DMDM	50019.62	15.00	–	–	–	–
IMBIH-g2 ^(a)	50019.80	10.00	–	–	–	–

^(a) Gravimetric calibration (TS stability check)

^(b) Volume difference between two gravimetric calibrations is small ($\Delta V = 2.72$ mL) and the contribution to uncertainty is almost negligible.

The results of the HC are displayed at the following graph



8. CONCLUSIONS

The obtained En score satisfies the acceptance criterion ($En \leq 1$), thereby demonstrating the competence of IMBIH for the calibration of volumetric vessels using the volumetric method.

9. REFERENCES

- [1] [EURAMET Guide on Comparisons](#), EURAMET Guide No.4 (Version 2.0, April 2021)
- [2] [APMP guideline for using Hybrid Comparisons as CMC evidences](#) (November, 2023)
- [3] [Guidelines on the Calibration of Standard Capacity Measures Using the Volumetric Method](#) (Version 3.0, 02/2024)
- [4] M.G. Cox, Evaluation of key comparison data, *Metrologia* 39 (2002) 589–595, <https://doi.org/10.1088/0026-1394/39/6/10>
- [5] M.G. Cox, The evaluation of key comparison data: determining the largest consistent subset, *Metrologia* (2007), 44:187–200 <https://doi.org/10.1088/0026-1394/44/3/005>

Annex A

IMBIH Results



BOSNIA AND HERZEGOVINA
INSTITUTE OF METROLOGY
OF BOSNIA AND HERZEGOVINA

CERTIFIKAT O KALIBRACIJI
CALIBRATION CERTIFICATE

Kalibraciona oznaka: LV-INT-002/26
Calibration mark:

Kalibracija je izvršena u skladu sa zahtjevima međunarodnog standarda BAS EN ISO/IEC 17025 – Opšti zahtjevi za kompetentnost ispitnih i kalibracionih laboratorija. Institut za mjeriteljstvo Bosne i Hercegovine (IMBiH) je punopravni član Evropske asocijacije nacionalnih mjeriteljskih instituta – EURAMET, u okviru koje se provode eksterni auditi implementiranog sistema upravljanja kvalitetom.

The calibration was performed in full compliance with the International standard BAS EN ISO/IEC 17025 – General requirements for the competence of testing and calibration laboratories. The Institute of Metrology of Bosnia and Herzegovina (IMBiH) is full member of European Association of National Metrology Institutes – EURAMET, where external audits (Peer Reviews) are conducted to assess the implemented quality management system.

Predmet kalibracije: ETALONSKA MJERNA POSUDA / STANDARD TEST MEASURE
Calibration Item: 50 L

Proizvođač: JUSTUR
Manufacturer:

Tip / Serijski broj: ON-50
Type / Serial Number: s/n: 120192/1

Klijent: EURAMET Project 1788
Customer: Hybrid Comparison

Broj dokumenta: 06.3-46-9-1104-8/25
Document Number:

Ukupan broj stranica: 3
Total number of pages:

Datum prijema: - Period kalibracije: 21.01.2026.
Date of receipt: Period of calibration:

Certifikatom o kalibraciji dokazuje se sljedivost prema državnim etalonima sa ostvarenom sljedivošću do primarne realizacije mjernih jedinica u Međunarodnom sistemu mjernih jedinica (SI). Certifikat o kalibraciji nije važeći ukoliko je bez potpisa i pečata, a rezultati kalibracije odnose se samo na navedeni predmet i datum kalibracije. Ovaj certifikat o kalibraciji je dozvoljeno umnožavati samo u cjelini. U slučaju spora u tumačenju teksta mjerodavan je tekst na jednom od tri službena jezika u BiH.

The calibration certificate documents the traceability to the National standards traceable to the primary realization of measurement units in the International Systems of Units (SI). The calibration certificate is not valid without the signature and stamp, and the calibration results refer only to the calibrated item and date of calibration. This calibration certificate may only be reproduced as a complete document. In the event of a dispute in the interpretation of the text, the version written in one of the three official languages of BiH is considered valid.

Uradio:
Performed by:

Balta Arif
Arif Balta

Odobrio:
Approved by:

Ernad Borovac
Ernad Borovac

Datum:
Date

21.01.2026

M.P.
Stamp

Ovlaštena osoba
Authorised person

Milica Ristović Krstić, mr

Branilaca Sarajeva 25, 71000 Sarajevo

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www.met.gov.ba info@met.gov.ba

ID BROJ: 4201178930001





1. OPIS PREDMETA KALIBRACIJE / DESCRIPTION OF CALIBRATED ITEM

Osnovne karakteristike / Basic Characteristics

– Nazivna zapremina posude / Nominal Capacity of SCM:	50 L
– Serijski broj / Serial Number:	120192/1
– Referentna temperatura / Referent Temperature:	20°C
– Materijal posude / Material:	Nehrđajući čelik 304
– Koeficijent toplotnog širenja / Coefficient of Thermal Expansion:	5.18E-05 1/°C
– Vrijeme pražnjenja i okapavanja / Emptying and Dripping Time:	60 s 30 s
– Tip posude (kalibracije) / Type of Vessel (Calibration):	EX
– Maksimalno dozvoljena greška / Maximum Permissible Error:	-

2. METODA KALIBRACIJE / CALIBRATION METHOD

Kalibracija je provedena volumetrijskom metodom u skladu sa internom procedurom LV-P.03 koja je usklađena sa EURAMET cg-21: "Guidelines on the Calibration of Standard Capacity Measures using Volumetric Method".
 Calibration is performed by volumetric method in accordance to internal procedure LV-P.03 that is agreed with EURAMET cg-21: "Guidelines on the Calibration of Standard Capacity Measures using Volumetric Method".

Podaci o kalibraciji / Calibration Conditions

– Nazivna zapremina Etalona / Nominal Volume of Standard:	50 L
– Broj punjenja posude / Number of SCM fillings:	1
– Vrsta tečnosti / Type of Liquid:	Obična voda
– Temperatura tečnosti etalona / Temperature of Liquid - Standard:	(16.1 – 16.4) °C
– Temperatura tečnosti posude / Temperature of Liquid - SCM:	(16.3 – 16.5) °C
– Temperatura okoline / Ambient Temperature:	(17.4 – 17.5) °C
– Ambijentalni pritisak / Ambient Pressure:	(948 – 949.4) mbar
– Relativna vlažnost zraka / Relative Humidity of Air:	(53.6 – 60.4) %

Lokacija kalibracije / Calibration performed: Laboratorija za volumen - Dolina 6

3. SLJEDIVOST / TRACEABILITY

Etaloni i merna oprema / Standards and Measuring Equipment

Etalonska posuda Standard	JUSTUR - Prelivna pipeta; Cert.: IMBIH br. LV-026/25
Termometar-etalon Thermometer-stand.	Ahlborn, Almemo 2890-9/FD A612SA; Cert.: IMBIH br.LT-056/25
Termometar-posuda Thermometer-SCM	Testo AG, Testo 735-2/0614 0235; Cert.: IMBIH br.LT-058/25
Termometar-zrak Thermometer-air	Ahlborn, Almemo 2890-9/FHAD 46-41; Cert.: IMBIH br.LT-059-060/25
Mjerilo pritiska Pressure gauge	Ahlborn, Almemo 2890-9/FD A612SA; Cert.: IMBIH br.LM-P-038/25
Mjerilo vlažnosti Hygrometer:	Ahlborn, Almemo 2890-9/FHAD 46-41; Cert.: IMBIH br.LT-059-060/25



4. REZULTATI MJERENJA / RESULTS OF MEASUREMENTS

Rezultati/Results	Tip/Type: EX	Ref.Temp. 20°C	kg5: 2.00
Nazivni volumen <i>Nominal Volume</i>	Volumen @20°C <i>Volume @20°C</i>	Greška mjerenja ΔV <i>Measur. Error ΔV</i>	Proširena mj.nesig. <i>Expanded meas.unc</i>
50 L	500±3.99 mL	-13.99 mL	15.31 mL

Izmjerena vrijednost se koriguje prema izrazu: $V_{stvarno} = V_{izmjereno} - \Delta V$

5. MJERNA NESIGURNOST / MEASUREMENT UNCERTAINTY

Iskazana je proširena mjerna nesigurnost dobijena množenjem standardne mjerne nesigurnosti faktorom "k=2" koji obezbjeđuje vjerovatnoću pokrivanja od 95%. Mjerna nesigurnost je izračunata u skladu sa Guide to the Expression of Uncertainty in Measurements "GUM" (JCGM 100:2008). Iskazana mjerna nesigurnost ne uključuje procjenu dugoročne stabilnosti.

Reported is the expanded uncertainty of measurement which results from the standard uncertainty multiplied by coverage factor "k=2" such that the coverage probability corresponds to 95%. It is calculated according to the Guide to the Expression of Uncertainty in Measurements "GUM" (JCGM 100:2008). The reported uncertainty does not include an estimate of long-term stability.

6. NAPOMENA / REMARK

Calibration performed within ILC, EURAMET Project 1788
 HYBRID COMPARISON: CALIBRATION OF 50 L NECK TYPE PROVING TANK – VOLUMETRIC METHOD

KRAJ CERTIFIKATA O KALIBRACIJI
 END OF CALIBRATION CERTIFICATE

Data form

General Information

Laboratory	Laboratory for volume and flow IMBIH
Responsible person	Emad Borovac
Date	22.1.2026

Equipment

Measurement Equipment	Manufacturer	Type	Range	Resolution	Traceability (when applied)
Volume Standard	JUSTUR	KONP-50 Overflow pipette	50 L	-	IMBIH
Thermometer for water - TS	TESTO	735-2	(0 - 200) °C	0.001 K	IMBIH
Thermometer for water - Standard	AHLBORN	FNA30L0250T	(5 - 50) °C	0.01 K	IMBIH
Thermometer for air measurement	AHLBORN	FHAD 46-41	(-20 - 80) °C	0.01 K	IMBIH
Barometer	AHLBORN	FD A612SA	(700-1050) mbar	0.1 mbar	IMBIH
Hygrometer	AHLBORN	FHAD 46-41	(0 - 100) %RH	0.1%RH	IMBIH

Calibration results

Water Temperature - Standard	(16.1 – 16.4) °C
Water Temperature - TS	(16.3 – 16.5) °C
Air temperature	(17.4 – 17.5) °C
Pressure	(948.0 – 949.4) mbar
Humidity	(53.6 – 60.4) %

Test number	Volume (mL)
1	50014.24
2	50013.83
3	50014.39
4	50013.73
5	50013.76
Mean value	50013.99
Standard deviation	0.3015

Uncertainty budget

Quantity (x_i)	Value	Distribution	Standard uncertainty $u(x_i)$	Sensitivity coefficient c_i	Uncertainty $u(y_i)$	Comment/ Explanation
Repeatability	-	Normal	1.348E-01	1	1.348E-01	
Volume of reference standard at referent temperature (mL)	5.0000.57	Normal & rectangular	5.000E+00	1.000E+00	5.000E+00	
Water temperature of reference standard (°C)	16.30	Normal & rectangular	8.295E-02	-5.645E+00	4.683E-01	
Water temperature of DUT (°C)	16.36	Normal & rectangular	7.737E-02	5.645E+00	4.368E-01	
Cubic coefficient of expansion of reference standard (°C ⁻¹)	7.95	Rectangular	2.590E-06	-1.852E+05	4.797E-01	
Cubic coefficient of expansion of DUT (°C ⁻¹)	5.180E-05	Rectangular	2.590E-06	1.820E+05	4.713E-01	
Cubic coefficient of expansion of water (°C ⁻¹)	5.180E-05	Rectangular	2.000E-06	3.220E+03	6.440E-03	
Meniscus reading (mL)	-	-	3.821E+00	1	3.821E+00	
Contribution from air bubbles, residua, etc. (ml)	-	-	3.500E+00	1	3.500E+00	
Other (Resolution, Zero adjustment, verticality)	-	-	2.425E+00	1	2.425E+00	
Uncertainty (mL)					7.656	
Expanded uncertainty (mL) (k=2)					15.312	

Standard Calibration Procedure (short description)

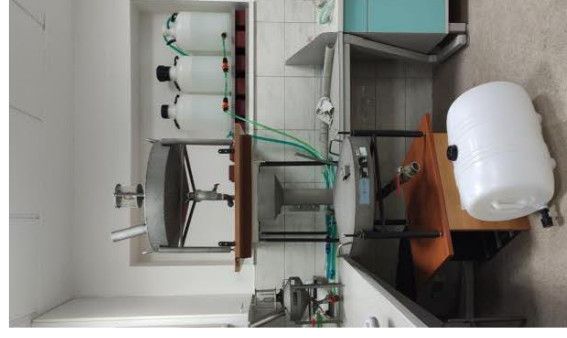
$$V_t = NV_0 [1 - \gamma_{RS}(t_{ORS} - t_{RS}) + \beta(t_{SCM} - t_{RS}) + \gamma_{SCM}(t - t_{SCM})] + \Delta V$$

1. Stabilization of filled DUT and standard, water and other measuring equipment (24 hours).
2. Drain standard and DUT
3. Fill the standard and record the water temperature
4. Record environmental data
5. Drain standard into DUT
6. Adjust the meniscus and record the water temperature.
7. Drain the DUT
8. Repeat steps 3 - 7 (5 times)
9. Record the environmental data

Comments:

Signature:
Ernad Borovac

ERNAD BOROvac
dokument potvrđen s jednodrotnim kodom
Halcom CA
cijelovitost dokumenta potvrđena s senzerskim certifikatom
Serijski broj certifikata / Datum potpisa
15D01A / 26.01.2026, 09:24





BOSNIA AND HERZEGOVINA
INSTITUTE OF METROLOGY
OF BOSNIA AND HERZEGOVINA

CERTIFIKAT O KALIBRACIJI
CALIBRATION CERTIFICATE

Kalibraciona oznaka: LV-INT-001/26
Calibration mark:



Ovaj certifikat je u skladu sa kalibracionim i mjernim mogućnostima koje se nalaze u Dodatku C Sporazuma o međusobnom priznavanju (CIPM MRA) koji je propisan od strane Međunarodnog komiteta za tegove i mjere. U okviru CIPM MRA, svi instituti međusobno priznaju kalibracione i mjerne certifikate za veličine, opsege i mjerne nesigurnosti specificirane u Dodatku C (za detalje vidjeti <http://www.bipm.org>).
This certificate is consistent with the capabilities that are included in Appendix C of the CIPM MRA drawn up by the CIPM. Under the CIPM MRA, all participating institutes recognize the validity of each other's calibration and measurement certificates for the quantities, ranges and measurement uncertainties specified in Appendix C (for details see <http://www.bipm.org>).

Predmet kalibracije Calibration Item	ETALONSKA MJERNA POSUDA / STANDARD TEST MEASURE 50 L
Proizvođač Manufacturer	JUSTUR
Tip / Serijski broj: Type / Serial Number:	ON-50 s/n:120192/1
Klijent: Customer:	EURAMET Project 1788 Hybrid Comparison
Broj dokumenta: Document Number:	06.3-46-9-1104-7/25
Ukupan broj stranica: Total number of pages:	3
Datum prijema: Date of receipt:	-
Period kalibracije: Period of calibration:	21.01.2026.

Certifikatom o kalibraciji dokazuje se sljedivost prema državnim etalonima sa ostvarenom sljedivošću do primarne realizacije mjernih jedinica u Međunarodnom sistemu mjernih jedinica (SI). Certifikat o kalibraciji nije važeći ukoliko je bez potpisa i pečata, a rezultati kalibracije odnose se samo na navedeni predmet i datum kalibracije. Ovaj certifikat o kalibraciji je dozvoljeno umnožavati samo u cjelini. U slučaju spora u tumačenju teksta mjerodavan je tekst na jednom od tri službena jezika u BiH.
The calibration certificate documents the traceability to the National standards traceable to the primary realization of measurement units in the International Systems of Units (SI). The calibration certificate is not valid without the signature and stamp, and the calibration results refer only to the calibrated item and date of calibration. This calibration certificate may only be reproduced as a complete document. In the event of a dispute in the interpretation of the text, the version written in one of the three official languages of BiH is considered valid.

Uradio:
Performed by:


Arif Balta

Odobrio:
Approved by:


Ernad Borovac

Datum
Date

21.01.2026.

M.P.
Stamp



Ovlaštena osoba
Authorised person


Milica Ristović Krstić, mr





1. OPIS PREDMETA KALIBRACIJE / DESCRIPTION OF CALIBRATED ITEM

Osnovne karakteristike / Basic Characteristics

– Nazivna zapremina / Nominal Capacity:	50 L
– Serijski broj / Serial Number:	120192/1
– Referentna temperatura / Reference Temperature:	20°C
– Materijal posude / Material:	Nehrđajući čelik 304
– Koefficient toplotnog širenja / Coefficient of Thermal Expansion:	5.18E-05 1/°C
– Vrijeme pražnjenja i okapavanja / Emptying and Dripping Time:	60 s 30 s
– Tip posude (kalibracije) / Type of Vessel (Calibration):	EX
– Maksimalno dozvoljena greška / Maximum Permissible Error:	-

2. METODA KALIBRACIJE / CALIBRATION METHOD

Kalibracija je provedena gravimetrijskom metodom u skladu sa internim uputstvom LV-U.04 koje je usklađena sa EURAMET cg-19: "Guidelines on the determination of uncertainty in gravimetric volume calibration".

Calibration is performed by gravimetric method in accordance to internal procedure LV-U.04 which is agreed with EURAMET cg-19: "Guidelines on the determination of uncertainty in gravimetric volume calibration".

Podaci o kalibraciji / Calibration Conditions

– Vrsta tečnosti / Type of Liquid:	Obična voda
– Temperatura tečnosti / Liquid Temperature:	(16.3 – 16.5) °C
– Temperatura okoline / Ambient Temperature:	(17.5 – 17.5) °C
– Ambijentalni pritisak / Ambient Pressure:	(948.1 – 948.9) mbar
– Relativna vlažnost zraka / Relative Humidity of Air:	(55.8 – 60.1) %

Lokacija kalibracije / Calibration performed: Laboratorija za volumen - Dolina 6

3. SLJEDIVOST / TRACEABILITY

Etaloni i mjerna oprema / Standards and Measuring Equipment

Elektronska vaga <i>Electronic Scale</i>	Sartorius, LA 64001S; Cert.: IMBIH br.LM-V-16/25
Termometar-voda <i>Thermometer-water</i>	Testo AG, Testo 735-2/0614 0235; Cert.: IMBIH br.LT-058/25
Termometar-zrak <i>Thermometer-air</i>	Ahlborn, Almemo 2890-9/FHAD 46-41; Cert.: IMBIH br.LT-059-060/25
Mjerilo pritiska <i>Pressure gauge</i>	Ahlborn, Almemo 2890-9/FD A612SA; Cert.: IMBIH br.LM-P-038/25
Mjerilo vlažnosti <i>Hygrometer:</i>	Ahlborn, Almemo 2890-9/FHAD 46-41; Cert.: IMBIH br.LT-059-060/25



4. REZULTATI MJERENJA / RESULTS OF MEASUREMENTS

Rezultati/Results	Tip/Type: EX	Ref.Temp. 20°C	k ₉₅ 2.00
Nazivni volumen Nominal Volume	Volumen @20°C Volume @20°C	Greška mjerenja ΔV Measur. Error ΔV	Proširena mj.nesig. Expanded meas.unc
50 L	50017.08 mL	-17.08 mL	10.00 mL

Izmjerena vrijednost se koriguje prema izrazu: $V_{stvarno} = V_{izmjereno} - \Delta V$

5. MJERNA NESIGURNOST / MEASUREMENT UNCERTAINTY

Iskazana je proširena mjerna nesigurnost dobijena množenjem standardne mjerne nesigurnosti faktorom "k=2" koji obezbjeđuje vjerovatnoću pokrivanja od 95%. Mjerna nesigurnost je izračunata u skladu sa Guide to the Expression of Uncertainty in Measurements "GUM" (JCGM 100:2008). Iskazana mjerna nesigurnost ne uključuje procjenu dugoročne stabilnosti.

Reported is the expanded uncertainty of measurement which results from the standard uncertainty multiplied by coverage factor "k=2" such that the coverage probability corresponds to 95%. It is calculated according to the Guide to the Expression of Uncertainty in Measurements "GUM" (JCGM 100:2008). The reported uncertainty does not include an estimate of long-term stability.

6. NAPOMENA / REMARK

Calibration performed within ILC, EURAMET Project 1788
HYBRID COMPARISON: CALIBRATION OF 50 L NECK TYPE PROVING TANK – GRAVIMETRIC METHOD
 (Stability Check)

KRAJ CERTIFIKATA O KALIBRACIJI
 END OF CALIBRATION CERTIFICATE



BOSNIA AND HERZEGOVINA
INSTITUTE OF METROLOGY
OF BOSNIA AND HERZEGOVINA

CERTIFIKAT O KALIBRACIJI
CALIBRATION CERTIFICATE

Kalibraciona oznaka: LV-INT-003/26
Calibration mark:



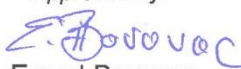
Ovaj certifikat je u skladu sa kalibracionim i mjernim mogućnostima koje se nalaze u Dodatku C Sporazuma o međusobnom priznavanju (CIPM MRA) koji je propisan od strane Međunarodnog komiteta za tegove i mjere. U okviru CIPM MRA, svi instituti međusobno priznaju kalibracione i mjerne certifikate za veličine, opsege i mjerne nesigurnosti specificirane u Dodatku C (za detalje vidjeti <http://www.bipm.org>).
This certificate is consistent with the capabilities that are included in Appendix C of the CIPM MRA drawn up by the CIPM. Under the CIPM MRA, all participating institutes recognize the validity of each other's calibration and measurement certificates for the quantities, ranges and measurement uncertainties specified in Appendix C (for details see <http://www.bipm.org>).

Predmet kalibracije Calibration Item	ETALONSKA MJERNA POSUDA / STANDARD TEST MEASURE 50 L
Proizvođač Manufacturer	JUSTUR
Tip / Serijski broj: Type / Serial Number:	ON-50 s/n:120192/1
Klijent: Customer:	EURAMET Project 1788 Hybrid Comparison
Broj dokumenta: Document Number:	06.3-46-9-1104-9/25
Ukupan broj stranica: Total number of pages:	3
Datum prijema: Date of receipt:	-
Period kalibracije: Period of calibration:	18.02.2026.

Certifikatom o kalibraciji dokazuje se sljedivost prema državnim etalonima sa ostvarenom sljedivošću do primarne realizacije mjernih jedinica u Međunarodnom sistemu mjernih jedinica (SI). Certifikat o kalibraciji nije važeći ukoliko je bez potpisa i pečata, a rezultati kalibracije odnose se samo na navedeni predmet i datum kalibracije. Ovaj certifikat o kalibraciji je dozvoljeno umnožavati samo u cjelini. U slučaju spora u tumačenju teksta mjerodavan je tekst na jednom od tri službena jezika u BiH.
The calibration certificate documents the traceability to the National standards traceable to the primary realization of measurement units in the International Systems of Units (SI). The calibration certificate is not valid without the signature and stamp, and the calibration results refer only to the calibrated item and date of calibration. This calibration certificate may only be reproduced as a complete document. In the event of a dispute in the interpretation of the text, the version written in one of the three official languages of BiH is considered valid.

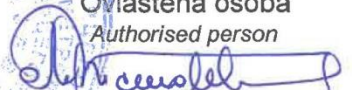
Uradio:
Performed by:

Arif Balta

Odobrio:
Approved by:

Ernad Borovac

Datum
Date
18.02.2026.

M.P.
Stamp

Ovlaštena osoba
Authorised person

Milica Ristović Krstić, mr





1. OPIS PREDMETA KALIBRACIJE / DESCRIPTION OF CALIBRATED ITEM

Osnovne karakteristike / Basic Characteristics

– Nazivna zapremina / Nominal Capacity:	50 L
– Serijski broj / Serial Number:	120192/1
– Referentna temperatura / Reference Temperature:	20°C
– Materijal posude / Material:	Nehrđajući čelik 304
– Koeficijent toplotnog širenja / Coefficient of Thermal Expansion:	5.18E-05 1/°C
– Vrijeme pražnjenja i okapavanja / Emptying and Dripping Time:	60 s 30 s
– Tip posude (kalibracije) / Type of Vessel (Calibration):	EX
– Maksimalno dozvoljena greška / Maximum Permissible Error:	-

2. METODA KALIBRACIJE / CALIBRATION METHOD

Kalibracija je provedena gravimetrijskom metodom u skladu sa internim uputstvom LV-U.04 koje je usklađena sa EURAMET cg-19: "Guidelines on the determination of uncertainty in gravimetric volume calibration".
Calibration is performed by gravimetric method in accordance to internal procedure LV-U.04 which is agreed with EURAMET cg-19: "Guidelines on the determination of uncertainty in gravimetric volume calibration".

Podaci o kalibraciji / Calibration Conditions

– Vrsta tečnosti / Type of Liquid:	Obična voda
– Temperatura tečnosti / Liquid Temperature:	(16.5 – 16.7) °C
– Temperatura okoline / Ambient Temperature:	(17.8 – 17.8) °C
– Ambijentalni pritisak / Ambient Pressure:	(952 – 952.2) mbar
– Relativna vlažnost zraka / Relative Humidity of Air:	(53.8 – 54.7) %

Lokacija kalibracije / Calibration performed: Laboratorija za volumen - Dolina 6

3. SLJEDIVOST / TRACEABILITY

Etaloni i mjerna oprema / Standards and Measuring Equipment

Elektronska vaga <i>Electronic Scale</i>	Sartorius, LA 64001S; Cert.: IMBIH br.LM-V-16/25
Termometar-voda <i>Thermometer-water</i>	Testo AG, Testo 735-2/0614 0235; Cert.: IMBIH br.LT-058/25
Termometar-zrak <i>Thermometer-air</i>	Ahlborn, Almemo 2890-9/FHAD 46-41; Cert.: IMBIH br.LT-059-060/25
Mjerilo pritiska <i>Pressure gauge</i>	Ahlborn, Almemo 2890-9/FD A612SA; Cert.: IMBIH br.LM-P-038/25
Mjerilo vlažnosti <i>Hygrometer</i>	Ahlborn, Almemo 2890-9/FHAD 46-41; Cert.: IMBIH br.LT-059-060/25



4. REZULTATI MJERENJA / RESULTS OF MEASUREMENTS

Rezultati/Results	Tip/Type: EX	Ref.Temp. 20°C	k ₉₅ 2.00
Nazivni volumen <i>Nominal Volume</i>	Volumen @20°C <i>Volume @20°C</i>	Greška mjerenja ΔV <i>Measur. Error ΔV</i>	Proširena mj.nesig. <i>Expanded meas.unc</i>
50 L	50019.80 mL	-19.80 mL	10.00 mL

Izmjerena vrijednost se koriguje prema izrazu: $V_{stvarno} = V_{izmjereno} - \Delta V$

5. MJERNA NESIGURNOST / MEASUREMENT UNCERTAINTY

Iskazana je proširena mjerna nesigurnost dobijena množenjem standardne mjerne nesigurnosti faktorom "k=2" koji obezbjeđuje vjerovatnoću pokrivanja od 95%. Mjerna nesigurnost je izračunata u skladu sa Guide to the Expression of Uncertainty in Measurements "GUM" (JCGM 100:2008). Iskazana mjerna nesigurnost ne uključuje procjenu dugoročne stabilnosti.

Reported is the expanded uncertainty of measurement which results from the standard uncertainty multiplied by coverage factor "k=2" such that the coverage probability corresponds to 95%. It is calculated according to the Guide to the Expression of Uncertainty in Measurements "GUM" (JCGM 100:2008). The reported uncertainty does not include an estimate of long-term stability.

6. NAPOMENA / REMARK

Calibration performed within ILC, EURAMET Project 1788
 HYBRID COMPARISON: CALIBRATION OF 50 L NECK TYPE PROVING TANK – GRAVIMETRIC METHOD
 (Stability Check II)

KRAJ CERTIFIKATA O KALIBRACIJI
 END OF CALIBRATION CERTIFICATE

Annex B

DMDM Results



РЕПУБЛИКА СРБИЈА
Republic of Serbia
МИНИСТАРСТВО ПРИВРЕДЕ
Ministry of Economy

ДИРЕКЦИЈА ЗА МЕРЕ И ДРАГОЦЕНЕ МЕТАЛЕ
Directorate of Measures and Precious Metals (DMDM)

11 000 Београд, 11 000 Belgrade, Мике Аласа 14, Mike Alasa 14, ПАК 105 305, ПП 34
Телефон/phone 011/32 82 736, факс/fax 011/21 81 668, www.dmdm.gov.rs

Број/Archive No: 000520308 2026 10811 002 005 392 044 04 003

Датум/ Date: 10.2.2026.

УВЕРЕЊЕ О ЕТАЛОНИРАЊУ Calibration certificate

Укупан број страна/ Total pages: 3

Назив/ Object: Мерна посуда / Proving tank
Произвођач/ Manufacturer: Justur, Словачка / Justur, Slovakia
Тип/ Type: ON-50
Производна ознака/ Serial No: 120192/1
Датум (период) еталонирања /
Date of calibration: 2.2.2026.
Корисник мерног средства/ Customer: Институт за метрологију Босне и Херцеговине
(ИМБиХ), Бранилаца Сарајева 25, 71000 Сарајево
/ Institute of Metrology of Bosnia and Herzegovina
(IMBiH), Branilaca Sarajeva 25, 71000 Sarajevo

МЕРЕЊЕ ИЗВРШИЛА

Metrologist

L. Mičić
Ljiljana Mičić

РУКОВОДИЛАЦ ОДЕЉЕЊА ЗА МАСУ,
ПРИТИСАК, ЗАПРЕМИНУ И ПРОТОК /
Head of Section for mass, pressure, volume and flow

Dragan Pantić
Dragan Pantić

В.Д. ПОМОЋНИКА ДИРЕКТОРА

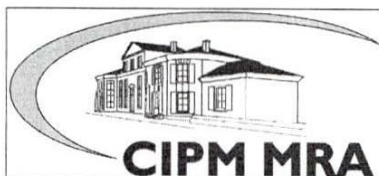
Acting Assistant Director

Nikola Petrović
Nikola Petrović



М.П.

Ово уверење је у складу са могућностима мерења и еталонирања (CMCs),
које су дате у додатку С Аранжмана о међусобном признавању (CIPM
MRA), који је припремио Међународни комитет за тегове и мере (CIPM).
Према CIPM MRA, сви институти-учесници међусобно признају важење
уверења о еталонирању и мерењу за величине, опсеге и мерне
несигурности, наведене у KCDB бази (<https://www.bipm.org/kcdb/>).
This certificate is consistent with the calibration and measurement capabilities
(CMCs) that are included in Appendix C of the Mutual Recognition Arrangement
(CIPM MRA) drawn up by the International Committee for Weights and
Measures (CIPM). Under the CIPM MRA, all participating institutes recognize
the validity of each other's calibration and measurement certificates for the
quantities, ranges and measurement uncertainties specified in the KCDB (for
details see <https://www.bipm.org/kcdb/>).



Без одобрења Сектора за развој метрологије уверење о еталонирању сме се умножавати искључиво као целина.
Calibration certificate shall not be copied in full without approval of Metrology Development Sector

ПУ-04-А-05 издање/измена 03/00
issue/change

1. Опис, и када је неопходно, стање мерног средства / Description, and when necessary, condition of measuring instrument

Називна запремина мерне посуде је 50 L. На посуди се налази нивоказна цев од стакла и мерни лењир са скалом. Нивоказна цев смештена је у непосредној близини врата мерне посуде и постављена паралелно у односу на њега. Најмањи подељак на мерном лењиру је 25 mL што одговара вредности од 4,25 mm. Вредност кубног коефицијента топлотног ширења материјала мерне посуде $51,8 \cdot 10^{-6} 1/^{\circ}\text{C}$ је добијена од корисника. Лабораторија се одриче од одговорности.

На мерној посуди се налази мерно средство за нивелисање. Време искапавања приликом пражњења воде из мерне посуде је 30 s. Време пражњења мерне посуде је 60 s. Пражњење је извршено са потпуно отвореним вентилом. На половини времена откапавања вентил мерне посуде је затворен и поново отворен.

/

The nominal capacity of the proving tank is 50 L. The vessel is equipped with a glass level gauge and a graduated scale. The level gauge is positioned in the immediate vicinity of the proving tank neck and is installed parallel to it. Resolution on the scale is 25 mL, corresponding to a length of 4,25 mm. The value of the cubic thermal expansion coefficient of the proving tank material $51,8 \times 10^{-6} 1/^{\circ}\text{C}$ was provided by the customer. The laboratory disclaims any responsibility.

The proving tank is fitted with a levelling device. The dripping time during discharge of water from the proving tank is 30 s. The delivery time of the proving tank is 60 s. Discharge was performed with the valve fully open. At half of the dripping time, the proving tank valve was closed and then reopened.

Датум пријема мерног средства/ Date of receipt of the measuring instrument: 27.1.2026.

2. Метода еталонирања/ Method of calibration

Еталонирање оквашене мерне посуде, предвиђене да „садржи” запремину течности, урађено је према радном упутству РУ-306 - Радно упутство за еталонирање мерних посуда волуметријском методом, верзија/издање 04/01 (01/2026), усаглашеним са EURAMET cg-21 Guidelines on the Calibration of Standard Capacity Measures using the Volumetric Method, Version 3.0 (02/2024). Коришћена течност за еталонирање је вода из водоводне мреже.

/

The calibration of pre - wetted proving tank, intended “to contain” volume of liquid, was performed in accordance with the working instruction RU-Z06 – Working instruction for calibration of standard capacity measures by volumetric method, version/issue 04/01 (01/2026), in accordance with EURAMET cg-21 Guidelines on the Calibration of Standard Capacity Measures using the Volumetric Method, Version 3.0 (02/2024). The liquid used for calibration was demineralized deaerated water.

3. Метролошка следивост/ Traceability

Резултат еталонирања је следив до међународног еталона који представља реализацију јединице масе у складу са Међународним системом мерних јединица (SI). Мерења су урађена са преливном пипетом од метала називне запремине 50 L, производна ознака 1/11, произвођач Brenner, Немачка, уверење о еталонирању број 003343256 2025 10811 002 006 392 036 04 002(ДМДМ) од 27.8.2025. године.

/

The calibration result is traceable to the international standard representing the realization of the unit of mass in accordance with the International System of Units (SI). The measurements were performed using overflow pipette with a nominal capacity of 50 L, serial

number 3, manufactured by Brenner, Germany, calibration certificate No. 003343256 2025 10811 002 006 392 036 04 002 (DMDM), dated 27.8.2025.

4. Услови околине / *Environmental conditions*

У лабораторији, током еталонирања, измерене су следеће вредности / *In the laboratory, during calibration, the following values were measured:*

- температура ваздуха / *air temperature*: 17,3 °C to 17,5 °C,
- релативна влажност ваздуха / *relative humidity*: 50,9 % to 54,5 %,
- температура воде / *water temperature*: од 16,5 °C to 16,6 °C,
- атмосферски притисак / *atmospheric pressure*: 1003,03 mbar to 1003,53 mbar.

Локација еталонирања/ *Calibration location*:

Лабораторија за еталонирање мерила запремине и масе. / *Laboratory for the calibration of volume and mass measuring instruments.*

5. Резултати еталонирања/ *Calibration results*

Резултати се односе само на предмет еталонирања. / *Results relate only to the item calibrated.*

Запремина очитана на мерном лењиру мерне посуде / <i>Volume indicated on the graduated scale of the proving tank V_{read} (L)</i>	Запремина на референтној температури од 20 °C / <i>Volume at ref. temperature 20 °C, V_i (L)</i>	Грешка / <i>Error</i> <i>E = V_{read} - V_i (L)</i>	Мерна несигурност / <i>Measurement uncertainty U (L)</i>	Број поновљених мерања / <i>Number of repeated measurements</i>
50,000	50,020	- 0,020	0,015	5

6. Мерна несигурност/ *Measurement uncertainty*

Наведена проширена мерна несигурност резултата мерења дата је као стандардна мерна *несигурност*, помножена фактором прекривања/обухвата $k = 2$, који за нормалну расподелу одговара вероватноћи прекривања/обухвата приближно 95 %. Видети "Упутство за изражавање мерне несигурности" (JCGM 100:2008).

Uncertainty of measurement results is reported as an expanded measurement uncertainty, given as a standard measurement uncertainty multiplied by a coverage factor of $k = 2$ that for the normal distribution corresponds to the level of confidence of approximately 95 %. See "Guide to the Expression of Uncertainty in Measurement" (JGCM 100:2008).

Крај уверења о еталонирању
End of calibration certificate



Република Србија
Влада
Управа за заједничке послове републичких органа
Београд

Data form

General Information

Laboratory	DMDM
Responsible person	Lijana Mišić
Date	10.2.2026.

Equipment

Measurement/Equipment	Manufacturer	Type	Range	Serial number	Resolution	Traceability (when applied)
Volume Standard	Brenner, Germany	Ex	50 L	3	NA, volume standard is overflow pipette	DMDM, calibration certificate number 003343256 2025 10811 002 006 392 036 04 002 issued 27.8.2025.
Thermometer for water - Transfer Standard	Testo, Germany	Testo 735-2, Pt 100 probe	-200 °C to 800 °C	01936244/009	0.001 °C	IMBH, calibration certificate number LT-058/25 issued 19.8.2025.
Thermometer for water - Reference Standard	Fluke Hart Scientific	1528-R, Pt 100 probe	-189 °C to 960 °C	B44093 probe; T7-14009/2, T1	0.001 °C	DMDM, calibration certificate number 003392365 2025 10811 002 007 392 036 04 003 issued 12.8.2025.
Thermometer for air measurement	Testo, Germany	176 P1, data logger	-20 °C to 70 °C	41003948 0624, probe; 210903381	0.1 °C	DMDM, calibration certificate number 003392365 2025 10811 002 007 392 036 04 003 issued 20.10.2025.
Barometer	Setra	370	800 mbar to 1100 mbar	5182827	0.01 mbar	IMBH, calibration certificate number LM-P-047/25 issued 13.11.2025.
Hygrometer	Testo, Germany	176 P1, data logger	0 % to 100 %	41003948 0624, probe; 210903381	0.001	DMDM, calibration certificate number 003392365 2025 10811 002 007 392 036 04 003 issued 20.10.2025.

Calibration results

Water Temperature - Reference Standard, °C	16.55
Water Temperature - Transfer Standard, °C	16.58
Air Temperature, °C	17.4
Pressure, mbar	1003.44
Humidity, %	48.97

Test number	Volume (mL)
1	50023.87
2	50018.04
3	50019.07
4	50019.02
5	50018.08
Mean value	50019.62
Standard deviation	2.4286

Uncertainty budget

Quantity (x_i)	Value	Distribution	Standard uncertainty $u(x_i)$	Sensitivity coefficient c_i	Uncertainty $u(y_i)$	Comment/Explanation
Repeatability	2.428		1.0859	1	1.09E+00	
Volume of reference standard at referent temperature (mL)	49989.9	normal	5.1316	1	5.13E+00	
Water temperature of reference standard (°C)	16.55	rectangular	0.0798	-5.79E+00	-4.62E-01	
Water temperature of DUT (°C)	16.58	rectangular	0.0736	3.47E+00	2.56E-01	
Cubic coefficient of expansion of reference standard (°C ⁻¹)	0.00000518	rectangular	2.99E-06	7.75E+04	2.32E-01	
Cubic coefficient of expansion of DUT (°C ⁻¹)	0.00000518	rectangular	2.99E-06	1.71E+05	5.11E-01	
Cubic coefficient of expansion of water (°C ⁻¹)	0.000168	rectangular	2.00E-06	1.454E+03	2.91E-03	
Meniscus reading (mL)	3.125	rectangular	1.8042	1	1.80E+00	
Contribution from air bubbles, residual evaporation (ml)	3.5	rectangular	2.0207	1	2.02E+00	
Quantity of water added or removed (mL)	17.0	rectangular	0.0012	1	1.20E-03	
Other (Resolution, Zero adjustment, verticality), mL	7.5	rectangular	4.330127019	1	4.33E+00	
Expanded uncertainty (mL) (k=2)					7.962	
					15	

Standard Calibration Procedure (short description)

$$V_L = NV_0[1 - \gamma_{RS}(t_{ORS} - t_{RS}) + \beta(t_{SCM} - t_{RS}) + \gamma_{SCM}(t - t_{SCM})] + \Delta V$$

1. Level and fill the proving tank (TS) with water up to (approximately) the nominal volume.
 2. Measure and record the ambient conditions (air temperature, humidity and air pressure).
 3. Level and fill the 50 L overflow pipette (RS) with water.
 4. Empty proving tank (TS).
 5. Measure and record the temperature of water in overflow pipette (RS).
 6. Deliver the water from overflow pipette (RS) to proving tank (TS).
 7. Measure and record the temperature of water in proving tank (TS).
 8. Determine and record the error of proving tank (TS).
 9. Measure and record the ambient conditions (air temperature, humidity and air pressure).
- This cycle, from point 1 to point 9, was repeated five times.

Comments:

Signature:

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Calibration setup - DMDM

