

CertIPUR®
not all
reference materials
are the same





In order to obtain accurate analytical results, it is necessary to calibrate all of the instruments used in the analysis before commencing. However, such calibration work is only meaningful if reliable reference materials are employed.

Merck can now provide you with first-class reference materials – its Certipur® range of standards, suitable for all methods. All certified standards or secondary standards come with a comprehensive Certificate of Analysis, where all batch-specific parameters and important inspection-relevant data are documented: all raw materials used, uncertainty data, traceability including batch number, date of release, minimum shelf life and the responsible Laboratory Head.

Thus: not all products are the same. The best reference materials ever supplied by Merck carry the name Certipur®.



Index

CertiPUR® reference materials for reliable calibration ...

... in Atomic absorption spectroscopy	04
... in pH measurement	15
... in Conductivity measurement	23
... in Ion chromatography	26
... in UV/VIS spectroscopy	28
... in Volumetry	30
... in special applications	32

CertiPUR® reference materials for reliable calibration in atomic absorption spectroscopy

Atomic absorption spectroscopy

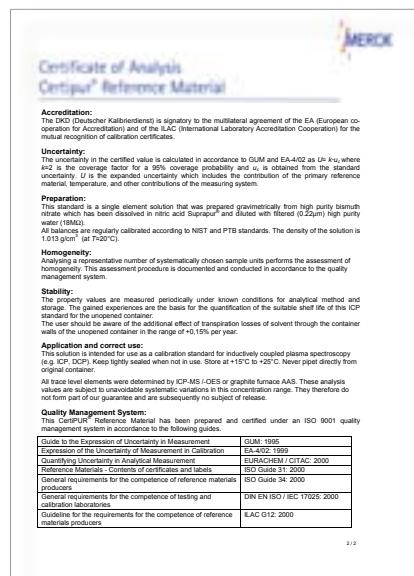
- Methods
- Traceability

CertiPUR® Products

- ICP standards
- Internal standard for ICP
- Isotope-enriched standards
- Multi element standards
- AAS standards
- Tritisol® standards
- Standards dissolved in oil
- Multi element standards, dissolved in oil



CertiPUR® by Merck – now with ISO 17025 accreditation to give you reliable measuring results.



ICP standards are analysed using ICP/OES and ICP/MS methods in general. The true value is certified by an accredited calibration laboratory according to ISO/IEC 17025. As an additional control, elemental analysis is carried out by titration. Content analysis has been optimised for all ICP standards by reviving a very old analytical method – use of a suitable internal standard. For this precision analysis, a method has been developed for all 68 element standards. The advantage is obvious: a high degree of precision; this is reflected in the uncertainty data, which can vary, depending on the chemical nature of the element concerned.

AAS standards are normally determined titrimetrically. Depending on the element involved, the ICP/OES method is also used.

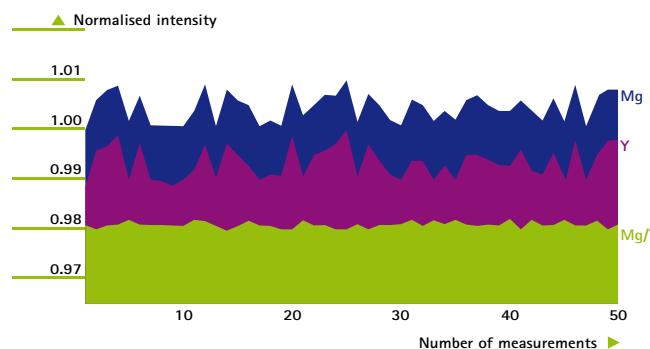
Traceability

ICP single- and multi-element standards are directly traceable to an international standard. Direct traceability means that the measuring instrument used in quality control is calibrated prior to each measurement using a primary or secondary standard obtained from an international institution such as NIST (National Institute of Standards and Technology, Gaithersburg, USA).

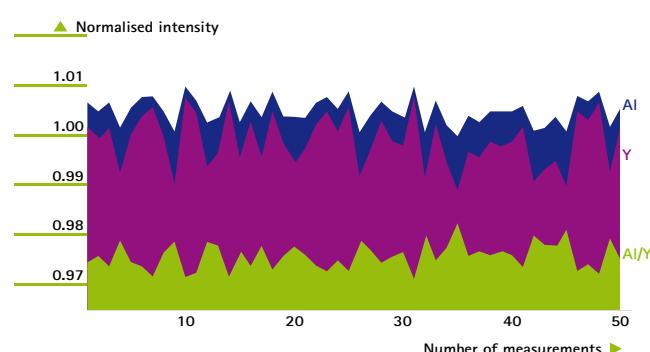
Traceability to the primary standard is documented in the Certificate of Analysis with indication of the batch used.

Isotope-enriched standards are certified directly by international bodies such as BAM (Bundesanstalt für Materialforschung und -prüfung, Berlin) and IRMM (Institute for Reference Materials and Measurements, Geel).

Standards used in AAS are also traceable to SRM from NIST. Analysis of content is generally carried out titrimetrically and is traceable to the original volumetric standard.



Determination of Mg – Y is suitable as internal standard



Determination of Al – Y is unsuitable as internal standard

ICP Single element standards

The quality control of our ICP single element standards is carried out by an accredited calibration laboratory of the DKD (DKD-K-14302). They are directly traceable to standard reference material from NIST. A certificate of analysis is enclosed in each package. It includes exact data on content including uncertainty budget, trace element impurities, composition, traceability, date of release and minimum shelf life.

CertiPUR® ICP standards

Designation	Element	Composition	ICP 1000 mg/l Order No. [100 ml]	ICP 10000 mg/l Order No. [100 ml]
Aluminium	Al	Al(NO ₃) ₃ in HNO ₃ 2–3%	1.70301.0100	1.70371.0100
Antimony	Sb	Sb ₂ O ₃ in HCl 7%	1.70302.0100	
Arsen	As	H ₃ AsO ₄ in HNO ₃ 2–3%	1.70303.0100	
Barium	Ba	Ba(NO ₃) ₂ in HNO ₃ 2–3%	1.70304.0100	
Beryllium	Be	Be ₄ O(C ₂ H ₃ O ₂) ₆ in HNO ₃ 2–3%	1.70305.0100	
Bismuth	Bi	Bi(NO ₃) ₃ in HNO ₃ 2–3%	1.70306.0100	
Boron	B	H ₃ BO ₃ in water	1.70307.0100	
Cadmium	Cd	Cd(NO ₃) ₂ in HNO ₃ 2–3%	1.70309.0100	
Calcium	Ca	Ca(NO ₃) ₂ in HNO ₃ 2–3%	1.70308.0100	1.70373.0100
Cerium	Ce	Ce(NO ₃) ₃ in HNO ₃ 2–3%	1.70311.0100	
Cesium	Cs	CsNO ₃ in HNO ₃ 2–3%	1.70310.0100	
Chromium	Cr	Cr(NO ₃) ₃ in HNO ₃ 2–3%	1.70312.0100	1.70374.0100
Cobalt	Co	Co(NO ₃) ₂ in HNO ₃ 2–3%	1.70313.0100	1.70375.0100
Copper	Cu	Cu(NO ₃) ₂ in HNO ₃ 2–3%	1.70314.0100	1.70378.0100
Dysprosium	Dy	Dy ₂ O ₃ in HNO ₃ 2–3%	1.70315.0100	
Erbium	Er	Er ₂ O ₃ in HNO ₃ 2–3%	1.70316.0100	
Europium	Eu	Eu ₂ O ₃ in HNO ₃ 2–3%	1.70317.0100	
Gadolinium	Gd	Gd ₂ O ₃ in HNO ₃ 2–3%	1.70318.0100	
Gallium	Ga	Ga(NO ₃) ₃ in HNO ₃ 2–3%	1.70319.0100	
Germanium	Ge	(NH ₄) ₂ GeF ₆ in water	1.70320.0100	
Gold	Au	H(AuCl ₄) in HCl 7%	1.70321.0100	
Hafnium	Hf	HfOCl ₂ in HCl 7%	1.70322.0100	
Holmium	Ho	Ho ₂ O ₃ in HNO ₃ 2–3%	1.70323.0100	
Indium	In	In(NO ₃) ₃ in HNO ₃ 2–3%	1.70324.0100	
Iridium	Ir	IrCl ₃ in HCl 7%	1.70325.0100	
Iron	Fe	Fe(NO ₃) ₃ in HNO ₃	1.70326.0100	1.70376.0100
Lanthanum	La	La(NO ₃) ₃ in HNO ₃ 2–3%	1.70327.0100	
Lead	Pb	Pb(NO ₃) ₂ in HNO ₃ 2–3%	1.70328.0100	1.70372.0100
Lithium	Li	LiNO ₃ in HNO ₃ 2–3%	1.70329.0100	
Lutetium	Lu	Lu ₂ O ₃ in HNO ₃ 2–3%	1.70330.0100	
Magnesium	Mg	Mg(NO ₃) ₂ in HNO ₃ 2–3%	1.70331.0100	1.70379.0100
Manganese	Mn	Mn(NO ₃) ₂ in HNO ₃ 2–3%	1.70332.0100	1.70380.0100
Mercury	Hg	Hg(NO ₃) ₂ in HNO ₃ 10%	1.70333.0100	1.70384.0100
Molybdenum	Mo	(NH ₄) ₆ Mo ₇ O ₂₄ in water	1.70334.0100	
Neodymium	Nd	Nd ₂ O ₃ in HNO ₃ 2–3%	1.70335.0100	
Nickel	Ni	Ni(NO ₃) ₂ in HNO ₃ 2–3%	1.70336.0100	1.70382.0100
Niobium	Nb	NH ₄ NbF ₆ in water	1.70337.0100	
Osmium	Os	(NH ₄) ₂ OsCl ₆ in HCl 7%	1.70338.0100	
Palladium	Pd	Pd(NO ₃) ₂ in HNO ₃ 2–3%	1.70339.0100	
Platinum	Pt	H ₂ PtCl ₆ in HCl 7%	1.70341.0100	
Potassium	K	KNO ₃ in HNO ₃ 2–3%	1.70342.0100	1.70377.0100



Dr. Dietmar Oeter,
Senior Manager, Quality Control
Life Science & Analytics
at Merck, on the occasion of CertiPUR®
ISO 17025 accreditation.



CertIPUR® ICP standards (continued)

Designation	Element	Composition	ICP 1000 mg/l Order No. [100 ml]	ICP 10000 mg/l Order No. [100 ml]
Phosphorous	P	H ₃ PO ₄ in water	1.70340.0100	1.70383.0100
Praseodymium	Pr	Pr ₂ O ₃ in HNO ₃ 2-3%	1.70343.0100	
Rhenium	Re	NH ₄ ReO ₄ in water	1.70344.0100	
Rhodium	Rh	Rh(NO ₃) ₃ in HNO ₃ 2-3%	1.70345.0100	
Rubidium	Rb	RbNO ₃ in HNO ₃ 2-3%	1.70346.0100	
Ruthenium	Ru	RuCl ₃ in HCl 7%	1.70347.0100	
Samarium	Sm	Sm ₂ O ₃ in HNO ₃ 2-3%	1.70348.0100	
Scandium	Sc	Sc ₂ O ₃ in HNO ₃ 7%	1.70349.0100	
Selenium	Se	SeO ₂ in HNO ₃ 2-3%	1.70350.0100	
Silicon	Si	SiO ₂ in NaOH	1.70365.0100	1.70386.0100
Silver	Ag	AgNO ₃ in HNO ₃ 2-3%	1.70352.0100	
Sodium	Na	NaNO ₃ in HNO ₃ 2-3%	1.70353.0100	1.70381.0100
Sulfur	S	H ₂ SO ₄ in water	1.70355.0100	1.70385.0100
Strontium	Sr	Sr(NO ₃) ₂ in HNO ₃ 2-3%	1.70354.0100	
Tantalum	Ta	(NH ₄) ₂ TaF ₇ in water	1.70356.0100	
Tellurium	Te	H ₆ TeO ₆ in HNO ₃ 2-3%	1.70357.0100	
Terbium	Tb	Tb(NO ₃) ₃ in HNO ₃ 2-3%	1.70358.0100	
Thallium	Tl	TlNO ₃ in HNO ₃ 2-3%	1.70359.0100	
Thulium	Tm	Tm(NO ₃) ₃ in HNO ₃ 2-3%	1.70361.0100	
Tin	Sn	SnCl ₄ in HCl 7%	1.70362.0100	
Titanium	Ti	(NH ₄) ₂ TiF ₆ in water (trace HF)	1.70363.0100	1.70387.0100
Tungsten	W	(NH ₄) ₂ WO ₄ in water	1.70364.0100	
Uranium	U	UO ₂ (NO ₃) ₂ HNO ₃ 2-3%	1.70360.0100	
Vanadium	V	NH ₄ VO ₃ in HNO ₃	1.70366.0100	1.70388.0100
Ytterbium	Yb	Yb ₂ O ₃ in HNO ₃ 2-3%	1.70367.0100	
Yttrium	Y	Y(NO ₃) ₃ in HNO ₃ 2-3%	1.70368.0100	
Zinc	Zn	Zn(NO ₃) ₂ in HNO ₃ 2-3%	1.70369.0100	1.70389.0100
Zirconium	Zr	ZrOCl ₂ in HCl	1.70370.0100	1.70390.0100

CertIPUR® standards 10 mg/l

Designation	Element	Composition	Order No. [100 ml]
Rhodium, internal standard for ICP	Rh	10 mg/l Rh(NO ₃) ₃ in HNO ₃ 2-3%	1.08525.0100
Mercury	Hg	10 mg/l Hg(NO ₃) ₂ in HNO ₃ 2-3%	1.08623.0100



Isotope-enriched standards

These standards have been specially developed for calibration purposes in IDA (Isotope Dilution Analysis). Isotopic enriched standard solutions are used in elemental analysis if a very exact assay is required. Using IDMS you will receive the smallest values in uncertainty.

These new Certipur spike solutions are certified primary reference materials. Certification is carried out by BAM (Bundesanstalt für Materialforschung und -prüfung, Berlin, Germany) and IRMM (Institute for Reference Materials and Measurement, Geel, Belgium).

CertiPUR® Reference material für isotopic dilution analysis		Order No. [50 ml]
Designation		
Spike Solution Ba-135	10 mg/kg	1.70272.0050
Spike Solution Cu-65	10 mg/kg	1.70275.0050
Spike Solution Fe-57	10 mg/kg	1.70276.0050
Spike Solution Mg-26	10 mg/kg	1.70277.0050
Spike Solution Pb-206	10 mg/kg	1.70279.0050
Spike Solution Tl-203	10 mg/kg	1.70280.0050



Merck chose these institutes for certification, as they have a leading competence in IDMS. Besides this, the certified values are controlled each by the other institute.

Merck Spike Solutions certified by BAM and IRMM

- The standard comes accompanied with a certificate of analysis as ready to use solution. This is especially of advantage as it is sometimes difficult to find a supplier for the raw materials, besides it is very much time consuming to prepare such a solution.
- Small packsizes of 50 ml (of course PFA bottles) guarantee always fresh solution.
- A comprehensive vademecum is supplied with each bottle. These instructions of use have been written by the responsible experts of BAM and IRMM. It is extremely valuable and helps you, even if you just start using the isotope dilution method.



ICP Multi element standards

Multi element calibration standards are directly traceable to standard reference material from NIST. A certificate of analysis is enclosed in each package. It includes exact data on content, composition, traceability, date of release and minimum shelf life.

CertiPUR® Multi Element Standards

ICP calibration standards

Multi element standard I 19 elements, different concentrations	
Order No.	1.15474.0100
Ag	50 mg/l
Al	100 mg/l
B	15 mg/l
Ba	5 mg/l
Be	1 mg/l
Bi	200 mg/l
Cd	20 mg/l
Co	20 mg/l
Cr	25 mg/l
Cu	20 mg/l
Fe	15 mg/l
Ga	150 mg/l
In	200 mg/l
Mn	5 mg/l
Ni	50 mg/l
Pb	200 mg/l
Sr	1 mg/l
Tl	400 mg/l
Zn	20 mg/l
Matrix	1 mol/l HNO ₃

Multi element standard III Earth alkali elements	
Order No.	1.15626.0100
Ba	1000 mg/l
Ca	1000 mg/l
Mg	1000 mg/l
Sr	1000 mg/l
Matrix	1 mol/l HNO ₃

Multi element standard IV 23 elements, 1000 mg/l	
Order No.	1.11355.0100
Ag	1000 mg/l
Al	1000 mg/l
B	1000 mg/l
Ba	1000 mg/l
Bi	1000 mg/l
Ca	1000 mg/l
Cd	1000 mg/l
Co	1000 mg/l
Cr	1000 mg/l
Cu	1000 mg/l
Fe	1000 mg/l
Ga	1000 mg/l
In	1000 mg/l
K	1000 mg/l
Li	1000 mg/l
Mg	1000 mg/l
Mn	1000 mg/l
Na	1000 mg/l
Ni	1000 mg/l
Pb	1000 mg/l
Sr	1000 mg/l
Tl	1000 mg/l
Zn	1000 mg/l
Matrix	1 mol/l HNO ₃

Multi element standard VIII Similar to Multi IV, but no silver	
Order No.	1.09492.0100
Al	100 mg/l
B	100 mg/l
Ba	100 mg/l
Be	100 mg/l
Bi	100 mg/l
Ca	100 mg/l
Cd	100 mg/l
Co	100 mg/l
Cr	100 mg/l
Cu	100 mg/l
Fe	100 mg/l
Ga	100 mg/l
In	100 mg/l
K	100 mg/l
Li	100 mg/l
Mg	100 mg/l
Mn	100 mg/l
Na	100 mg/l
Ni	100 mg/l
Pb	100 mg/l
Se	100 mg/l
Sr	100 mg/l
Te	100 mg/l
Tl	100 mg/l
Zn	100 mg/l
Matrix	1 mol/l HNO ₃

Multi element standard IX Toxic elements	
Order No.	1.09494.0100
As	100 mg/l
Be	100 mg/l
Cd	100 mg/l
Cr (VI)	100 mg/l
Hg	100 mg/l
Ni	100 mg/l
Pb	100 mg/l
Se	100 mg/l
Tl	100 mg/l
Matrix	1 mol/l HNO ₃

Multi element standard X For surface water, equivalent to NIST SRM 1643d	
Order No.	1.09493.0100
As	50 µg/l
B	100 µg/l
Ba	50 µg/l
Be	20 µg/l
Bi	10 µg/l
Ca	35000 µg/l
Cd	20 µg/l
Co	25 µg/l
Cr	20 µg/l
Cu	20 µg/l
Fe	100 µg/l
K	3000 µg/l
Mg	15000 µg/l
Mn	30 µg/l
Mo	100 µg/l
Na	8000 µg/l
Ni	50 µg/l
Pb	25 µg/l
Se	10 µg/l
Sr	100 µg/l
Tl	10 µg/l
V	50 µg/l
Zn	50 µg/l
Matrix	1 mol/l HNO ₃

Multi element standard XI For sewage sludge	
Order No.	1.09491.0100
Cd	10 mg/l
Cr	900 mg/l
Cu	800 mg/l
Hg	8 mg/l
Ni	200 mg/l
Pb	900 mg/l
Zn	2500 mg/l
Matrix	1 mol/l HNO ₃



**Multi element standard XIII
Trace metals**

Order No.	1.09480.0100
Al	500 mg/l
As	100 mg/l
Be	100 mg/l
Cd	25 mg/l
Co	100 mg/l
Cr	100 mg/l
Cu	100 mg/l
Fe	100 mg/l
Hg	5 mg/l
Mn	100 mg/l
Ni	100 mg/l
Pb	100 mg/l
Se	25 mg/l
V	250 mg/l
Zn	100 mg/l
Matrix	5% HNO ₃

**Multi element standard XVI
Quality control, 21 elements**

Order No.	1.09487.0100
As	100 mg/l
Be	100 mg/l
Ca	100 mg/l
Cd	100 mg/l
Co	100 mg/l
Cr	100 mg/l
Cu	100 mg/l
Fe	100 mg/l
Li	100 mg/l
Mg	100 mg/l
Mn	100 mg/l
Mo	100 mg/l
Ni	100 mg/l
Pb	100 mg/l
Sb	100 mg/l
Se	100 mg/l
Sr	100 mg/l
Ti	100 mg/l
Tl	100 mg/l
V	100 mg/l
Zn	100 mg/l
Matrix	5% HNO ₃

**Multi element standard XVII
HCl soluble elements**

Order No.	1.09495.0100
Hf	100 mg/l
Ir	100 mg/l
Sb	100 mg/l
Sn	100 mg/l
Ta	100 mg/l
Ti	100 mg/l
Zr	100 mg/l
Matrix	15% HCl

**ICP/MS calibration
standards**

**Multi element standard VI
calibration in ICP MS,
30 elements**

Order No.	1.10580.0100
Ag	10 mg/l
Al	10 mg/l
As	100 mg/l
B	100 mg/l
Ba	10 mg/l
Be	10 mg/l
Bi	10 mg/l
Ca	1000 mg/l
Cd	10 mg/l
Co	10 mg/l
Cr	10 mg/l
Cu	10 mg/l
Fe	100 mg/l
Ga	10 mg/l
K	10 mg/l
Li	10 mg/l
Mg	10 mg/l
Mn	10 mg/l
Mo	10 mg/l
Na	10 mg/l
Ni	10 mg/l
Pb	10 mg/l
Rb	10 mg/l
Se	100 mg/l
Sr	10 mg/l
Te	10 mg/l
Tl	10 mg/l
U	10 mg/l
V	10 mg/l
Zn	100 mg/l
Matrix	1 mol/l HNO ₃

**Multi element standard XXI
Set, contains 274473 and
108623**

Order No.	1.09498.0001
Ag	10 mg/l
Al	10 mg/l
As	10 mg/l
Ba	10 mg/l
Be	10 mg/l
Bi	10 mg/l
Ca	10 mg/l
Cd	10 mg/l
Co	10 mg/l
Cr	10 mg/l
Cs	10 mg/l
Cu	10 mg/l
Fe	10 mg/l
Ga	10 mg/l
Hg	10 mg/l
In	10 mg/l
K	10 mg/l
Li	10 mg/l
Mg	10 mg/l
Mn	10 mg/l
Na	10 mg/l
Ni	10 mg/l
Pb	10 mg/l
Rb	10 mg/l
Se	10 mg/l
Sr	10 mg/l
Tl	10 mg/l
U	10 mg/l
V	10 mg/l
Zn	10 mg/l
Matrix	5% HNO ₃ (Hg in separate bottle)

Wavelength calibration standards

Multi element standard V 26 elements, designed for Maxim	Order No. 1.10714.0500
Al	20 mg/l
As	20 mg/l
B	2 mg/l
Ba	2 mg/l
Be	1 mg/l
Ca	10 mg/l
Cd	2 mg/l
Cr	2 mg/l
Cu	2 mg/l
Fe	2 mg/l
Hg	5 mg/l
K	100 mg/l
Li	2 mg/l
Mg	1 mg/l
Mn	1 mg/l
Na	20 mg/l
Ni	5 mg/l
P	10 mg/l
Pb	20 mg/l
Sc	1 mg/l
Se	20 mg/l
Sr	1 mg/l
Te	20 mg/l
Ti	2 mg/l
Y	1 mg/l
Zn	2 mg/l
Matrix	5% HCl

Multi element standard XIV in HCl, 11 elements	Order No. 1.09481.0500
As	20 mg/l
K	100 mg/l
La	20 mg/l
Li	20 mg/l
Mn	20 mg/l
Mo	20 mg/l
Na	20 mg/l
Ni	20 mg/l
P	100 mg/l
S	100 mg/l
Sc	20 mg/l
Matrix	2% HCl

Tuning solution

Multi element standard XXIV tuning solution 700 ES	Order No. 1.09411.0500
AL	50 mg/l
As	50 mg/l
Ba	50 mg/l
Cd	50 mg/l
Co	50 mg/l
Cr	50 mg/l
Cu	50 mg/l
K	500 mg/l
Mn	50 mg/l
Mo	50 mg/l
Ni	50 mg/l
Pb	50 mg/l
Se	50 mg/l
Sr	50 mg/l
Zn	50 mg/l
Matrix	1% HNO ₃

ICP/MS plasma Setup solution

Multi element standard XX to setup the plasma	Order No. 1.09497.1000
Ba	10 µg/l
Ce	10 µg/l
Cd	10 µg/l
Cu	10 µg/l
Ge	10 µg/l
Mg	10 µg/l
Pb	10 µg/l
Rh	10 µg/l
Sc	10 µg/l
Tb	10 µg/l
Tl	10 µg/l
Matrix	5% HNO ₃

ICP/MS optimization solution

Multi element standard XXII for testing ICP MS instruments	Order No. 1.09499.0100
AL	0,2 mg/l
Cu	0,2 mg/l
Mg	0,2 mg/l
Pb	0,2 mg/l
Rh	0,2 mg/l
Matrix	2% HNO ₃

ICP/MS mass calibration

Multi element standard XXIII for mass calibration	Order No. 1.09410.0500
Ba	1 µg/l
B	1 µg/l
Co	1 µg/l
Fe	1 µg/l
Ga	1 µg/l
In	1 µg/l
K	1 µg/l
Li	1 µg/l
Lu	1 µg/l
Na	1 µg/l
Rh	1 µg/l
Sc	1 µg/l
Tl	1 µg/l
U	1 µg/l
Y	1 µg/l
Matrix	5% HNO ₃

Graphit furnace AAS standards

Multi element standard XVIII for calibration	Order No. 1.09500.0100
Ag	10 mg/l
Al	100 mg/l
As	100 mg/l
Ba	50 mg/l
Be	5 mg/l
Cd	5 mg/l
Co	50 mg/l
Cr	20 mg/l
Cu	50 mg/l
Fe	20 mg/l
Mn	20 mg/l
Ni	50 mg/l
Pb	100 mg/l
Sb	100 mg/l
Se	100 mg/l
Tl	100 mg/l
Matrix	5% HNO ₃

Cationic chromatography standards

Multi element standard VII for cationic chromatography	Order No. 1.10322.0100
Ba	100 mg/l
Ca	100 mg/l
K	100 mg/l
Li	100 mg/l
Mg	100 mg/l
Mn	100 mg/l
Na	100 mg/l
NH ₄	100 mg/l
Sr	100 mg/l
Matrix	0.001 mol/l HNO ₃

ICP/MS detection limit standard

Multi element standard XIX	Order No. 1.09496.0100
Be	10 µg/l
Co	10 µg/l
In	10 µg/l
Tl	10 µg/l
U	10 µg/l
Matrix	1% HNO ₃

AAS Standards

AAS Standards are traceable to standard reference material from NIST.

A batch specific certificate of analysis is available via internet (www.merck.de).

CertiPUR® AAS Standards			Concentration 1000 mg/l Order No. (100 ml)	Concentration 1000 mg/l Order No. (500 ml)
Designation	Element	Composition		
Aluminium	Al	Al(NO ₃) ₃ in HNO ₃ 0,5 mol/l	1.19770.0100	1.19770.0500
Antimony	Sb	Sb ₂ O ₃ in HCl 2 mol/l	1.70204.0100	1.70204.0500
Arsen	As	H ₃ AsO ₄ in HNO ₃ 0,5 mol/l	1.19773.0100	1.19773.0500
Barium	Ba	Ba(NO ₃) ₂ in HNO ₃ 0,5 mol/l	1.19774.0100	1.19774.0500
Beryllium	Be	Be ₄ O(C ₂ H ₃ O ₂) ₆ in HNO ₃ 0,5 mol/l	1.70207.0100	1.70207.0500
Bismuth	Bi	Bi(NO ₃) ₃ in HNO ₃ 0,5 mol/l	1.19804.0100	1.19804.0500
Boron	B	H ₃ BO ₃ in water	1.19500.0100	1.19500.0500
Calcium	Ca	Ca(NO ₃) ₂ in HNO ₃ 0,5 mol/l	1.19778.0100	1.19778.0500
Cadmium	Cd	Cd(NO ₃) ₂ in HNO ₃ 0,5 mol/l	1.19777.0100	1.19777.0500
Cesium	Cs	CsNO ₃ in HNO ₃ 0,5 mol/l	1.70212.0100	-
Chromium	Cr	Cr(NO ₃) ₃ in HNO ₃ 0,5 mol/l	1.19779.0100	1.19779.0500
Cobalt	Co	Co(NO ₃) ₂ in HNO ₃ 0,5 mol/l	1.19785.0100	1.19785.0500
Copper	Cu	Cu(NO ₃) ₂ in HNO ₃ 0,5 mol/l	1.19786.0100	1.19786.0500
Gold	Au	H(AuCl ₄) in HCl 2 mol/l	1.70216.0100	1.70216.0500
Indium	In	In(NO ₃) ₃ in HNO ₃ 0,5 mol/l	1.19504.0100	-
Iron	Fe	Fe(NO ₃) ₃ in HNO ₃ 0,5 mol/l	1.19781.0100	1.19781.0500
Lead	Pb	Pb(NO ₃) ₂ in HNO ₃ 0,5 mol/l	1.19776.0100	1.19776.0500
Lithium	Li	LiNO ₃ in HNO ₃ 0,5 mol/l	1.70223.0100	1.70223.0500
Magnesium	Mg	Mg(NO ₃) ₂ in HNO ₃ 0,5 mol/l	1.19788.0100	1.19788.0500
Manganese	Mn	Mn(NO ₃) ₂ in HNO ₃ 0,5 mol/l	1.19789.0100	1.19789.0500
Mercury	Hg	Hg(NO ₃) ₂ in HNO ₃ 2 mol/l	1.70226.0100	1.70226.0500
Molybdenum	Mo	(NH ₄) ₆ Mo ₇ O ₂₄ in water	1.70227.0100	1.70227.0500
Nickel	Ni	Ni(NO ₃) ₂ in HNO ₃ 0,5 mol/l	1.19792.0100	1.19792.0500
Palladium	Pd	Pd(NO ₃) ₂ in HNO ₃ 0,5 mol/l	1.14282.0100	1.14282.0500
Platinum	Pt	H ₂ PtCl ₆ in HCl 2 mol/l	1.70219.0100	1.70219.0500
Potassium	K	KNO ₃ in HNO ₃ 0,5 mol/l	1.70230.0100	1.70230.0500
Scandium	Sc	Sc ₂ O ₃ in HNO ₃ 1 mol/l	1.19513.0100	1.19513.0500
Selenium	Se	SeO ₂ in HNO ₃ 0,5 mol/l	1.19796.0100	1.19796.0500
Silicon	Si	(NH ₄) ₂ SiF ₆ in water	1.12310.0100	1.12310.0500
Silicon	Si	SiO ₂ in NaOH 0,5 mol/l	1.70236.0100	1.70236.0500
Silver	Ag	AgNO ₃ in HNO ₃ 0,5 mol/l	1.19797.0100	1.19797.0500
Sodium	Na	NaNO ₃ in HNO ₃ 0,5 mol/l	1.70238.0100	1.70238.0500
Strontium	Sr	Sr(NO ₃) ₂ in HNO ₃ 0,5 mol/l	1.19799.0100	1.19799.0500
Tellurium	Te	H ₆ TeO ₆ in HNO ₃ 0,5 mol/l	1.19514.0100	-
Thallium	Tl	TlNO ₃ in HNO ₃ 0,5 mol/l	1.19801.0100	1.19801.0500
Tin	Sn	SnCl ₄ in HCl 2 mol/l	1.70242.0100	1.70242.0500
Titanium	Ti	(NH ₄) ₂ TiF ₆ in water	1.70243.0100	1.70243.0500
Tungsten	W	(NH ₄) ₂ WO ₄ in water	1.70244.0100	1.70244.0500
Vanadium	V	NH ₄ VO ₃ in HNO ₃ 0,5 mol/l	1.70245.0100	1.70245.0500
Yttrium	Y	Y(NO ₃) ₃ in HNO ₃ 0,5 mol/l	1.19809.0100	1.19809.0500
Zinc	Zn	Zn(NO ₃) ₂ in HNO ₃ 0,5 mol/l	1.19806.0100	1.19806.0500
Zirconium	Zr	ZrOCl ₂ in HCl 2 mol/l	1.70234.0100	-

Tritisol® Standards

Tritisol® Standards are traceable to standard reference material from NIST.

A batch specific certificate of analysis is available via internet (www.merck.de).

Dilution of Tritisol® standards

In preparing a dilution series, the ICP- and AAS standards should be diluted with the same concentration of acid as is in the standard itself.

Tritisol® standards should be diluted to 1 l with 0.1 mol/l hydrochloric acid in the first step. Alternatively, 30 ml of 30% hydrochloric acid can be placed in a volumetric flask and made up to 1 l with distilled water. Further dilutions should then be made with distilled water.

As exceptions, the following Tritisol® standards should be diluted as indicated:

- Antimony, Tin: Place 200 ml 30% hydrochloric acid in a volumetric flask and make up to 1 l with distilled water. Use the same acid concentration for further dilutions.
- Gold: Place 500 ml 30% hydrochloric acid in a volumetric flask and make up to 1 l with distilled water.
- Lead, Selenium, Silver: Dilute to 1 l with 0.1 mol/l or place 5 ml 65% nitric acid in a volumetric flask and make up to the mark.
- Molybdenum: Place 10 ml 25% ammonia solution in a volumetric flask and make up to 1 l with distilled water.
- Silicon: Make up to the mark with distilled water.
- Vanadium: Place 5 ml 96% sulphuric acid in a volumetric flask and make up to 1 l with distilled water.

Minimum shelf life of standard solutions

- Original sealed AAS- and ICP standards: 3 years (see label or certificate of analysis)
- Opened AAS- and ICP standards: recommended max. 12 months
- Unopened Tritisol® ampoules: 5 years
- Solution of 1,000 mg/l: recommended max. 12 months
- Solution of 10–100 mg/l: recommended 1 month
- Solution of 1–10 mg/l: recommended max. 1 week
- Solution of <1 mg/l: recommended 1 day

Tritisol® Standards

Designation	Composition [1 g of element per ampoule]	Order No.
Aluminium	AlCl ₃ in water	1.09967.0001
Antimony	SbCl ₃ in 24% HCl	1.09920.0001
Arsen	As ₂ O ₅ in water	1.09939.0001
Barium	BaCl ₂ in 7% HCl	1.09968.0001
Cadmium	CdCl ₂ in water	1.09960.0001
Calcium	CaCl ₂ in 6.5% HCl	1.09943.0001
Chloride	HCl in water	1.09871.0001
Chromium	CrCl ₃ in 4.2% HCl	1.09948.0001
Cobalt	CoCl ₂ in water	1.09986.0001
Copper	CuCl ₂ in water	1.09987.0001
Fluoride	KF in water	1.09869.0001
Gold	H(AuCl ₄) in 12.72% HCl	1.09868.0001
Iron	FeCl ₃ in 15% HCl	1.09972.0001
Lead	Pb(NO ₃) ₂ in water	1.09969.0001
Lithium	LiCl in water	1.09934.0001
Magnesium	MgCl ₂ in 6% HCl	1.09949.0001
Manganese	MnCl ₂ in water	1.09988.0001
Molybdenum	(NH ₄) ₆ Mo ₇ O ₂₄ in 0.7% NH ₄ OH	1.09926.0001
Nickel	NiCl ₂ in water	1.09989.0001
Nitrite	NaNO ₂ in water	1.09866.0001
Phosphate	H ₃ PO ₄ in water	1.09870.0001
Potassium	KCl in water	1.09924.0001
Selenium	SeO ₂ in 6.3% HNO ₃	1.09915.0001
Silicon	SiCl ₄ in 14% NaOH	1.09947.0001
Silver	AgNO ₃ in 5% HNO ₃	1.09906.0001
Sodium	NaCl in water	1.09927.0001
Strontium	SrCl ₂ in 7% HCl	1.09993.0001
Sulphate	H ₂ SO ₄ in water	1.09872.0001
Tin	SnCl ₄ in 24% HCl	1.09929.0001
Titanium	(NH ₄) ₂ TiF ₆ in water	1.09829.0001
Vanadium	VOSO ₄ in 8.6% H ₂ SO ₄	1.09994.0001
Zinc	ZnCl ₂ in 0.06% HCl	1.09953.0001



Standards dissolved in oil

Standards dissolved in oil are ready-to-use calibration standards for the analysis of non-aqueous matrices.

For AAS, they are diluted to the required concentration with Merck standard oil or with non-polar solvents (e.g. petroleum benzene, lubricating oil, paraffin, benzene, mineral oil).

For the elements calcium, potassium, sodium and zinc, the standard solutions can also be prepared from salts (available as cyclohexanebutyric acid or 2-ethylhexanoic acid salts) in the concentrations required for the application involved. The procedure involved is to mix a precisely weighed quantity of salt with 3 ml xylene and 5 ml 2-ethylhexanoic acid and to dissolve by warming carefully with occasional gentle shaking. The solution thus obtained is then diluted to the required concentration with a non-polar solvent.

A batch specific certificate of analysis is available via internet (www.merck.de).

CertiPUR® Standards, dissolved in oil

Designation	Raw material	Concentration	Order No. [100 ml]
Calcium	2-Ethylhexanoic acid-Ca salt	1 g/kg	1.15053.0100
Cobalt	Cyclohexanebutyric acid-Co(II) salt	1 g/kg	1.15061.0100
Copper	Cyclohexanebutyric acid-Cu(II) salt	1 g/kg	1.15055.0100
Phosphorus	Triphenyl phosphate	1 g/kg	1.15072.0100
Potassium	Cyclohexanebutyric acid-K salt	1 g/kg	1.15054.0100
Sodium	Cyclohexanebutyric acid-Na salt	1 g/kg	1.15058.0100

CertiPUR® Multi element standards, Oil dissolved calibration standards

Designation	Composition [also see page 9]	Order No.
Multi element standard I	4 elements, different concentrations Ba (8 g/kg), Ca (4 g/kg), Mg (1 g/kg), Zn (1.6 g/kg)	1.15075.0100
Multi element standard II	21 elements, 100 ppm Ag, Al, B, Ba, Ca, Cd, Cr, Cu, Fe, Mg, Mn, Mo, Na, Ni, P, Pb, Si, Sn, Ti, V, Zn	1.09469.0100
Multi element standard III	21 elements, 900 ppm Ag, Al, B, Ba, Ca, Cd, Cr, Cu, Fe, Mg, Mn, Mo, Na, Ni, P, Pb, Si, Sn, Ti, V, Zn	1.09479.0100

Auxiliaries

Designation	Order No.
Standard oil for AAS (30–40 m Pa * s)	1.13898.2500

Certipur® reference materials for reliable calibration in pH measurement

pH Measurement

- Methods
- Accreditation
- Quality control
- Traceability

Certipur® Products

- Certified secondary standard reference materials
- Certified buffer solutions
- Certified buffer solutions in sachets
- Titrisol® buffer concentrates

The measurement of pH value is the most commonly used analytical method. This is because the determination itself and the subsequent maintenance of pH value is of critical importance in numerous chemical, biochemical and biological processes, especially those in quality assurance and in-process-control.



Certipur reference materials guarantee comparability and reliability

Reference materials have a direct influence on the accuracy of measurement. In addition, duplicate measurements are expensive and time-consuming. This is the reason why Merck supplies certified buffer substances and solutions for the convenient and reliable calibration of your pH instruments.

- **Top-quality certified secondary standard buffers and solutions.**

Showing a maximum deviation of max. ± 0.003 pH units, they are extremely precise and hence suitable for the monitoring of instrumentation.

- **Ready-to-use buffer solutions and Titrisol solutions.**

With a guaranteed measurement uncertainty of max. ± 0.01 pH units over the whole shelf life of our ready-to-use buffer solutions are particularly suitable for routine laboratory use. As well are our Titrisol buffer concentrates with a measurement uncertainty of ± 0.02 pH units.

- **Ready-to-use buffer solutions in sealed sachets.**

These guarantee precise results as they are always fresh and free of contamination. Here we guarantee an uncertainty of ± 0.01 pH units.

Merck has its own independent accredited calibration laboratory for pH measurement

Merck runs its own calibration laboratory for pH measurement. This has been accredited by DKD (Deutscher Kalibrierdienst: German Calibration Service) under DKD-K-14301 and is regularly audited by DKD or by PTB (Physikalisch-Technische Bundesanstalt: Federal Physical-Technical Institute, Braunschweig, Germany). All Merck buffer substances and solutions are subjected to quality control in this laboratory. In order to be able to provide our customers with the best possible service, we produce our own, certified primary reference materials.

Accreditation

The basis of our accreditation is our adherence to European Standard DIN EN ISO/IEC 17025. In contrast to certification according to DIN EN ISO 9001:2000 which is based on the presence of a company-wide quality management system, accreditation is based on the presence of a competent testing laboratory where not only qualified staff have to be employed but where each and every analysis carried out has to correspond to specified criteria. All instrumentation used is regularly checked by officially authorized calibration laboratories. In addition, all relevant parameters used in measurement, e.g. weight and temperature, have to correspond to national and international standards.

Within the framework of accreditation Merck is forced to make a comprehensive statistical uncertainty budget according to GUM (Guide to the Expression of Uncertainty in Measurement): all errors that can influence pH measurement are assessed and included in a so-called »uncertainty budget«.

The accredited laboratory of Merck is also obliged to participate regularly in an external international laboratory testing program for pH values.

The Merck pH laboratory is also a member of the German Calibration Service (DKD) and as such is available to our customers as an accredited independent pH laboratory.





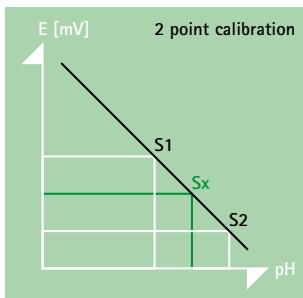
Quality control

Our certified secondary standard reference materials are tested with two specially developed platinum hydrogen electrodes using differential potentiometry. The total uncertainty factor of the measured pH using this method is max. ± 0.003 pH units. Buffers prepared are hence extremely precise.

For the precise measurement of their ready-to-use buffer solutions, Tritisol® concentrates or sachets, Merck uses a 5 point calibration with an accuracy of $\leq \pm 0.01$ pH units or ± 0.02 pH units; the more simple but less accurate 2 point calibration method has an accuracy of only $\geq \pm 0.05$ pH units.

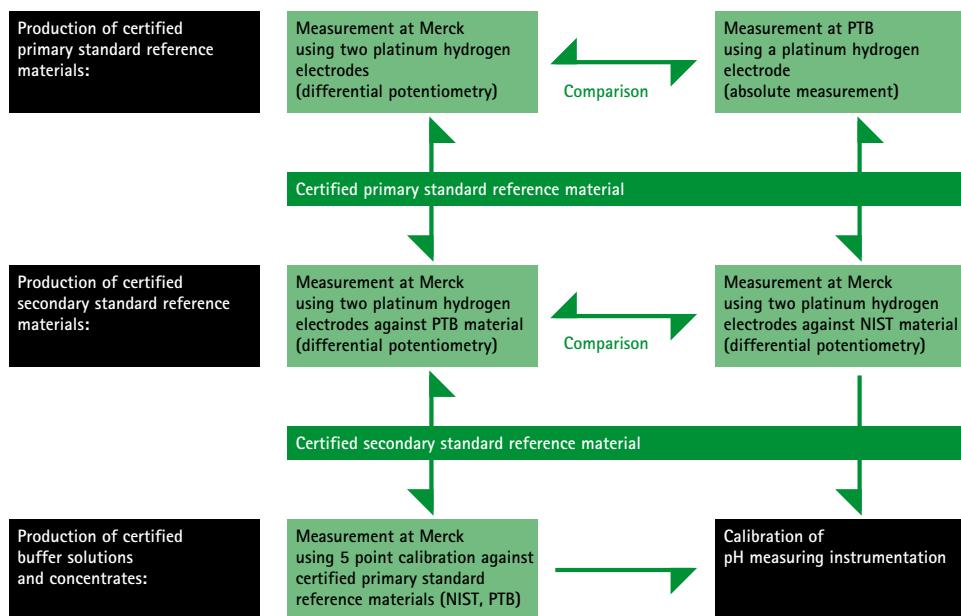
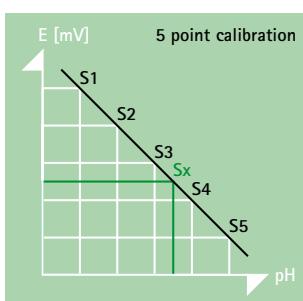
In the 5 point calibration method, the calibration gradient is calculated with 5 standard buffer solutions using linear regression and employing a specially developed software programme. The Δ pH deviation provides information on the quality of the measurements obtained.

The high quality standard provided by Certipur buffers means that pH measurements are independent of time and location; they are hence comparable.



Traceability

Our reference materials are measured directly against certified primary reference materials from NIST (National Institute of Standards and Technology, Gaithersburg, USA) and PTB (Physikalisch-Technische Bundesanstalt: Federal Physical-Technical Institute, Braunschweig, Germany). Hence, Certipur buffer substances and solutions are as it were, »doubly traceable«.





Certified secondary standard reference buffer solutions

These serve the purpose of precisely calibrating and monitoring pH measurement instrumentation. Deviation is max. ± 0.003 pH units. Every Certipur product is delivered with a Certificate of Analysis showing the relevant data.

Production of such solutions is time-consuming and expensive: Merck sends analytically characterised buffer material to PTB. There they are transformed into primary certified standard reference materials through absolute measurement.

As such primary standards are too expensive for the end consumer, Merck prepares secondary standard material from them and then carries out comparative measurement against the primary standards. This quality control is carried out in Merck's accredited calibration laboratory using differential potentiometry with two specially developed platinum hydrogen electrodes. This method allows the pH value of two solutions of the same composition to be accurately compared using differential potentiometry method.

In addition, the Certipur buffer solutions and substances are compared to the primary standard reference material from NIST.

CertiPUR® certified secondary standard reference buffer solutions (25 °C)

Designation	pH value (25 °C)	Package size	Order No.
CertiPUR certified secondary standard reference buffer solution pH 1.681 Potassium tetroxalat dihydrate	1.68 ₁	5 x 100 ml	1.07204.0105
CertiPUR certified secondary standard reference buffer solution pH 4.005 Potassium hydrogen phthalate	4.00 ₅	5 x 100 ml	1.07200.0105
CertiPUR certified secondary standard reference buffer solution pH 6.863 Potassium dihydrogen phosphate/ Disodium hydrogen phosphate	6.86 ₃	5 x 100 ml	1.07202.0105
CertiPUR certified secondary standard reference buffer solution pH 7.416 Potassium dihydrogen phosphate/ Disodium hydrogen phosphate	7.41 ₆	5 x 100 ml	1.07205.0105
CertiPUR pH certified secondary standard reference buffer solution 9.184 Disodium tetraborate decahydrate	9.18 ₄	5 x 100 ml	1.07203.0105

CertiPUR® certified secondary reference buffer substances (25 °C)

Designation	pH value (25 °C)	Package size	Order No.
CertiPUR certified secondary reference buffer substance Potassium tetroxalate dihydrate	1.68 ₁	25 g	1.01961.0025
CertiPUR certified secondary reference buffer substance Potassium hydrogen tartate	3.63 ₉	25 g	1.01963.0025
CertiPUR certified secondary reference buffer substance Potassium hydrogen phthalate	4.00 ₅	25 g	1.01965.0025
CertiPUR certified secondary reference buffer substance Potassium hydrogen phosphate/ Disodium hydrogen phosphate	6.86 ₃ 7.41 ₆	2 x 25 g	1.01960.0001
CertiPUR certified secondary reference buffer substance Disodium tetraborate decahydrate	9.18 ₄	25 g	1.01964.0025
CertiPUR certified secondary reference buffer substance Sodium hydrogencarbonate/Sodium carbonate	10.01 ₄	2 x 25 g	1.01962.0001



Ready-to-use buffer solutions

All Certipur buffer solutions are traceable to standard reference materials from NIST and PTB. They are analysed in our own independent accredited calibration laboratory with a combined glass electrode and 5 point calibration according to DIN 19628 using reference material for the preparation of standard buffer solutions according to DIN 19266. Deviation is max. ± 0.01 pH units (ab pH 10: max. ± 0.02 pH units).

CertipUR® buffer solutions (20 °C)				
Designation	pH value (20 °C)	Composition	Package size	Order No.
Certipur buffer solution	1.00	Glycine Sodium chloride Hydrogen chloride	1,000 ml	1.09432.1000
Certipur buffer solution	2.00	Citric acid Sodium hydroxide Hydrogen chloride	1,000 ml 10 l Titripac®	1.09433.1000 1.09433.9010
Certipur buffer solution	3.00	Citric acid Sodium hydroxide Hydrogen chloride	1,000 ml	1.09434.1000
Certipur buffer solution	4.00	Citric acid Sodium hydroxide Hydrogen chloride	1,000 ml 4 l Titripac® 10 l Titripac®	1.09435.1000 1.09435.4000 1.09435.9010
Certipur buffer solution	4.66	Acetic acid Sodium acetate	1,000 ml	1.07827.1000
Certipur buffer solution	5.00	Citric acid Sodium hydroxide	1,000 ml	1.09436.1000
Certipur buffer solution	6.00	Citric acid Sodium hydroxide	1,000 ml	1.09437.1000
Certipur buffer solution	6.88	Disodium hydrogen phosphate Potassium dihydrogen phosphate	1,000 ml	1.07294.1000
Certipur buffer solution	7.00	Disodium hydrogen phosphate Potassium dihydrogen phosphate	1,000 ml 4 l Titripac® 10 l Titripac®	1.09439.1000 1.09439.4000 1.09439.9010
Certipur buffer solution	8.00	Boric acid Sodium hydroxide Hydrogen chloride	1,000 ml	1.09460.1000
Certipur buffer solution	9.00	Boric acid Sodium hydroxide Potassium chloride	1,000 ml 4 l Titripac® 10 l Titripac®	1.09461.1000 1.09461.4000 1.09461.9010
Certipur buffer solution	9.22	Disodium tetraborate	1,000 ml	1.01645.1000
Certipur buffer solution	10.00	Boric acid Sodium hydroxide Potassium chloride	1,000 ml 4 l Titripac® 10 l Titripac®	1.09438.1000 1.09438.4000 1.09438.9010
Certipur buffer solution	11.00	Boric acid Sodium hydroxide Potassium chloride	1,000 ml	1.09462.1000
Certipur buffer solution	12.00	Potassiumhydrogen- phosphate Sodium hydroxide	4 l Titripac®	1.99022.4000

CertiPUR® buffer solutions (25 °C)				
Designation	pH value (25 °C)	Composition	Package size	Order No.
CertiPUR buffer solution	4.01	Potassium hydrogen phthalate	1,000 ml	1.09406.1000
CertiPUR buffer solution	7.00	Disodium hydrogen phosphate Potassium dihydrogen phosphate	1,000 ml	1.09407.1000
CertiPUR buffer solution	9.00	Boric acid Sodium hydroxide Potassium chloride	1,000 ml	1.09408.1000
CertiPUR buffer solution	10.00	Boric acid Sodium hydroxide Potassium chloride	1,000 ml	1.09409.1000



CertiPUR® buffer solutions (20 °C) – colour coded				
Designation	pH value (20 °C)	Composition	Package size	Order No.
CertiPUR buffer solution	4.00 [red]	Citric acid Sodium hydroxide Hydrogen chloride	500 ml 10 l Titripac® 4 l Titripac®	1.09475.0500 1.09475.9010 1.09475.4000
CertiPUR buffer solution	7.00 [green]	Disodium hydrogen phosphate Potassium dihydrogen phosphate	500 ml 10 l Titripac® 4 l Titripac®	1.09477.0500 1.09477.9010 1.09477.4000
CertiPUR buffer solution	9.00 [blue]	Boric acid Potassium chloride Sodium hydroxide	500 ml 10 l Titripac® 4 l Titripac®	1.09476.0500 1.09476.9010 1.09476.4000
CertiPUR buffer solution	10.00 [yellow]	Boric acid Potassium chloride Sodium hydroxide	500 ml 10 l Titripac® 4 l Titripac®	1.09400.0500 1.09400.9010 1.09400.4000



CertiPUR® buffer sachets**Ready-to-use buffer solutions, packed in practical small quantities in sealed sachets.**

All Certipur buffer sachets are traceable to standard reference materials from NIST and PTB. They are analysed in our own independent accredited calibration laboratory with a combined glass electrode and 5 point calibration according to DIN 19628 using reference material for the prepreation of standard buffer solutions according to DIN 19266. Deviation is max. ± 0.01 pH units (pH 10: max. ± 0.02 pH units).

Ordering information CertiPUR® buffer solutions in sachets (25 °C)				
Designation	pH value (25 °C)	Composition	Package size	Order No.
CertiPUR buffer solution	2.00	Citric acid Sodium hydroxide Hydrogen chloride	30 sachets á 30 ml	1.99012.0001
CertiPUR buffer solution	4.01	Potassium hydrogen phthalate	30 sachets á 30 ml	1.99001.0001
CertiPUR buffer solution	7.00	Potassium dihydrogen phosphate Disodium hydrogen phosphate	30 sachets á 30 ml	1.99002.0001
CertiPUR buffer solution	9.00	Boric acid Sodium hydroxide Potassium chloride	30 sachets á 30 ml	1.99003.0001
CertiPUR buffer solution	9.18	Disodium tetraborate	30 sachets á 30 ml	1.99019.0001
CertiPUR buffer solution	10.00	Boric acid Sodium hydroxide Potassium chloride	30 sachets á 30 ml	1.99004.0001
CertiPUR buffer solution	11.00	Boric acid Sodium hydroxide Potassium chloride	30 sachets á 30 ml	1.99021.0001
CertiPUR buffer solution	12.00	Disodium hydrogen phosphate Sodium hydroxide	30 sachets á 30 ml	1.99022.0001
CertiPUR buffer solution Set I	4.01 7.00 9.00		3 x 10 sachets á 30 ml	1.99005.0001
CertiPUR buffer solution Set II	4.01 7.00 10.00		3 x 10 sachets á 30 ml	1.99006.0001

Advantages of CertiPUR® buffer sachets:

- Always fresh and ready-to-use
- Guaranteed precise pH value
- No residues
- Includes batch-specific Certificate of Analysis
- Always available in suitable quantities
- No risk of contamination
- Easy to use



Titrisol® buffer concentrates

All Titrisol® buffer concentrates are traceable to standard reference materials from NIST and PTB. They are analysed in our own independent accredited calibration laboratory with a combined glass electrode and 5 point calibration according to DIN 19628 using reference material for the preparation of standard buffer solutions according to DIN 19266. Deviation is max. ± 0.02 pH units (pH 10, 11, 12, 13: max. ± 0.05 pH units).

Titrisol® buffer concentrate for 500 ml buffer solution (20 °C)				
Designation	pH value (20 °C)	Composition	Package size	Order No.
Buffer Titrisol®	1.00	Glycine, Sodium chloride, Hydrogen chloride	1 ampoule	1.09881.0001
Buffer Titrisol®	2.00	Citric acid, Sodium hydroxide, Hydrogen chloride	1 ampoule	1.09882.0001
Buffer Titrisol®	3.00	Citric acid, Sodium hydroxide, Hydrogen chloride	1 ampoule	1.09883.0001
Buffer Titrisol®	4.00	Citric acid, Sodium hydroxide, Hydrogen chloride	1 ampoule	1.09884.0001
Buffer Titrisol®	5.00	Citric acid, Sodium hydroxide	1 ampoule	1.09885.0001
Buffer Titrisol®	6.00	Citric acid, Sodium hydroxide	1 ampoule	1.09886.0001
Buffer Titrisol®	7.00	Disodium hydrogen phosphate, Potassium dihydrogen phosphate	1 ampoule	1.09887.0001
Buffer Titrisol® acc. to Weise	7.20	Disodium hydrogen phosphate, Potassium dihydrogen phosphate	1 ampoule	1.09879.0001
Buffer Titrisol®	8.00	Boric acid, Sodium hydroxide, Hydrogen chloride	1 ampoule	1.09888.0001
Buffer Titrisol®	9.00	Boric acid, Sodium hydroxide, Hydrogen chloride	1 ampoule	1.09889.0001
Buffer Titrisol®	10.00	Boric acid, Sodium hydroxide, Hydrogen chloride	1 ampoule	1.09890.0001
Buffer Titrisol®	11.00	Boric acid, Sodium hydroxide, Potassium chloride	1 ampoule	1.09880.0001
Buffer Titrisol®	12.00	Disodium hydrogen phosphate, Sodium hydroxide	1 ampoule	1.09892.0001
Buffer Titrisol®	13.00	Potassium chloride, Sodium hydroxide	1 ampoule	1.09893.0001



CertIPUR® reference materials for reliable calibration in conductivity measurement

Conductivity measurement

- Traceability

CertIPUR® Products

- Certified reference material
for conductivity measurement
- Certipur conductivity sachets

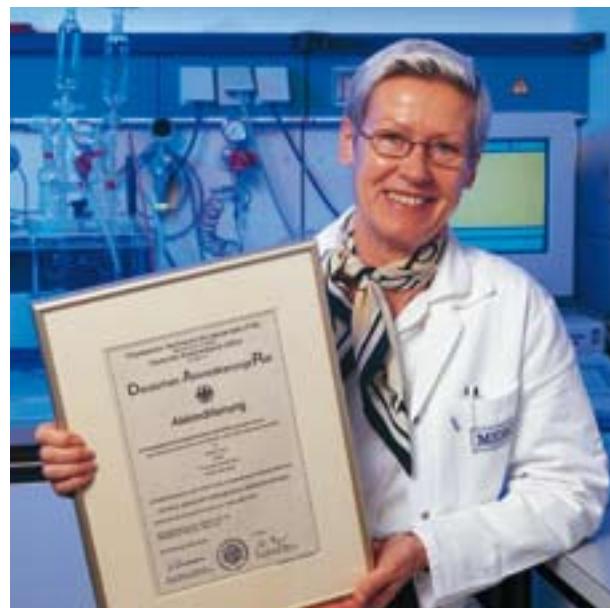
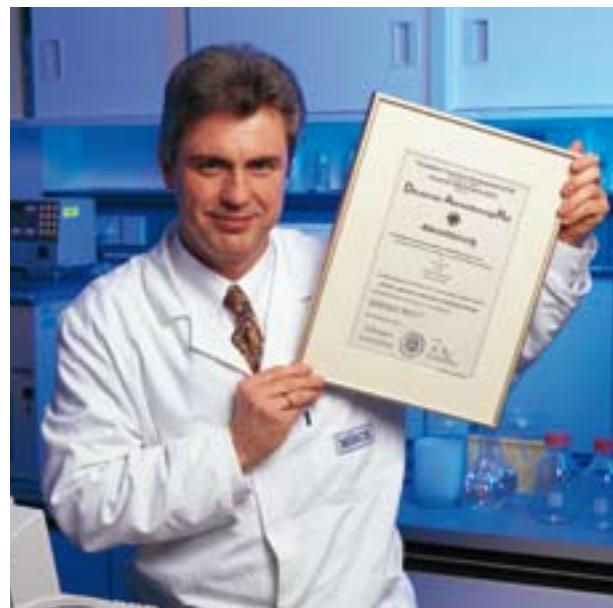
In conductivity measurement the reliable calibration of your instruments is the first indispensable step. Certipur reference materials guarantee accurate and comparable results.

Reference material for conductivity measurement

Merck now certifies its Certipur reference materials for conductivity measurement in its own, accredited calibration laboratory: Merck produces primary reference materials which are then certified by PTB (Physikalisch-Technische Bundesanstalt, Braunschweig). The Merck conductivity standards are then hence traceable to these primary reference materials.

In addition, the Merck standards are measured against international conductivity standards from NIST (National Institute of Standards and Technology, Gaithersburg, USA). Both of the traceability procedures are documented in the Certificate of Analysis.

CertiPUR® Reference Material for Conductivity Measurement		
Designation	nominal Conductivity (mS/cm) at 25°C	Order No. [500 ml]
Conductivity water	0	1.01810.0105
Potassium chloride solution (0.0001 mol/l)	0.015	1.01811.0105
Potassium chloride solution (0.001 mol/l)	0.147	1.01557.0500
Potassium chloride solution (0.01 mol/l)	1.41	1.01203.0500
Potassium chloride solution (0.1 mol/l)	12.8	1.01254.0500
Potassium chloride solution (1 mol/l)	111	1.01255.0500



Ideal for mobile analysis: CertiPUR® Sachets

In environmental analysis it is often necessary to perform the measurement directly at the river or at similar places. Our sachets were designed especially for this purpose. They are reliable, easy-to-use and always fresh. Safe and neat packages with small portions suitable for laboratory and external use prevent the solutions from contamination through micro-organisms, CO₂ or other foreign substances. The conductivity standards are ready-to-use and therefore ideal for mobile analysis. In principle, you do not even need a beaker. To measure the electrode can simply be inserted into the sachet.

CertiPUR® Conductivity Solutions in Sachets

Designation	Nominal Conductivity (mS/cm) at 25°C	Package Size	Order No.
Potassium chloride solution (0.001 mol/l)	0.147	30 Sachets à 30 ml	1.01586.0001
Potassium chloride solution (0.01 mol/l)	1.41	30 Sachets à 30 ml	1.01553.0001
Potassium chloride solution (0.1 mol/l)	12.8	30 Sachets à 30 ml	1.01554.0001



Advantages of CertiPUR® conductivity sachets:

- Solutions are always fresh and ready-to-use
- Available in suitable quantities
- Guaranteed precise conductivity values
- No risk of contamination
- No residues
- Easy to use
- Includes batch-specific certificate of analysis (traceable to PTB and NIST)



CertiPUR® reference materials for reliable calibration in ion chromatography

Ion chromatography

- Methods
- Traceability

CertiPUR® Products

- Ion chromatography standards
- Ion chromatography multi standards, anionic
- Ion chromatography multi standards, cationic

Ion chromatography requires the constant use of calibration solutions. Merck has a wide range of single- and multi-element solutions for this purpose. Recent additions are the multi-element solutions for environmental analysis: for this purpose, a new standard has been developed based on nitrogen and phosphorus rather than the previously used ions nitrate and phosphate.

All ion chromatography standards – with the exception of fluoride – are traceable to NIST (National Institute of Standards and Technology, Gaithersburg, USA) standard reference materials.

CertiPUR® ion chromatography standards

Designation	Item	Composition	Concentration	Package size	Order No.
Ammonium	ready to use solution	NH ₄ Cl in water	1,000 mg/l	500 ml	1.19812.0500
Bromide	ready to use solution	NaBr in water	1,000 mg/l	500 ml	1.19896.0500
Chloride	ready to use solution	NaCl in water	1,000 mg/l	500 ml	1.19897.0500
	Titrisol®	HCl in water	1 g	1 Ampoule	1.09871.0001
Chromate	ready to use solution	K ₂ CrO ₄ in water	1,000 mg/l	500 ml	1.19780.0500
Cyanide	ready to use solution	K ₂ [Zn(CN) ₄] in water	1,000 mg/l	500 ml	1.19533.0500
Fluoride	ready to use solution	NaF in water	1,000 mg/l	500 ml	1.19814.0500
	Titrisol®	KF in water	1 g	1 Ampoule	1.09869.0001
Nitrate	ready to use solution	NaNO ₃ in water	1,000 mg/l	500 ml	1.19811.0500
Nitrite	ready to use solution	NaNO ₂ in water	1,000 mg/l	500 ml	1.19899.0500
	Titrisol®	NaNO ₂ in water	1 g	1 Ampoule	1.09866.0001
Phosphate	ready to use solution	KH ₂ PO ₄ in water	1,000 mg/l	500 ml	1.19898.0500
	Titrisol®	H ₃ PO ₄ in water	1 g	1 Ampoule	1.09870.0001
Sodium	ready to use solution	NaNO ₃ in water	1,000 mg/l	500 ml	1.19507.0500
Sulphate	ready to use solution	Na ₂ SO ₄ in water	1,000 mg/l	500 ml	1.19813.0500
	Titrisol®	H ₂ SO ₄ in water	1 g	1 Ampoule	1.09872.0001

CertiPUR® ion chromatography multi element standards, anionic

Designation	Composition	Matrix	Package size	Order No.
Anion multi element standard I	1,000 mg/l F 1,000 mg/l Br 1,000 mg/l PO ₄	water	500 ml	1.11437.0500
Anion multi element standard II	1,000 mg/l Cl 1,000 mg/l NO ₃ 1,000 mg/l SO ₄	water	500 ml	1.11448.0500
IC multi element standard I	100 mg/l F 250 mg/l Cl 500 mg/l NO ₃ 500 mg/l SO ₄ 1,000 mg/l PO ₄	water	500 ml	1.70398.0500
IC multi element standard II	500 mg/l PO ₄ -P 500 mg/l NH ₄ -N 500 mg/l NO ₃ -N	water	500 ml	1.70399.0500

CertiPUR® ion chromatography multi element standards, cationic

Designation	Composition	Matrix	Package size	Order No.
Cation chromatography standard acc. to EN ISO 14911	100 mg/l Li 100 mg/l Na 100 mg/l K 100 mg/l NH ₄ 100 mg/l Mn 100 mg/l Ca 100 mg/l Mg 100 mg/l Sr 100 mg/l Ba	0.001 mol/l HNO ₃	100 ml	1.10322.0100

CertIPUR® reference materials for reliable calibration in UV/VIS spectroscopy

UV / VIS standards

- Methods
- Traceability

CertIPUR® Products

- UV / VIS standards



UV/VIS spectroscopy is indispensable in the modern analytical laboratory. It is a method that is well-established and is reliable and accurate. However, UV/VIS spectrometers must be checked regularly for correctness and uniformity of results and function and documented as such. This is obligatory when working according to DAB or Ph. Eur., but also when working according to GLP, GMP, USP and DIN EN ISO 9001:2000 or DIN EN ISO/IEC 17025. The following parameters can be determined using UV/VIS standards according to Ph. Eur.:

- Absorbance
- Stray light
- Spectral resolution power
- Wavelength accuracy

CertiPUR® UV/VIS standards

Designation	Content	Order No.
UV/VIS standard 1	Potassium dichromate solution for the absorbance acc. to DAB and Ph.Eur. 2 x 10 ml K ₂ Cr ₂ O ₇ 60.06 mg/l in H ₂ SO ₄ 0.01 N und 6 x 10 ml H ₂ SO ₄ 0.01 N	1.08160.0001
UV/VIS standard 1A	Potassium dichromate solution for the absorbance at 430 nm acc. to DAB and Ph.Eur. 2 x 10 ml K ₂ Cr ₂ O ₇ 600.6 mg/l in H ₂ SO ₄ 0.01 N und 6 x 10 ml H ₂ SO ₄ 0.01 N	1.04660.0001
UV/VIS standard 2	Sodium nitrite solution for straylight testing acc. to DAB and Ph.Eur. 3 x 10 ml NaNO ₂ 50 g/l in H ₂ O	1.08161.0001
UV/VIS standard 3	Sodium iodide solution for straylight testing acc. to DAB and Ph.Eur. 3 x 10 ml NaI 10 g/l in H ₂ O	1.08163.0001
UV/VIS standard 4	Potassium chloride solution for straylight testing acc. to DAB and Ph.Eur. 3 x 10 ml KCl 12 g/l in H ₂ O	1.08164.0001
UV/VIS standard 5	Toluene solution in hexane for testing the spectral resolution power acc. to DAB and Ph.Eur. 2 x 10 ml 0.02 % (v/v) Toluol in n-Hexan und 6 x 10 ml n-Hexan	1.08165.0001
UV/VIS standard 6	Holmium oxide solution reference material for the wavelength acc. to DAB and Ph.Eur. 3 x 10 ml Ho ₂ O ₃ 40 g/l in HClO ₄ (10 % v/v)	1.08166.0001

Auxiliaries

Designation	Order No.
Precision Cell	100-QS for calibration [Hellma]



Certipur® reference materials for reliable calibration in volumetry

Volumetry

- Methods
- Traceability

Certipur® Products

- Secondary reference materials for alkalimetry
- Secondary reference materials for redox titration
- Secondary reference materials for iodometry
- Secondary reference materials for acidimetry
- Secondary reference materials for argentometry
- Secondary reference materials for complexometry

Standard solutions are required for adjusting and checking volumetric solutions. The compounds used must correspond precisely to their formulas within the scope of measuring accuracy; only such substances allow reliable statements to be made concerning the volumetric solution being used.

In order to guarantee the highest possible quality standard, the solutions are produced under the most stringent of control processes and subsequently measured with the highest degree of accuracy. The general purity grade is that of »GR«.

All standard solutions are directly traceable to standard reference materials from NIST (National Institute of Standards and Technology, Gaithersburg, USA).

CertiPUR® secondary reference material for alkalimetry

Designation	Package size	Order No.
Potassium hydrogenc phthalate	80 g	1.02400.0080
Benzoic acid	60 g	1.02401.0060

CertiPUR® secondary reference material for redox titration

Designation	Package size	Order No.
Iron(II)-ethylene diammonium sulphate tetrahydrate	80 g	1.02402.0080
Potassium dichromate	80 g	1.02403.0080
Di-Sodium oxalate	60 g	1.02407.0060

CertiPUR® secondary reference material for iodometry

Designation	Package size	Order No.
Potassium iodate	100 g	1.02404.0100

CertiPUR® secondary reference material for acidimetry

Designation	Package size	Order No.
Sodium carbonate	80 g	1.02405.0080
Tris(hydroxymethyl)-amino methane	80 g	1.02408.0080

CertiPUR® secondary reference material for argentometry

Designation	Package size	Order No.
Sodium chloride	80 g	1.02406.0080

CertiPUR® secondary reference material for complexometry

Designation	Package size	Order No.
Zinc	100 g	1.02409.0100
Calcium carbonate	50 g	1.02410.0050

CertIPUR® reference materials for reliable calibration in special applications

CertIPUR® Products

- TOC standard solution
according to DIN 38409-H3 (EN 1484)
- Barium sulphate White standard DIN 5033
- 2-Propanol standard for the analysis of tobacco
- DSC-Standards
- Ready-to-use colour comparison solutions
according to Ph. Eur.
- Reference materials for refractometry

TOC analysis according to EN 1484-H3 – potassium hydrogen phthalate standard

A new European standard has come into force for the analysis of TOC (Total Organic Compound): EN 1484-H3 (which replaces DIN 38409-H3). This standard regulates the procedures for the determination of the concentration of organic carbon in drinking-, ground-, surface-, lake- and waste water.

Our Certipur TOC standard facilitates the calibration of TOC instruments according to the new standard, hence creating a reliable basis for your analyses. The potassium hydrogen phthalate solution is available as a ready-to-use standard in a concentration of 1,000 mg/l in water. The standard is stabilised and protected from light in brown glass bottles. It has a minimum shelf life of 3 years for sealed, properly stored products.

CertiPUR® TOC-Standard	
Designation	Order No.
TOC standard solution acc. to EN 1484 / DIN 38409-H3 as potassium hydrogen phthalate in water, stabilized, 1000mg/l	1.09017.0100

Colour measurement and photometry according to DIN 5033, part 9

Colour measurement according to this standard is possible using the primary reference material provided by Merck. This has been certified by the PTB (Physikalisch-Technische Bundesanstalt, Braunschweig).

The Certificate of Analysis of barium sulphate white standard includes guaranteed values for spectral density (reflection from 350 – 800 nm), reflection factor and standard colour values.

CertiPUR® White Standard	
Designation	Order No.
Barium sulfate White standard acc. to DIN 5033	1.01748.0250

Reference materials for analysis of tobacco

Merck has developed a standard specially for the tobacco industry for extraction using isopropanol. The reference material includes an internal standard for subsequent gas chromatographic analysis.

CertiPUR® Standards for tobacco analysis	
Designation	Order No.
2-Propanol standard for tobacco analysis	1.00272.2500

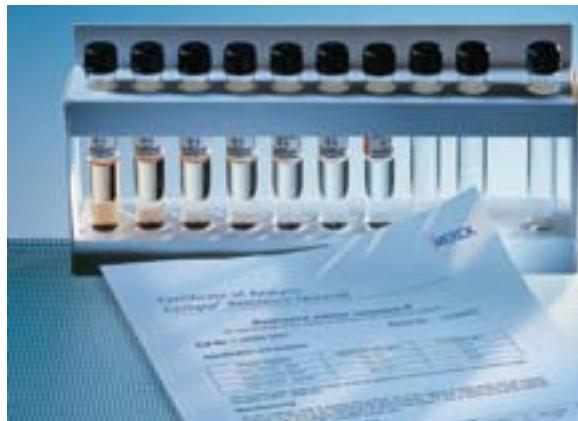
Reference materials for the temperature calibration of DSC instruments

Differential Scanning Calorimeters (DSC) require the calibration of the temperature on a regular basis. For this purpose Merck developed liquid crystal standards that allow the calibration in heating modus as well in cooling modus. They are traceable to PTB and NIST.

CertiPUR® DSC Standards			
Designation	Transition	Phase transition temperature (°C)	Order No.
BCH-52 Liquid crystal standard	nematic-isotropic	164	1.00006.9005
HP-53 Liquid crystal standard	smectic A-nematic	120	1.00007.9005
M-24 Liquid crystal standard	smectic A-nematic	67	1.00008.9005

Ready-to-use colour comparison solutions according to the European pharmacopoeia

Analysis of the colour of a liquid in the range brown – yellow – red is described in Ph. Eur. However, the preparation of the solutions required is complex and time-consuming. Certipur reference solutions save time and money: all colour standards – B, BY, Y, GY and R – are available as a ready-to-use kit in a Ph. Eur-suitable cuvette. To perform the analysis, the sample is simply placed in the empty cuvette contained in the kit and placed alongside the colour comparison solutions in the rack provided.



CertiPUR® Reference Colour Solutions acc. to Ph. Eur.

Designation	for examination of the colour of solutions acc. to	Order No. (1 set of cuvettes)
Reference Colour Solution B	Ph. Eur. B1–B9	1.00265.0001
Reference Colour Solution BY	Ph. Eur. BY1–BY7	1.00266.0001
Reference Colour Solution Y	Ph. Eur. Y1–Y7	1.00267.0001
Reference Colour Solution GY	Ph. Eur. GY1–GY7	1.00268.0001
Reference Colour Solution R	Ph. Eur. R1–R7	1.00269.0001
Empty cells with screw cap (25 units)		1.14724.0001

Reference materials for refractometry

These standards are for the calibration of refractometers. We offer a big range of different refractive index standards in order to perform calibration in the same range as the final measurement. They replace the former CRM's from the European community, which were described in the European Pharmacopoeia. These Certipur standards are traceable to SRM from NIST¹ and to PTB².

CertiPUR® Refractive index standards

Designation		refractive index (20°C)	Order No.
Refractive index standard Kit 1, (2,2,4-Trimethyl-pentane/water)	one box contains 5 ampoules each, filled with 8 ml	1.3915	1.08962.0001
Refractive index standard Kit 2, (Toluene/water)	one box contains 5 ampoules each, filled with 8 ml	1.4969	1.08961.0001
Refractive index standard Kit 3, (1-Methyl-naphthalene/water)	one box contains 5 ampoules each, filled with 8 ml	1.6160	1.08963.0001

¹NIST – National Institute of Standards and Technology, Gaithersburg, USA

²PTB – Physikalisch-Technische Bundesanstalt, (Federal Physical-Technical Institute); Braunschweig, Germany



Within the European Union and even worldwide, analytical results have to become more comparable and more transparent. Quality control, especially for the reference materials, is gaining in importance with respect to the accuracy and precision of analytical measurements. You avoid repeat analyses having to be performed and ultimately save costs. Merck now supplies a range of first-class reference materials for all analytical methods under the tradename Certipur. For each standard provided, the optimal analytical method has been selected; not only that, but the methods involved are constantly being refined. Merck invests substantially in equipping its own laboratories and optimises the quality and accuracy of its products with every new instrument generation.

All Certipur reference materials are traceable to national or international standards.

- BAM – Federal Institute for Materials Research and Testing, Berlin, Germany
- IRMM – Institute for Reference Materials and Measurements, European Commission, Geel, Belgium
- NIST – National Institute of Standards and Technology, Gaithersburg, USA
- PTB – Federal Physical-Technical Institute, Braunschweig, Germany

Merck has two calibration laboratories.

Merck has its own independent accredited calibration laboratory [DKD-K-14301] for pH and conductivity measurement. This provides additional proof of the reliability of the products on offer. In November 2004 a second laboratory was accredited as calibration laboratory according to ISO/IEC 17025. In lab DKD-K-14302 ICP single element standards are certified.

Definitions

Traceability

Property of the result of a measurement or of the value of a standard whereby it can be related to stated references, usually national or international standards, through an unbroken chain of comparisons all having stated uncertainties [ISO Guide 30].

Certified primary reference material

Reference material, accompanied by a certificate, one or more of whose property values are certified by a technically valid procedure, which establishes its traceability to an accurate realization of the unit in which property values are expressed and for which each certified values is accompanied by an uncertainty at a stated level of confidence [ISO Guide 30]. It is directly measured and certified by a certifying body.

Certified secondary reference material

Reference material, accompanied by a certificate, one or more of whose property values are certified by a technically valid procedure, which establishes its traceability to an accurate realization of the unit in which property values are expressed and for which each certified values is accompanied by an uncertainty at a stated level of confidence [ISO Guide 30]. It is directly measured against primary reference material, certified by a certifying body.

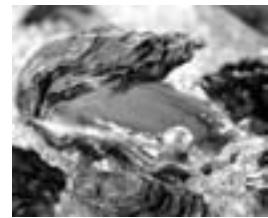
Secondary reference material

Reference material, accompanied by a certificate, one or more of whose property values are certified by a technically valid procedure, which establishes its traceability to an accurate realization of the unit in which property values are expressed and for which each certified values is accompanied by an uncertainty at a stated level of confidence [ISO Guide 30]. It is directly measured against primary reference material.

Reference material

A Material or substance one or more of whose property values are sufficiently homogeneous, stable and well established to be used for the calibration of an apparatus, the assessment of a measurement method or for assigning values to materials [ISO Guide 30]. It is traceable against primary or secondary reference material and accompanied by a certificate of the producer.

CertIPUR®
Not all
reference materials
are the same



Method:	Certified primary reference material:	Certified secondary reference material:	Secondary reference material:	Reference material:	Traceability:
Atomic absorption spectroscopy	–	ICP single element standards	ICP multi element standards	–	Element standards (standard reference material from NIST)
	Spike solutions (certified by BAM, IRMM)	–	–	–	–
	–	–	–	AAS standards (solutions and concentrates)	Volumetric and element standards (standard reference material from NIST)
pH measurement	–	Standard reference buffer solutions and substances	–	–	Buffers (primary reference material: PTB; NIST)
	–	–	–	Buffers (Solutions and concentrates)	Buffers (primary reference material: PTB; NIST)
Conductivity measurement	–	Conductivity standards	–	–	Conductivity standards (primary reference material: PTB; NIST)
Ion chromatography	–	–	Ion chromatography standards	Ion chromatography standards	Volumetric and Ion chromatography standards (standard reference material from NIST)
UV/VIS spectroscopy	–	–	UV/VIS standards	–	UV/VIS standards (standard reference material from NIST, physical methods)
Volumetry	–	–	Volumetric standards	–	Volumetric standards (standard reference material from NIST)
Additional methods	Barium sulphate white standard (certified by PTB)	–	Refractive Index standards DSC standards	TOC standard, Reference colour solutions acc. Ph. Eur., 2-Propanol standard	–

CertiPUR®

Not all reference materials are the same

Would you like more information on CertiPUR®?

If so, just ask us.

We will be glad to help with any calibration problem you may have.

Merck KGaA
64271 Darmstadt, Germany
Fax: +49-6151-726080
E-mail: reagents@merck.de
www.merck-chemicals.com

10/07

W 283120



We provide information and advice to our customers on application technologies and regulatory matters to the best of our knowledge and ability, but without obligation or liability. Existing laws and regulations are to be observed in all cases by our customers. This also applies in respect to any rights of third parties. Our information and advice do not relieve our customers of their own responsibility for checking the suitability of our products for the envisaged purpose.