Specification – Certified Reference Material

Element ICP Standard Solution 1000 mg/l

Accreditation:

DAkkS Deutsche Akkreditierungsstelle D-RM-15185-01-00

Merck KGaA, Darmstadt, Germany is accredited by the German accreditation authority as registered reference material producer (D-RM-15185-01-00) in accordance with **ISO 17034**.

Producer: Merck KGaA, Frankfurter Str. 250, 64293 Darmstadt, Germany
Description of CRM: Element ICP Standard Solution 1000 mg/l
Expiry date: 4 years
Storage: +15°C to +25°C tightly closed in the original container
Specification: 956 – 1011 mg/kg

Article	Analyte	Description of CRM	Associated uncertainty*, $U=k\cdot u$ ($k=2$) as mass fraction
1.70301	Al	Aluminium ICP Standard	± 5 mg/kg
1.70302	Sb	Antimony ICP Standard	± 5 mg/kg
1.70303	As	Arsenic ICP Standard	± 5 mg/kg
1.70304	Ba	Barium ICP Standard	± 5 mg/kg
1.70305	Be	Beryllium ICP Standard	± 6 mg/kg
1.70306	Bi	Bismuth ICP Standard	± 5 mg/kg
1.70307	B	Boron ICP Standard	± 6 mg/kg
1.70309	Cd	Cadmium ICP Standard	± 5 mg/kg
1.70308	Ca	Calcium ICP Standard	± 5 mg/kg
1.70311	Ce	Cerium ICP Standard	± 5 mg/kg
1.70310	Cs	Cesium ICP Standard	± 5 mg/kg
1.70312	Cr	Chromium ICP Standard	± 5 mg/kg
1.70313	Co	Cobalt ICP Standard	± 5 mg/kg
1.70314	Cu	Copper ICP Standard	± 5 mg/kg
1.70315	Dy	Dysprosium ICP Standard	± 5 mg/kg
1.70316	Er	Erbium ICP Standard	± 5 mg/kg
1.70317	Eu	Europium ICP Standard	± 5 mg/kg

1.70318	Gd	Gadolinium ICP Standard	± 5 mg/kg
1.70319	Ga	Gallium ICP Standard	± 6 mg/kg
1.70320	Ge	Germanium ICP Standard	± 5 mg/kg
1.70321	Au	Gold ICP Standard	± 5 mg/kg
1.70322	Hf	Hafnium ICP Standard	± 5 mg/kg
1.70323	Ho	Holmium ICP Standard	± 6 mg/kg
1.70324	In	Indium ICP Standard	± 5 mg/kg
1.70325	Ir	Iridium ICP Standard	± 8 mg/kg **
1.70326	Fe	Iron ICP Standard	± 5 mg/kg
1.70327	La	Lanthanum ICP Standard	± 5 mg/kg
1.70328	Pb	Lead ICP Standard	± 5 mg/kg
1.70329	Li	Lithium ICP Standard	± 5 mg/kg
1.70330	Lu	Lutetium ICP Standard	± 5 mg/kg
1.70331	Mg	Magnesium ICP Standard	± 5 mg/kg
1.70332	Mn	Manganese ICP Standard	± 5 mg/kg
1.70333	Hg	Mercury ICP Standard	± 8 mg/kg
1.70334	Mo	Molybdenum ICP Standard	± 5 mg/kg
1.70335	Nd	Neodymium ICP Standard	± 6 mg/kg
1.70336	Ni	Nickel ICP Standard	± 5 mg/kg
1.70337	Nb	Niobium ICP Standard	± 5 mg/kg
1.70338	Os	Osmium ICP Standard	± 5 mg/kg **
1.70339	Pd	Palladium ICP Standard	± 5 mg/kg
1.70340	P	Phosphorus ICP Standard	± 6 mg/kg
1.70341	Pt	Platinum ICP Standard	± 5 mg/kg
1.70342	K	Potassium ICP Standard	± 5 mg/kg
1.70343	Pr	Praseodymium ICP Standard	± 9 mg/kg
1.70344	Re	Rhenium ICP Standard	± 6 mg/kg
1.70345	Rh	Rhodium ICP Standard	± 5 mg/kg
1.70346	Rb	Rubidium ICP Standard	± 8 mg/kg
1.70347	Ru	Ruthenium ICP Standard	± 8 mg/kg **
1.70348	Sm	Samarium ICP Standard	± 5 mg/kg
1.70349	Sc	Scandium ICP Standard	± 5 mg/kg
1.70350	Se	Selenium ICP Standard	± 8 mg/kg
1.70365	Si	Silicon ICP Standard	± 6 mg/kg
1.70352	Ag	Silver ICP Standard	± 5 mg/kg
1.70353	Na	Sodium ICP Standard	± 5 mg/kg
1.70355	S	Sulfur ICP Standard	± 5 mg/kg
1.70354	Sr	Strontium ICP Standard	± 5 mg/kg
1.70356	Ta	Tantalum ICP Standard	± 5 mg/kg
1.70357	Te	Tellurium ICP Standard	± 6 mg/kg

1.70358	Tb	Terbium ICP Standard	± 5 mg/kg
1.70359	Tl	Thallium ICP Standard	± 5 mg/kg
1.70361	Tm	Thulium ICP Standard	± 6 mg/kg
1.70362	Sn	Tin ICP Standard	± 5 mg/kg
1.70363	Ti	Titanium ICP Standard	± 5 mg/kg
1.70364	W	Tungsten ICP Standard	± 5 mg/kg
1.70366	V	Vanadium ICP Standard	± 5 mg/kg
1.70367	Yb	Ytterbium ICP Standard	± 5 mg/kg
1.70368	Y	Yttrium ICP Standard	± 6 mg/kg
1.70369	Zn	Zinc ICP Standard	± 5 mg/kg
1.70370	Zr	Zirconium ICP Standard	± 5 mg/kg

* The uncertainty can vary depending on the primary reference material.
** Standard is not within accreditation scope of ISO 17034 and DIN EN ISO/IEC 17025.

Metrological traceability: Directly traceable to the corresponding / suitable primary standard NIST SRM
NIST: National Institute of Standards and Technology, Gaithersburg, USA

Measurement method: Inductively coupled plasma optical emission spectrometry ICP-OES.

Intended use: This certified reference material is intended for use as a calibration standard in element analysis.

Associated uncertainty:

The associated uncertainty U_{CRM} reported with the certified values is calculated as combined expanded uncertainty $U_{CRM}=k \cdot u_{CRM}$ in accordance with GUM and EA-4/02, with $k=2$ as the coverage factor for a 95% coverage probability.

The combined uncertainty u_{CRM} is derived from combination of the squared uncertainty contributions:

$$u_{CRM} = \sqrt{u^2_{characterisation} + u^2_{homogeneity} + u^2_{stability}}$$

$u_{characterisation}$: is the uncertainty in accordance with DIN EN ISO/IEC 17025 which includes the contributions of the primary reference material and the measuring system. The characterisation measurements have been conducted by our DAkkS accredited calibration laboratory.

$u_{homogeneity}$: is the between-bottle variation in accordance with ISO 17034. The assessment of homogeneity is performed by analysis of a representative number of systematically chosen sample units.

$u_{stability}$: is the uncertainty obtained from short-term and long-term stability in accordance with ISO 17034. The stability studies are the basis for the quantification of the expiry date of this reference material for the unopened bottle.

Detailed information is provided by the certificates and the certification report on our website.