

CRM Certification

Main benefits of our certification in comparison to the ones given by other producers are to be found in the following:

- ✓ The Certificate of Analysis, reports the actual values and not simply the calculated ones;
- ✓ Created in accordance with ISO Guide 31 and ISO Guide 35;
- ✓ Certified values and uncertainties are obtained on the basis of two independent methods when possible (even for multi-element solutions);
- ✓ The uncertainties refer to each of the components separately and not to the uncertainty of the whole mixture.

Each solution is barcode identified

Traceable to SI

Certification Date and Stability Check Date

Unique LOT number

CERTIFIED REFERENCE MATERIAL

This document is designed and the certified value(s) and uncertainty(ies) are determined in accordance with ISO Guide 31⁽¹⁾, ISO Guide 35⁽²⁾ and Eurachem / CITAC Guides⁽³⁾

Lot N: XXXX

Barcode: XXXXX

Certification Date: 28.06.2016
Date of Stability last check:

Description of the Reference Material (CRM):

Solution of: Al 100mg/l; Ag 100mg/l; As 100mg/l; B 100mg/l; Ba 100mg/l; Be 100mg/l; Bi 100mg/l; Ca 100mg/l; Cd 100mg/l; Co 100mg/l; Cr 100mg/l; Cu 100mg/l; Fe 100mg/l; K 100mg/l; Li 100mg/l; Mg 100mg/l; Mn 100mg/l; Mo 100mg/l; Na 100mg/l; Ni 100mg/l; Pb 100mg/l; Sb 100mg/l; Se 100mg/l; Sr 100mg/l; Ti 100mg/l; Tl 100mg/l; V 100mg/l; Zn 100mg/l; Matrix: 5% HNO₃

Ref N: MB56A K1.5N L.5

Certified value/ Uncertainty:

Element	Certified Value and Uncertainty [mg/l]	Metrological traceability:
Al	100.12 ± 0.30	NIST SRM No 3101a Lot 060502
Ag	100.10 ± 0.31	NIST SRM No 3151 Lot 992212
As	100.65 ± 0.54	NIST SRM No CGAS1-1 Lot G2-AS02102
B	100.18 ± 0.34	NIST SRM No 3107 Lot 110830
Ba	100.21 ± 0.33	NIST SRM No 3104a Lot 070222
Be	99.89 ± 0.28	NIST SRM No 3105a Lot 090514
Bi	99.71 ± 0.37	NIST SRM No 3106 Lot 991212
Ca	99.34 ± 0.23	NIST SRM No 3109a Lot 130213
Cd	99.29 ± 0.33	NIST SRM No 3108 Lot 130116
Co	99.76 ± 0.26	NIST SRM No 3113 Lot 000630
Cr	99.85 ± 0.27	NIST SRM No 3112a Lot 030730
Cu	100.23 ± 0.25	NIST SRM No 3114 Lot 121207
Fe	99.30 ± 0.30	NIST SRM No 3126a Lot 140812
K	100.45 ± 0.32	NIST SRM No 3141a Lot 140813
Li	99.66 ± 0.31	NIST SRM No 3129a Lot 100714
Mg	99.40 ± 0.22	NIST SRM No 3131a Lot 050302
Mn	99.77 ± 0.29	NIST SRM No 3132 Lot 050429
Mo	100.03 ± 0.32	NIST SRM No 3134 Lot 891307
Na	100.69 ± 0.32	NIST SRM No 3152a Lot 120715
Ni	99.76 ± 0.32	NIST SRM No 3136 Lot 120619
Pb	98.53 ± 0.63	NIST SRM No 3128 Lot 101026
Sb	99.70 ± 0.35	NIST SRM No 3102a Lot 061229
Se	99.28 ± 0.54	NIST SRM No 3149 Lot 100901
Sr	100.07 ± 0.27	NIST SRM No 3153a Lot 990906
Ti	100.50 ± 0.28	NIST SRM No 3162a Lot 060808
Tl	100.01 ± 0.42	NIST SRM No 3158 Lot 993012
V	99.86 ± 0.35	NIST SRM No 3165 Lot 992706
Zn	99.43 ± 0.30	NIST SRM No 3168a Lot 120629

Method(s) of certification used: CRM's calibration procedure(s):

(y) WQP 5.15.1.24

Notes:

The certified value was obtained by a weighted mean of the results of two independent methods among: Classical Volumetric, Primary Gravimetric, Instrumental (AAS, ICP or IC)

Concept of Certification and traceability statement:

This certified reference material is produced using a high-purity starting material, acid from sub-boiling and 18 MΩ·cm deionized water. The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k = 2$, which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty of measurement has been determined in accordance with EA 4/02.

Property of the result of a measurement whereby it can be related to stated references, usually national or international standards, through an unbroken chain of comparisons all having stated uncertainties (ISO VIM).

The metrological traceability is assured through calibration on ICP-OES, AAS. The calibration curve is drawn using a series of standard solutions prepared from a certified reference material traceable to SI of NIST (SRM) and of accredited according to ISO/IEC 17025⁽⁴⁾ and/or ISO Guide 34⁽⁵⁾ laboratories/producers. All contributions in relation to the certification of standard solutions are considered when evaluating the uncertainty.

The measurement results are traceable to SI. All analytical balances used for the preparation of the solution are calibrated yearly under an in-house procedure with analytical weights, traceable to DKD and are checked daily.

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Purity of Each
Starting Material

Density for weight/
weight calculations

Intended usage

Class A laboratory glassware is used.

The results from temperature measurement are traceable to SI. The thermometers used for solution's calibration are calibrated from an ISO 17025 accredited laboratory. The ambient conditions are controlled with a hygrometer calibrated from an ISO 17025 accredited laboratory.

Starting material, purity * :

Al 99.999%	55 : Al[Al] : 8N : T- : 5 : N06
AgNO ₃ 99.999%	50 : Ag[AgNO ₃] : 5N : T- : 5 : O01
H ₃ AsO ₄ 99.999%	100 : As[H ₃ AsO ₄] : H ₂ O : TNH4 : 5 : K06
H ₃ BO ₃ 99.999%	5 : B[H ₃ BO ₃] : H ₂ O : T- : 5 : O01
Ba(NO ₃) ₂ 99.999%	20 : Ba[Ba(NO ₃) ₂] : 2N : T- : 5 : O08
Be ₄ O(C ₂ H ₃ O ₂) ₆ 99.9989%	20 : Be[Be ₄ O(C ₂ H ₃ O ₂) ₆] : 5N : T- : 489 : O04
Bi 99.999%	50 : Bi[Bi] : 5N : T- : 5 : N01
Ca(NO ₃) ₂ 99.998%	80 : Ca[Ca(NO ₃) ₂] : 5N : T- : 48 : O06
Cd 99.999%	50 : Cd[Cd] : 5N : T- : 5 : O01
Co(NO ₃) ₂ 99.999%	30 : Co[Co(NO ₃) ₂] : 8N : T- : 5 : O02
Cr(NO ₃) ₃ 99.999%	50 : Cr[Cr(NO ₃) ₃] : 2N : T- : 5 : O01
Cu 99.999%	60 : Cu[Cu] : 10N : T- : 5 : O05
Fe 99.99%	50 : Fe[Fe] : 10N : T- : 4 : O02
KNO ₃ 99.999%	50 : K[KNO ₃] : 5N : T- : 5 : N05
Li ₂ CO ₃ 99.999%	55 : Li[Li ₂ CO ₃] : 2N : T- : 5 : O01
Mg(NO ₃) ₂ 99.999%	60 : Mg[Mg(NO ₃) ₂] : 5N : T- : 5 : O01
Mn 99.99%	50 : Mn[Mn] : 5N : T- : 4 : O05
(NH ₄) ₂ MoO ₄ 99.999	20 : Mo[(NH ₄) ₂ MoO ₄] : 5N0.5F : T- : 5 : O02
NaNO ₂ 99.9985%	50[100] : Na[NaNO ₂] : 5N : T- : 485 : N07-12
Ni(NO ₃) ₂ 99.999%	50 : Ni[Ni(NO ₃) ₂] : 5N : T- : 5 : O02
Pb(NO ₃) ₂ 99.999%	50 : Pb[Pb(NO ₃) ₂] : 5N : T- : 5 : N04
Sb 99.999%	50 : Sb[Sb] : 10N2F : T- : 5 : O03
Se 99.999%	50 : Se[Se] : 2N : T- : 5 : N02
SrCO ₃ 99.998%	50 : Sr[SrCO ₃] : 2N : T- : 48 : N03
(NH ₄) ₂ TiF ₆ 99.999%	10 : Ti[(NH ₄) ₂ TiF ₆] : 5N0.5F : T- : 5 : N04
Ti 99.999%	20 : Ti[Ti] : 5N : T- : 5 : N03
NH ₄ VO ₃ 99.996%	20 : V[NH ₄ VO ₃] : 2N : T- : 46 : O04
Zn 99.99	50 : Zn[Zn] : 5N : T- : 4 : O02

Density * : 1.042 g/cm³ at 20 °C

Minimum shelf-life: 08.2018 (unopened bottle in aluminized bag)

Date of opening:

* These values are not certified. (Recommended period of use should not exceed 12 months from date of opening)

Intended use: For Laboratory Use Only

Calibration of ICP-OES, AAS

Preparation of working reference samples*

Validation of analytical methods

Detection limit and linearity studies

This statement is not intended to restrict the use for other purposes.

Instructions for the correct use of this reference material:

This certified reference material can be used directly or can be diluted in an appropriate high-purity matrix. Only a clean class A glassware should be used. Do not pipet from container. Obtained concentration (in mg/l) after dilution is a result from the multiplication of certified value of CRM concentration and the CRM's volume used for dilution and divided into the flask's volume used for dilution.

Stability and storage:

This CRM is with a guaranteed stability until $\pm 0.5\%$ of the certified concentration within its shelf-life. Stability is guaranteed provided that the solution is kept in its original packaging, tightly closed under normal laboratory conditions.

Hazardous situation:

The normal laboratory safety precautions should be observed when working with this RM. Further details for the handling of this RM are available as safety data sheet.

Level of homogeneity:

This solution was mixed according to an in-house procedure and is guaranteed to be homogeneous. To ensure sufficient homogeneity of the sample prior to use thoroughly mix by inversion.

Names of certifying officers:

Laboratory:  Tihomir Stoyanov

Manager:  Krassimira Taralova

- [1] ISO Guide 31: Reference materials - Contents of certificates and labels
- [2] ISO Guide 35: Reference materials - General and statistical principles for certification
- [3] EURACHEM/CITAC Guide: Quantifying Uncertainty in Analytical Measurement
- [4] ISO/IEC 17025: General requirements for the competence of testing and calibration laboratories
- [5] ISO Guide 34: General Requirements for the Competence of Reference Material Producers

This certificate relates solely to the lot number given above.
All processes (including generating of this certificate) are completely controlled by the specialized Computer-Aided-Manufacturing (CAM) software.

This Certified Reference Material was produced under a quality management system that is:
- Registered to ISO 9001 Quality Management System (Lloyd's Register Quality Assurance Ltd Cert No SOF0368072)
- Accredited according to ISO/IEC 17025 - Testing (ANAB Cert No AT-1836)
- Accredited according to ISO Guide 34 - Reference Material Producer (ANAB Cert No AR-1835)