*Trace*CERT®

CRM Solutions for ICP, AAS and IC

Certified Standard Solutions produced under ISO/IEC 17025 and ISO Guide 34

2nd Edition

SIGMA-ALDRICH®

*Trace*CERT® Traceable Certified Reference Materials

*Trace*CERT CRMs are high accuracy standards for instrument calibration and process validation.

Following lengthy cooperation with different metrological institutes, Sigma-Aldrich® has built a laboratory for Certified Reference Material (CRM) production and certification in Buchs, Switzerland. Since 2007 the lab holds the highest achievable quality assurance level for CRM producers: double accreditation, as a testing lab following ISO/IEC 17025 and also as a CRM producer following ISO Guide 34. This combination is also called the "Gold Standard" accreditation for CRM producers.

The scope of the double accreditation at the Buchs site currently includes gravimetry, density, ICP, titrimetry and high performance quantitative NMR (HP-qNMR). This range of techniques allows us to produce CRMs for a variety of applications. While this brochure is focusing on **CRM solutions for AAS, ICP and Ion Chromatography**, the *Trace*CERT product line also comprises NIST traceable organic **neat CRMs** for chromatography and quantitative NMR. Please learn more by visiting our webpage **sigma-aldrich.com/tracecert**

For all *Trace*CERT standards we guarantee:

- Highest accuracy and reliability of certified concentrations
- Traceability to internationally accepted references (i.e. NIST, BAM or SI unit kg)
- Production in accordance with ISO/IEC 17025 and ISO Guide 34
- Comprehensive certificate according to ISO Guide 31
- Competitive price

What makes *Trace*CERT stand above the others?

SRMS 001
ISO Guide 34

STS 490
ISO 17025

16368-02
ISO 9001

*Elemental and ion standards are available from various suppliers. Why should I buy Trace***CERT** *certified standards?* Indeed many different standards are available covering a wide range of quality, service and price. As the world's number one in supplying research chemicals and standards, Sigma-Aldrich introduced *Trace*CERT reference materials to underpin its **leading position** in terms of **quality** and customer convenience.

*What makes Trace***CERT** *standards higher in quality?* Highest quality depends on many different technical and personal skills. These CRMs are produced and certified in accordance to metrological guidelines: **highest accuracy,** low uncertainties and in-depth documentation are what make *Trace*CERT products so reliable. These solutions are traceable to at least two independent references; NIST traceability is guaranteed whenever possible. In addition, we have extensive packaging knowledge and we guarantee all certified values until the bottle is in the customer's hands.

What is the value of Sigma-Aldrich's double accreditation to the customer? **Reliability!** Every analytical laboratory will demonstrate the correctness of its measurement results. The use of accurate and well-documented standards is, therefore, the first step to achieving correct measurement results. Our double accreditation, according to ISO/IEC 17025 and ISO Guide 34, is an explicit affirmation of our competence to produce, certify and supply certified reference materials. Our **customers can count on this competence** and refer to it. We know: Buying analytical standards is a matter of trust.

What about the price? These highest quality CRMs are competitively priced when compared to the products of other CRM manufacturers. When you check our website at **sigma-aldrich.com/tracecert** you will see that highest quality is not necessarily the most expensive.

Produced in double accredited laboratory fulfilling ISO/IEC 17025 and ISO Guide 34

Manufacturing of Inorganic CRMs

The most accurate approach for the production of standards is high-precision weighing. Under ISO Guide 34 there is a particular focus on the quality of the starting materials and the entire manufacturing process including the choice of optimal packaging.


Copper


Silver


Tin


Gold


Silicium


Cobalt

Only **materials of highest purity** are used for the production of *Trace*CERT standards. The starting materials are **characterized by two different approaches:** the direct measurement of the purity by the most accurate method (e.g. titrimetry or high-precision ICP-OES). These measurements are compared to an internationally accepted reference material (i.e. NIST, BAM). In addition the purity of the starting materials is assigned by the "100% minus impurities" approach. Both approaches must lead to the same value within the range of their uncertainties. All starting materials are pretreated by surface etching or drying before they go to the high precision weighing room.

Gravimetric preparation using pure materials is practical and the most accurate realization of concentration units. **High-precision weighing** is a key step of the production, leading to direct traceability to the SI unit kilogram. The use of ultramicro balances with readability down to 100 ng in combination with a specially designed weighing room leads to maximum accuracy.

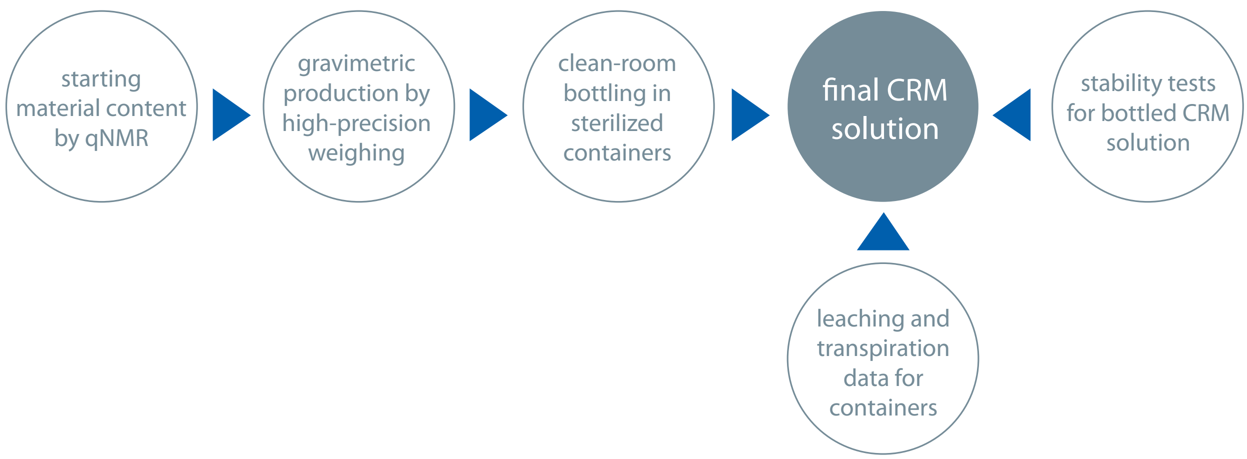
The weighed starting materials are dissolved in **ultrapure acids or bases** and then **precisely diluted** with ultrapure water to the final concentration. Also this operation is performed gravimetrically to achieve highest precision. **Homogenization** of the solution is achieved by overhead tumbling of the container for several hours. In the final bottling step, contamination is prevented by working under **clean room conditions** and by using PTFE-tubing and an inert peristaltic pump. After bottling, every batch is then compared to a second (whenever possible independent) reference material. Only when calculation and measurements are matching within their uncertainties (usually within 0.2 - 0.5 %) the batch is released for certification.

Manufacturing of Organic IC Solutions

The task of establishing traceability for organic compounds is most efficiently solved by ^{1}H quantitative NMR (qNMR). As a relative primary method, the big advantage of qNMR is the fact that the signal intensity of the integrals is in direct proportion to the number of hydrogen atoms leading to the signal. The chemical structure of the compound has no influence on the signal intensity. This allows for comparing different compounds quantitatively with high precision. Therefore, a small set of NIST traceable standards is sufficient to certify basically any organic compound. In other words, the direct response of a qNMR experiment is of highest accuracy, leading to certified values with low uncertainties.

With a few exceptions (like sodium oxalate where the compound carries no protons), the starting materials for our IC standard solutions of organic analytes are all certified by qNMR. The certified bulk material is transferred into a 60L PVDF container by high precision weighing and dissolved with high-purity water (specific conductivity of 18 MΩ•cm, total organic carbon at low ppb level and 0.2 µm filtered) until the calculated mass of the final solution is reached.

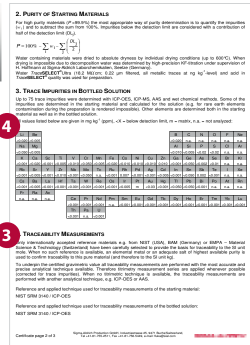
Equal to the inorganic standards, the solution is then homogenized by overhead tumbling of the container. After that, the final bottles are filled with solution under clean-room conditions using PTFE-tubing and a peristaltic pump.

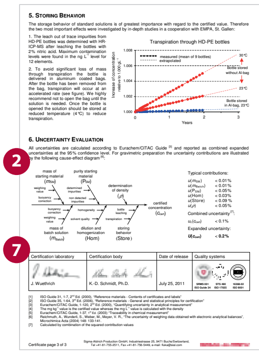


Certification and Comprehensive Documentation

For each *Trace*CERT product, a detailed and comprehensive certificate of **up to four pages** is supplied, either delivered with the product (for the ICP standards) or downloadable from the Internet using product number and lot number (for the AAS and IC standards). **Example certificates** for every product can be downloaded from the Internet (**sigma-aldrich.com/tracecert**).

The certificates are in accordance with **ISO Guide 31**. Below you see an example of a certificate for a platinum ICP standard highlighting the most important features.





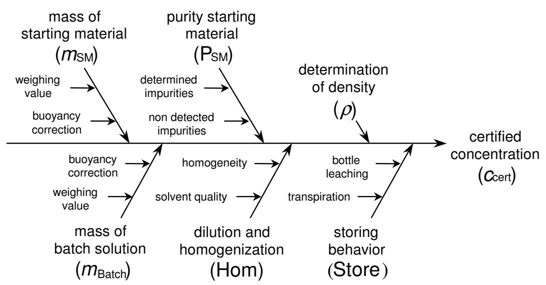
Lot Specific Content Including Uncertainties:

1

Certified value traceable to SI unit kg and uncertainty according to ISO Guide 35 [2] and Eurachem/CITAC Guide [3]		
Constituent	Certified value at 20 °C [4]	Expanded uncertainty [$U = k \cdot u_c$; $k = 2$]
Platinum	**1000 mg L^{-1}** **976 mg kg^{-1}**	**2 mg L^{-1}** **2 mg kg^{-1}**

Certified values are reported as mass per volume and as mass per mass.
Uncertainty budgets are obtained by summing up all the contributing influence parameters ("bottom-up" approach) and are illustrated by a cause-effect diagram:

2



Typical contributions:

$u(m_{SM})$	< 0.01 %
$u(m_{Batch})$	< 0.01 %
$u(P_{SM})$	< 0.05 %
$u(Hom)$	< 0.03 %
$u(Store)$	< 0.09 %
$u(\rho)$	< 0.05 %

Combined uncertainty [7]:

$u_c(c_{cert})$ < 0.1 %

Expanded uncertainty:

$U(c_{cert})$ **< 0.2 %**

Traceability Statement

3 Reference and applied technique used for traceability measurements of the starting material: NIST SRM 3140 / ICP-OES

Reference and applied technique used for traceability measurements of the bottled solution: NIST SRM 3140 / ICP-OES

Trace Impurities in Bottled Solution*

Up to 75 trace impurities, determined with ICP-OES, ICP-MS, AAS and wet chemical methods.

4

Li	Be											B	C	N	O	F	Ne
<0.020	<0.005											<0.020	n.a.	n.a.	n.a.	n.a.	n.a.
Na	Mg											Al	Si	P	S	Cl	Ar
<0.050	<0.005											<0.010	<0.005	<0.02	<0.02	n.a.	n.a.
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr
<0.001	<0.020	<0.001	<0.005	<0.010	<0.050	<0.005	<0.020	<0.010	<0.010	<0.010	0.010	<0.001	<0.050	<0.002	<0.01	n.a.	n.a.
Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe
<0.001	<0.005	<0.001	<0.010	<0.001	<0.050	n.a.	<0.001	0.007	<0.001	<0.001	<0.005	<0.001	<0.050	0.002	<0.001	n.a.	n.a.
Cs	Ba	La	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn
<0.001	<0.005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.005	m	<0.03	<0.001	<0.050	<0.050	<0.001	n.a.	n.a.	n.a.
Fr	Ra	Ac															
n.a.	n.a.	n.a.															
				Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu
				<0.001	<0.001	<0.001	n.a.	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
				Th	Pa	U											
				<0.001	n.a.	<0.001											

**This is only reported for the ICP standard solutions. For the IC standard solutions, trace impurities of the most relevant ions are given*

5

Expiration Date:

Expiry date: **JUN / 2015**
(unopened bottle in aluminized bag)

Bottle opening date:

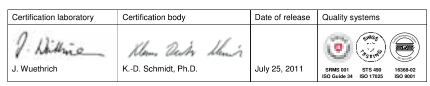
6

Density:

ρ = 1024.3 kg m^{-3} $u_c(\rho)$ = 0.5 kg m^{-3}

7

Signatures and Accreditation Stamps

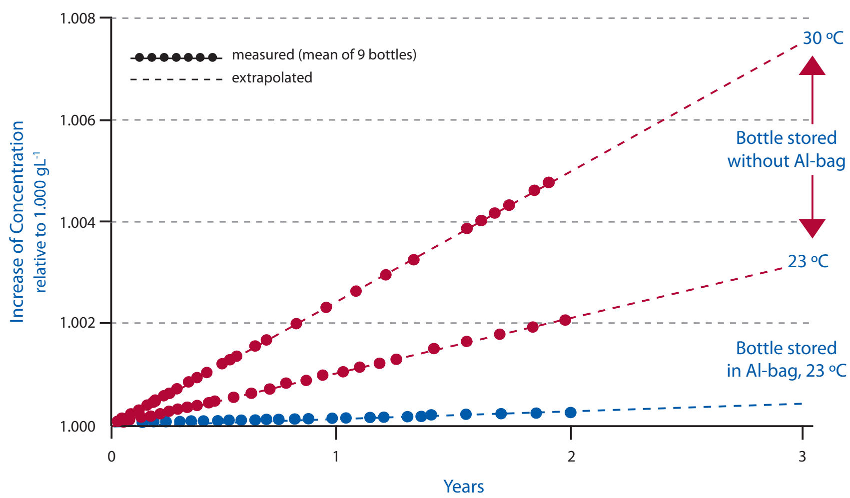


Packaging and Stability

The ideal container for standard solutions is totally inert, i.e., will not absorb the analyte, does not leach impurities into the solution, is impermeable to the solvent and atmosphere, is easy to handle and affordable. For *Trace*CERT standards we have developed the **most suitable container** fulfilling all of these criteria: the HDPE bottle. These bottles are extensively tested for leaching of impurities and the loss of weight by transpiration of the solvent was also investigated comprehensively as shown in the diagram below. The results of this study are also stated in the certificate of each *Trace*CERT product. For maximum shelf life, the bottles for ICP standards are sealed in aluminum bags to further prevent transpiration. Only this **special packaging** makes it possible to guarantee the ambitious specification of 0.2% uncertainty over the entire shelf life.

In the case of organic IC Standards, the HDPE bottles are x-ray sterilized and the bottled solution is additionally stabilized with sodium azide (about 5 mg/L) and filtered through a 0.2 µm membrane.

Transpiration Through HDPE Bottle



Sensitive trace analysis applications require extremely pure sample preparation reagents. Sigma-Aldrich offers a comprehensive range of reagents to satisfy all purity requirements.

Visit our website to view our products or obtain a copy of our Inorganic Trace Analysis brochure (code LBJ): **sigma-aldrich.com/traceselect**

*Trace*CERT Product Portfolio

The *Trace*CERT product line of ICP, AAS and IC standard solutions actually comprises over 200 products. Since we are continuously expanding the product range, we also recommend consulting our website at **sigma-aldrich.com/tracecert**. In addition to our broad catalog offering, we also offer custom standards (see page 11).

1000 mg/L Single Element Standard Solutions for AAS and ICP

AAS standards are supplied in 250 mL HDPE bottles (with some exceptions). Shelf life of these products is usually 3 years. The certificate can be downloaded from the Internet using product number and lot number.

ICP standards are supplied in 100 mL HDPE bottles and sealed in an aluminum bag. We can, therefore, guarantee an expiry of up to 4 years for the ICP standards. The printed certificate is delivered with the product.

Element (1000 mg/L)	Composition	Cat. No. AAS Standard	Package Size	Cat. No. ICP Standard	Package Size
Aluminum	$Al(NO_3)_3$ x $9H_2O$ + nitric acid	39435	250 mL	61935	100 mL
Antimony	Sb metal + nitric acid (+ hydrofluoric acid traces)	94117	250 mL	73495	100 mL
Arsenic	As_2O_3 + nitric acid (+ NaOH for AAS)	39436	250 mL	01969	100 mL
Barium	$BaCO_3$ + nitric acid	90092	250 mL	59943	100 mL
Berylium	Be acetate + nitric acid	41856	250 mL	51985	100 mL
Bismuth	Bi metal + nitric acid	76668	250 mL	05719	100 mL
Boron	H_3BO_3 + water	40591	250 mL	01932	100 mL
Cadmium	Cd metal + nitric acid	51994	250 mL	36379	100 mL
Calcium	$CaCO_3$ + nitric acid	69349	250 mL	19051	100 mL
Cerium	CeO_2 + nitric acid	53378	250 mL	16734	100 mL
Cesium	$CsNO_3$ + nitric acid	67717	250 mL	96664	100 mL
Chromium	$Cr(NO_3)_3$ + nitric acid	02733	250 mL	74582	100 mL
Cobalt	Co metal + nitric acid	05202	250 mL	30329	100 mL
Copper	Cu metal + nitric acid	38996	250 mL	68921	100 mL
Dysprosium	Dy_2O_3 + nitric acid	78247	100 mL	68339	100 mL
Erbium	Er_2O_3 + nitric acid	38716	100 mL	05693	100 mL
Europium	Eu_2O_3 + nitric acid	03734	100 mL	05779	100 mL
Gadolinium	Gd_2O_3 + nitric acid	68837	100 mL	16639	100 mL
Gallium	Ga metal + nitric acid	52874	100 mL	16639	100 mL
Germanium	Ge semi-metal + nitric acid (hydrofluoric acid traces)	92685	250 mL	05419	250 mL
Gold	Au metal + hydrochloric acid (nitric acid traces)	08269	100 mL	38168	100 mL
Hafnium	Hf metal + nitric acid (hydrofluoric acid traces)	55816	250 mL	04617	100 mL
Holmium	Ho_2O_3 + nitric acid	18039	100 mL	01541	100 mL
Indium	In metal + nitric acid	42225	100 mL	00734	100 mL
Iron	Fe metal + nitric acid	16596	250 mL	43149	100 mL
Lanthanum	La_2O_3 + nitric acid	43678	100 mL	11523	100 mL
Lead	$Pb(NO_3)_2$ + nitric acid	16595	250 mL	41318	100 mL
Lithium	Li_2CO_3 + nitric acid	59916	250 mL	12292	100 mL
Lutetium	Lu_2O_3 + nitric acid	38476	100 mL	03909	100 mL
Magnesium	Mg metal + nitric acid	42992	250 mL	30083	100 mL
Manganese	Mn metal + nitric acid	77036	250 mL	74128	100 mL
Mercury	Hg metal + nitric acid	16482	100 mL	28941	100 mL
Molybdenum	Mo metal + hydrochloric acid + (nitric acid traces)	67210	250 mL	68780	100 mL
Neodymium	Nd_2O_3 + nitric acid	41695	100 mL	0 4730	100 mL
Nickel	Ni metal + nitric acid	42242	250 mL	28944	100 mL
Niobium	Nb metal + nitric acid (hydrofluoric acid traces)	42887	100 mL	67913	100 mL
Palladium	Pd metal + hydrochloric acid (nitric acid traces)	78437	100 mL	77091	100 mL
Phosphorus	H_3PO_4 + water	51474	250 mL	38338	100 mL
Platinum	Pt metal + hydrochloric acid (nitric acid traces)	47037	100 mL	19078	100 mL

Element (1000 mg/L)	Composition	Cat. No. AAS Standard	Package Size	Cat. No. ICP Standard	Package Size
Potassium	KNO_3 + nitric acid	96665	250 mL	06335	100 mL
Rhodium	$RhCl_3$ + hydrochloric acid	11561	100 mL	04736	100 mL
Rubidium	$RbNO_3$ + nitric acid	55727	100 mL	01444	100 mL
Scandium	Sc_2O_3 + nitric acid	68418	100 mL	92279	100 mL
Selenium	Se metal + nitric acid	89498	250 mL	50002	100 mL
Silicon	Si metal + NaOH	16259	250 mL	15747	100 mL
Silicon	Si metal + nitric acid + hydrofluoric acid	--	--	08729	100 mL
Silver	Ag metal + nitric acid	39361	250 mL	12818	100 mL
Sodium	$NaNO_3$ + nitric acid	05201	250 mL	00462	100 mL
Strontium	$Sr(NO_3)_2$ + nitric acid	51287	250 mL	75267	100 mL
Sulfur	H_2SO_4 + water	18020	250 mL	18021	100 mL
Tantalum	Ta metal + nitric acid (hydrofluoric acid traces)	40413	100 mL	16641	100 mL
Tellurium	Te semi-metal + nitric acid + hydrofluoric acid	92027	250 mL	78358	100 mL
Terbium	Tb_2O_3 + nitric acid	50356	100 mL	44881	100 mL
Thallium	$TlNO_3$ + nitric acid	75159	100 mL	51873	100 mL
Thulium	Tm_2O_3 + nitric acid	59854	100 mL	01496	100 mL
Tin	Sn metal + hydrochloric acid	74244	250 mL	92615	100 mL
Titanium	Ti metal + nitric acid	04689	100 mL	12237	100 mL
Tungsten	W metal + nitric acid (hydrofluoric acid traces)	53465	100 mL	50334	100 mL
Vanadium	V_2O_5 + nitric acid	02334	250 mL	18399	100 mL
Yttrium	Y_2O_3 + nitric acid	40423	250 mL	01357	100 mL
Zinc	Zn metal + nitric acid	18827	250 mL	18562	100 mL
Zirconium	Zr metal + nitric acid + hydrofluoric acid	73574	250 mL	51244	100 mL

10,000 mg/L Single Element Standard Solutions for AAS and ICP

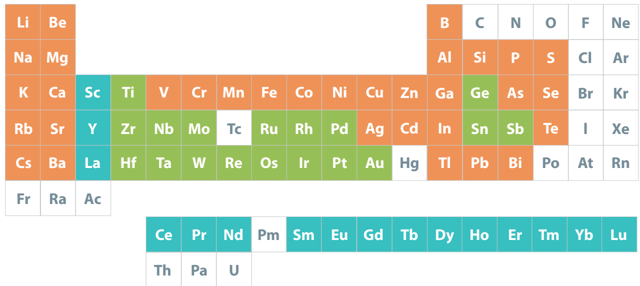
Element (10,000 mg/L)	Composition	Cat. No.	Package Size
Aluminum	$Al(NO_3)_3 \times 9H_2O$ + nitric acid	41377	100 mL
Antimony	Sb metal + nitric acid + hydrofluoric acid	91482	100 mL
Boron	H_3BO_3 + ammonium hydroxid solution	18822	100 mL
Cadmium	Cd metal + nitric acid	90006	100 mL
Calcium	$CaCO_3$ + nitric acid	94458	100 mL
Cesium	$CsNO_3$ + nitric acid	79261	100 mL
Chromium	$Cr(NO_3)_3$ + nitric acid	93104	100 mL
Cobalt	Co metal + nitric acid	01488	100 mL
Copper	Cu metal + nitric acid	94459	100 mL
Iron	Fe metal + nitric acid	56209	100 mL
Lead	$Pb(NO_3)_2$ + nitric acid	39082	100 mL
Magnesium	Mg metal + nitric acid	80759	100 mL
Manganese	$Mn(NO_3)_2 \times 4H_2O$ + nitric acid	42071	100 mL
Nickel	Ni metal + nitric acid	19013	100 mL
Palladium	Pd metal + hydrochloric acid (nitric acid traces)	50719	100 mL
Phosphorous	H_3PO_4 + water	19916	100 mL
Potassium	KNO_3 + nitric acid	68371	100 mL
Sodium	$NaNO_3$ + nitric acid	39924	100 mL
Sulfur	H_2SO_4 + water	94430	100 mL
Tin	Sn metal + nitric acid + hydrofluoric acid	42991	100 mL
Titanium	Ti metal + nitric acid + hydrofluoric acid	44973	100 mL
Tungsten	W metal + nitric acid + hydrofluoric acid	50938	100 mL
Vanadium	V metal + nitric acid	44712	100 mL
Yttrium	Y_2O_3 + nitric acid	02312	100 mL
Zinc	Zn metal + nitric acid	68961	100 mL

Multielement Standards for ICP

All our multielement standard solutions are delivered in 100 mL HDPE bottles (except for the USP mixes, which are delivered in FEP (Fluorinated Ethylene Propylene) bottles), sealed in an aluminium bag and the printed certificate is delivered with the product.

Periodic Table Mixes

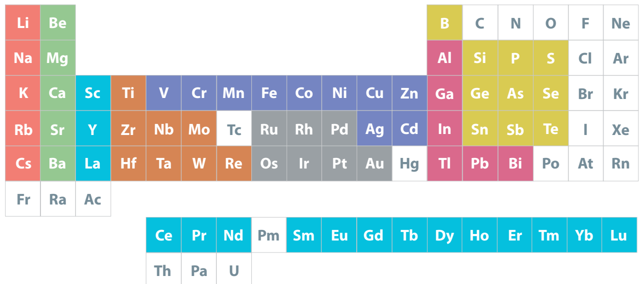
With these three multielement standard solutions, all ICP measurable elements of the periodic table are covered (excluding mercury). All components are present at a concentration of 10 mg/L.



Cat. No.	Description	Composition	Matrix	Package Size
92091	Periodic Table Mix 1 for ICP	33 elements (10 mg/L each)	10% nitric acid	100 mL
41135	Periodic Table Mix 2 for ICP	18 elements (10 mg/L each)	5% hydrochloric acid and 1% hydrofluoric acid	100 mL
78334	Periodic Table Mix 3 for ICP	16 elements (10 mg/L each)	5% nitric acid	100 mL

Chemical Group Mixes

Each of these eight multielement standard solutions contains a specific group of elements. Concentrations of the analytes are 100 mg/L except for the rare elements mix where the analytes have a concentration of 50 mg/L.



Cat. No.	Description	Composition	Matrix	Package Size
96441	Alkali Metal Mix for ICP	5 elements (100 mg/L each)	2% nitric acid	100 mL
67288	Alkaline Earth Metal Mix for ICP	5 elements (100 mg/L each)	2% nitric acid	100 mL
67349	Rare Earth Metal Mix for ICP	16 elements (50 mg/L each)	2% nitric acid	100 mL
55263	Metalloid and Non-Metal Mix for ICP	10 elements (100 mg/L each)	10% nitric acid and <0.5% hydrofluoric acid	100 mL
51509	Post-transition Metal Mix for ICP	6 elements (100 mg/L each)	2% nitric acid	100 mL
04330	Transition Metal Mix 1 for ICP	10 elements (100 mg/L each)	2% nitric acid and 1% hydrofluoric acid	100 mL
96442	Transition Metal Mix 2 for ICP	8 elements (100 mg/L each)	2% nitric acid	100 mL
93468	Transition Metal Mix 3 for ICP	7 elements (100 mg/L each)	5% nitric acid	100 mL

USP and other ICP Mixes

We offer two standard mixes for the new pharmacopeia (USP) monographs 232 and 233 for elemental impurities determination in pharmaceutical products.

Cat. No.	Description and Composition	Package Size
89395	USP 232 Element Impurities, Standard 1 (in 10% nitric acid) 1.5 mg/L: As 100 mg/L: Mo, V 25 mg/L: Cd 5 mg/L: Pb 500 mg/L: Ni 15 mg/L: Hg 1000 mg/L: Cu	100 mL
39967	USP 232 Element Impurities, Standard 2 (in 10% HCl) 100 mg/L: Ir, Os, Pd, Pt, Rh, Ru	100 mL

Cat. No.	Description and Composition	Package Size
90243	Multielement standard solution I for ICP (in 10 % HNO_3) Ag, Ba, Ca, Cd, Co, Cu, Fe, Mg, Mn, Sr, Zn: 10 mg/L each Al, B, Cr, Li, Mo, Na, Ni, Tl: 50 mg/L each Bi, K, Pb: 100 mg/L each	100 mL
49596	Multielement standard solution III for ICP (in 5 % HNO_3) K: 200 mg/L Mg: 400 mg/L Na: 1000 mg/L Ca: 2000 mg/L	100 mL
51844	Multielement standard solution IV for ICP (in 10 % HNO_3) Cr, Cu, Ni: 20 mg/L each Al, As, Ba, Pb, V: 40 mg/L each B, Fe, Se, Tl, Zn: 100 mg/L each Be, Cd, Co, Mn: 10mg/L each	100 mL
54704	Multielement standard solution V for ICP (in 10 % HNO_3) Ag, Al, Ba, Be, Bi, Cd, Co, Cr, Cs, Cu, Ga, In, Li, Mg, Mn, Mo, Ni, Pb, Rb, Sr, Tl, V, Zn: 10 mg/L each Ca, Fe, Ca, Na:100 mg/L each	100 mL

1000 mg/L Single Ion Standards for IC

All IC standards are supplied in HDPE bottles. As a unique feature for these IC standards we list the most common trace impurities that are relevant for the IC separation.

Inorganic Anions (1000 mg/L)	Composition	Cat. No.	Package Size
Bromide	NaBr + water	43147	100 mL
Chloride	NaCl + water	39883	100 mL
Chromate	K_2CrO_4 + water	40121	100 mL
Cyanide	$K_2Zn(CN)_4$ + water	90157	100 mL
Fluoride	NaF + water	77365	100 mL
Iodide	KI + water	41271	100 mL
Nitrate	$NaNO_3$ + water	74246	100 mL
Nitrate Nitrogen	$NaNO_3$ + water	53638	100 mL
Nitrite	$NaNO_2$ + water (NaOH stabilized)	67276	100 mL
Nitrite Nitrogen	$NaNO_2$ + water (NaOH stabilized)	36427	100 mL
Phosphate	Na_2HPO_4 + water	38364	100 mL
Sulfate	Na_2SO_4 + water	90071	100 mL

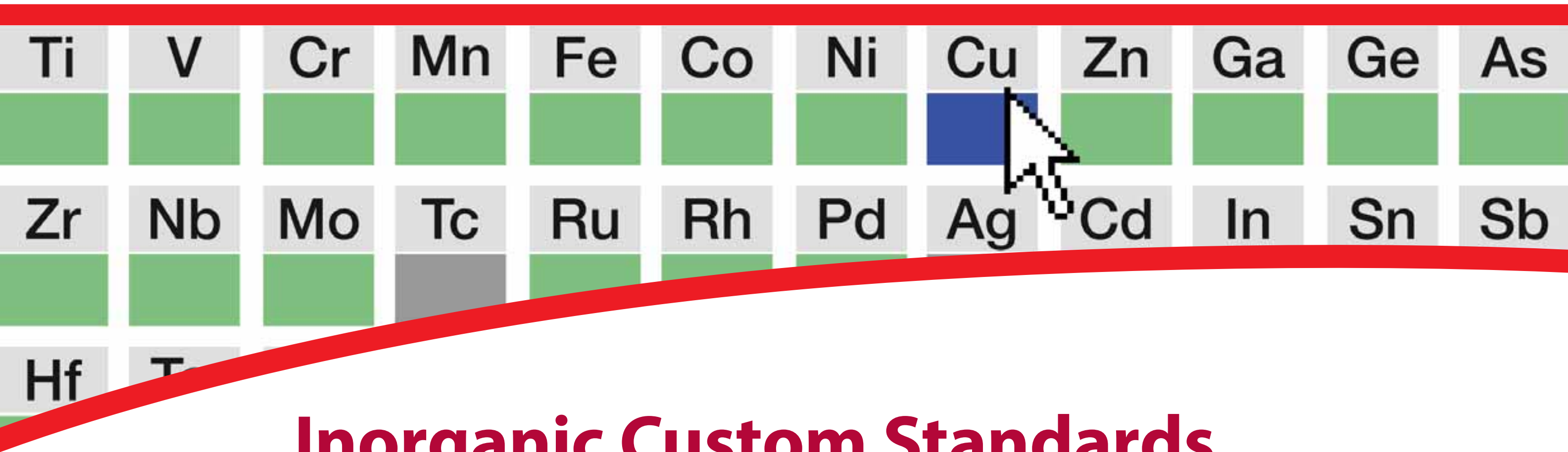
Organic Anions (1000 mg/L)	Composition	Cat. No.	Package Size
Acetate	Acetic acid, NaOH, water	51791	100 mL
Adipate	Adipic acid + water	40968	100 mL
Benzoate	Benzoic acid, water	40497	100 mL
Butyrate	Sodium butyrate, water	08089	100 mL
Citrate	Citric acid, water	96068	100 mL
Formate	Calcium formate, water	44293	100 mL
Glutarate	Glutaric acid + water	07438	100 mL
Glycolate	Glyolic acid + water	07391	100 mL
Lactate	Magnesium L-lactate + water	07096	100 mL
Malate	L-($^{-}$)-Malic acid + water	06994	100 mL
Maleate	Maleic acid, water	06908	100 mL
Malonate	Malonic acid, water	42412	100 mL
Oxalate	Sodium oxalate, water	73139	100 mL
Phthalate	Potassium phthalate monobasic, water	90677	100 mL
Propionate	Sodium propionate, water	51716	100 mL
Succinate	Succinic acid + water	43057	100 mL
Tartrate	L-($^{+}$)-Tartaric acid, water	43484	100 mL

Inorganic Cations (1000 mg/L)	Composition	Cat. No.	Package Size
Ammonium	NH_4Cl + water	59755	100 mL
Ammonium (Nitrogen)	NH_4Cl, water	89503	100 mL
Barium	$BaCO_3$ + nitric acid	87142	100 mL
Cadmium	Cd metal + nitric acid	69679	100 mL
Calcium	$CaCO_3$ + nitric acid	39865	100 mL
Cobalt	Co metal + nitric acid	49594	100 mL
Copper	Cu metal + nitric acid	40786	100 mL
Lead	$Pb(NO_3)_2$ + nitric acid	51777	100 mL
Lithium	Li_2CO_3 + nitric acid	59878	100 mL
Magnesium	Mg metal + nitric acid	89441	100 mL
Manganese	Mn metal + nitric acid	51439	100 mL
Nickel	Ni metal + nitric acid	42637	100 mL
Potassium	KNO_3 + water	53337	100 mL
Sodium	$NaNO_3$ + water	43492	100 mL
Strontium	$Sr(NO_3)_2$ + nitric acid	42151	100 mL
Zinc	Zn metal + nitric acid	67902	100 mL

Multiion Standards for IC

All Standards are packaged in a HDPE bottle. The starting materials for the two PRIMUS primary multiion standards were certified by EMPA (Eidgenössische Materialprüfungs- und Forschungsanstalt) and BAM (Bundesamt für Materialforschung und -prüfung, Germany).

Multiion Standards	Description and Composition	Package Size
89886	Primary Multi Anion Standard Solution (PRIMUS), certified for ion chromatography, Reference material traceable to SI, 10.0 mg/kg ± 0.2% F^-, Cl^-, NO_3^-, PO_4^{2-}, SO_4^{2-} each anion	50 mL
89316	Primary Multi Cation Standard Solution (PRIMUS), certified for ion chromatography, Reference material traceable to SI, 10.0 mg/kg ± 0.2% Li^+, Na^+, K^+, Mg^{2+}, Ca^{2+} each cation	50 mL
91286	Multi Cation Standard 1 for IC, Ca: 1000 mg/L; K: 200 mg/L; Li: 50 mg/L; Mg: 200 mg/L; Na: 200 mg/L	100 mL



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Analytes
Concentrations

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