

# Certipur<sup>®</sup>

## Standard reference materials and buffers


Not all reference materials are the same ...




# Certipur<sup>®</sup>—Standard reference materials and buffers

In order to obtain accurate analytical results, it is essential to calibrate all of the instruments used for analysis before commencing. However, such calibration work is only meaningful if reliable reference materials are employed. With Merck Millipore's Certipur<sup>®</sup> reference materials you can have always confidence in your analytical results.

All Certipur<sup>®</sup> reference materials and standards come with a comprehensive Certificate of Analysis (CoA), where all batch-specific parameters and important inspection-relevant data are documented: used analytical method, uncertainty data, traceability including batch number, date of release, minimum shelf life and the responsible laboratory head.

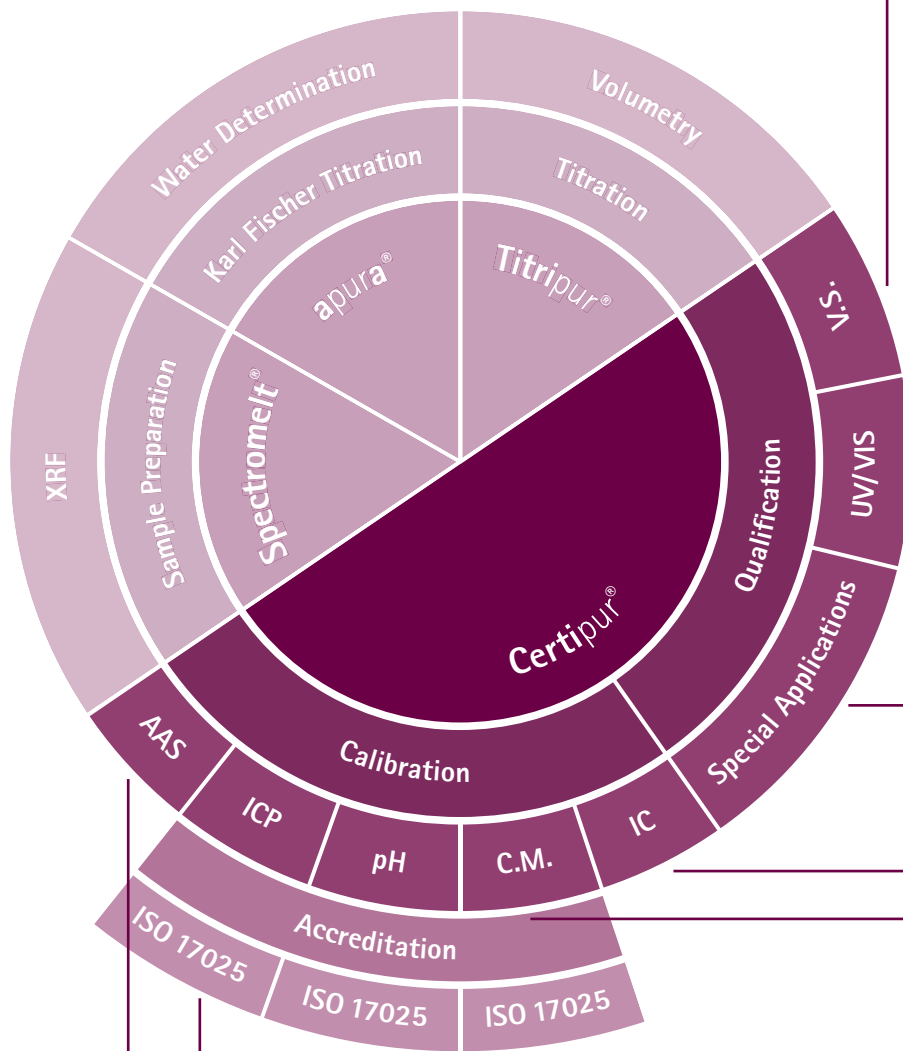
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-  Benefits
- Outstanding, application-oriented quality
  - Stringent quality management system
  - Always reliable and reproducible results
  - Accreditation according to ISO 17025
  - Traceability to standard reference material from NIST and PTB
  - Strict specifications

 [www.merckmillipore.com/certipur](http://www.merckmillipore.com/certipur)

# Certipur®—our quality standard in instrumental analysis

Merck Millipore supplies a range of first-class reference materials for a huge range of analytical methods under the trade name Certipur®, so as to fulfill your quality management requirements. For each standard provided, the optimal analytical method has been selected; not only that, but the methods involved are constantly being refined. Merck Millipore invests substantially in equipping its own laboratories and optimizes the quality and accuracy of its products with every new instrument generation.



## Specification / Traceability

- ISO** International Organization for Standardization
- NIST** National Institute of Standards and Technology, USA
- PTB** Physical Technical Institute, Germany
- Reag. Ph Eur** Reagents specified by the European Pharmacopoeia
- USP** United States Pharmacopoeia requirements for reagents

### Volumetric standards for titration [V.S.]

Volumetric standards | Traceable to standard reference material from NIST and specified according to Reag. Ph Eur and USP

### UV-VIS spectroscopy [UV-VIS]

UV-VIS standards | UV-VIS standards are specified according to Reag. Ph Eur

### Special applications

Refractive Index standards | Barium sulfate white standard | TOC standard | Reference colour solutions according to Ph Eur | 2-Propanol standard

### Ion chromatography [IC]

Ion chromatography standards | Traceable to standard reference material from NIST

### Conductivity measurement [C.M.]

Conductivity standards | Conductivity standards traceable to standard reference material from NIST and PTB | Measured in Merck Millipore's accredited laboratory for pH and conductivity measurement according to ISO 17025

### pH measurement [pH]

Buffer solutions and substances and buffer concentrates | Traceable to standard reference material from NIST and PTB | Measured in Merck Millipore's accredited laboratory for pH and conductivity measurement according to ISO 17025

### Inductively coupled plasma spectroscopy [ICP]

ICP single-element standards | ICP multi-element standards | Traceable to standard reference material from NIST and PTB | Measured in Merck Millipore's accredited laboratory for ICP according to ISO 17025

### Atomic absorption spectroscopy [AAS]

AAS standards: ready-to-use solutions and concentrates in ampoules | AAS standards dissolved in oil | Traceable to standard reference material from NIST

# Certipur® – accreditation and ISO certification

With the worldwide globalization, analytical results have to become more comparable and transparent. Quality management especially for reference material is gaining in importance with respect to the accuracy and precision of analytical measurements. Using high sophisticated reference materials leads to avoid repeat analysis and safe qualitatively costs.

## Accreditation

Accreditation and certification is a process in which certification of competency, authority, or credibility is presented. The basis of our accreditation is our adherence to DIN EN ISO / IEC 17025. In contrast to certification according to DIN EN ISO 9001:2008 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 Millipore 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 measurement are assessed and included in a so-called »uncertainty budget«. The accredited laboratory of Merck Millipore is also obliged to participate regularly in an external international laboratory testing program. The Merck Millipore laboratory is also a member of the German calibration service (DKD) and as such is available to our customers as an accredited independent laboratory for pH, conductivity and ICP.



## ISO 9001

With our DIN EN ISO 9001:2008 certification we ensure customer satisfaction and improve our efficiency. It helps to sponsor our business and organization as best in class. Our commitment for continuous improvements are exhibited and it provides confidence to the supply chain.

## ISO 17025

DIN EN ISO/IEC 17025:2005 is one of the most popular quality standards for all testing and calibration laboratories. It is for use by laboratories to design their Quality Management System, administrative and operative procedures and specifies the general requirements for the competence to carry out tests and / or calibration methods. All measurements and decisions should be based on accurate, repeatable, verifiable, reliable and correct measurements and procedures. Customers should ensure that all data and opinions upon which they rely could be traced back through an unbroken chain of data based on ISO 17025.

## Reference material

Material, sufficiently homogeneous and stable with respect to one or more specified properties, which has been established to be fit for its intended use in a measurement process [ISO Guide 30].

## Certified reference material

Reference material characterized by a metrologically valid procedure for one or more specified properties, accompanied by a certificate that provides the values of the specified property, its associated uncertainty, and a statement of metrological traceability [ISO Guide 30].

- **Primary reference material** It is directly measured and certified by a certifying body.
- **Secondary reference material** It is directly measured against primary reference material.

## Traceability

Traceability means to verify a reference material to a stated international reference material of an official authority body like NIST and PTB through an unbroken chain of comparisons.

# Certipur<sup>®</sup> reference materials for reliable calibration in atomic absorption spectroscopy

## ■ Certipur<sup>®</sup> products

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## ■ Benefits

- ICP standards according to ISO 17025
- Standards are traceable to primary standards
- ICP standards with an extensive Certificate of Analysis

Certipur<sup>®</sup> by Merck Millipore – with ISO 17025 accreditation to give you reliable measuring results.





## Quality management

ICP standards are analyzed using ICP / OES and ICP / MS methods. The true value is certified by an accredited calibration laboratory according to ISO / IEC 17025.

For this 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 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 standard obtained from an international institution such as NIST.

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

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.

| Certificate of Analysis  |           | Certipur® Reference Material |          |   |          |
|--|-----------|------------------------------|----------|---|----------|
| <b>Bismuth ICP Standard 1000 mg/l Bi CertiPUR®</b>   |           | <b>Lot No.: HC112304</b>     |          |   |          |
| <b>1.70306.0100</b>  |           |                              |          |   |          |
| This Certificate of Analysis is based on the data from the Merck Calibration Laboratory for ICP-OES, according to DIN EN ISO / IEC 17025. Accredited by the DKD (Deutscher Kalibrierdienst).   |           |                              |          |   |          |
| DAR Reg.-No.:  |           | DKD-K-14302                  |          |   |          |
| Ref. Calibration Certificate:  |           | 504/DKD-K-14302/11-03        |          |   |          |
| <b>Composition:</b> Bismuth nitrate in nitric acid Suprapur® 2-3%  |           |                              |          |   |          |
| <b>Assay:</b> 988 mg/kg  |           | <b>Analysis:</b> ICP-OES     |          |   |          |
| 1001 mg/l (calculated)   |           |                              |          |   |          |
| <b>Measurement:</b> ± 3 mg/kg (± 0.3%)   |           |                              |          |   |          |
| <b>Uncertainty:</b> This value represents the expanded uncertainty (U) for a coverage probability of 95%. Refer to page 2 for further details.   |           |                              |          |   |          |
| <b>Traceability:</b> This ICP Standard has been measured applying high precision ICP-OES in comparison to the corresponding NIST SRM® 3106, lot 991212   |           |                              |          |   |          |
| <b>Trace impurities µg/ml:</b>   |           |                              |          |   |          |
| Ag <0.10   | Cr <0.02  | In <0.02                     | Ni <0.02 | Sb <0.02  | Tl <0.02 |
| Al <0.05   | Cu <0.02  | Ir <0.02                     | Ce <0.20 | Sc <0.02  | Tm <0.02 |
| As <0.20   | Dy <0.02  | K <0.20                      | P <0.20  | Se <0.20  | U <0.02  |
| Au <0.02   | Er <0.02  | La <0.02                     | Pb <0.05 | Si <0.20  | V <0.02  |
| B <0.05  | Eu <0.02  | Li <0.02                     | Pd <0.02 | Sm <0.02  | W <0.05  |
| Ba <0.02   | Fe <0.05  | Lu <0.02                     | Pv <0.02 | Sr <0.02  | Y <0.02  |
| Be <0.02   | Ga <0.02  | Mg <0.02                     | Pt <0.02 | Th <0.02  | Zr <0.02 |
| Bi   | +         | Ge <0.02                     | Mn <0.02 | Rh <0.02  | Ta <0.05 |
| Cd <0.05   | Gle <0.02 | Mo <0.02                     | Rn <0.02 | Tb <0.02  |          |
| Cf <0.02   | Hf <0.02  | Nb <0.10                     | Ru <0.02 | Tc <0.20  |          |
| Ce <0.02   | Hg <0.05  | Nb <0.05                     | Ru <0.02 | Th <0.02  |          |
| Co <0.02   | Ho <0.02  | Nd <0.02                     | S <0.20  | Ti <0.05  |          |
| Date of release: 2011-03-11  |           |                              |          | agreement of the EA (European metrology Accreditation Cooperation)  |          |
| Minimum shelf life: 2014-03-31   |           |                              |          | to GUM and EA-402 as U = k · u; U is obtained from the standard distribution of the primary reference item.       |          |
| <br>Dipl.-Ing. Ayfer Yıldırım<br>(responsible laboratory manager quality control)   |           |                              |          | metrically from high purity bismuth with filtered (0.2µm) high purity B standards. The density of the             |          |
|  |           |                              |          | le units performs the assessment conducted in accordance to the   |          |
| Application and correct use:<br>This solution is intended for use as a calibration standard for inductively coupled plasma spectroscopy (e.g. ICP, DCP). Keep tightly sealed when not in use. Store at +15°C to +25°C. Never pipet directly from original container.<br>All trace level elements were determined by ICP-MS / OES or graphite furnace AAS. These analysis values are subject to unavoidable systematic variations in this concentration range. They therefore do not form part of our guarantee and are subsequently no subject of release. |           |                              |          | ditions for analytical method and in of the suitable shelf life of this in losses of solvent through the 1r year. |          |
| Quality Management System:<br>The CertiPUR® Reference Material has been prepared and certified under an ISO 9001 quality management system in accordance to the following guides:  |           |                              |          |   |          |
| Guide to the Expression of Uncertainty in Measurement  |           | GUM: 1995                    |          |   |          |
| Expression of the Uncertainty of Measurement in Calibration  |           | EA-402: 1999                 |          |   |          |
| Quantifying Uncertainty in Analytical Measurement  |           | EURACHEM / CITAC: 2000       |          |   |          |
| Reference Materials - Contents of certificates and labels  |           | ISO Guide 31: 2000           |          |   |          |
| General requirements for the competence of reference materials producers   |           | ISO Guide 34: 2000           |          |   |          |
| General requirements for the competence of testing and calibration laboratories  |           | DIN EN ISO / IEC 17025: 2005 |          |   |          |
| Guideline for the requirements for the competence of reference materials producers   |           | ILAC G12: 2000               |          |   |          |

## ICP single-element standards

The quality control of our ICP single-element standards is carried out by the accredited calibration laboratory according to ISO 17025. They are directly traceable to primary 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 A-M

| Designation         | Element | Composition  | ICP 1000 mg/l<br>Order No. [100 ml] | ICP 10000 mg/l<br>Order No. [100 ml] |
|---------------------|---------|--|-------------------------------------|--------------------------------------|
| <b>A</b> Aluminium  | Al      | Al(NO <sub>3</sub> ) <sub>3</sub> in HNO <sub>3</sub> 2-3%   | 1.70301.0100                        | 1.70371.0100                         |
| Antimony            | Sb      | Sb <sub>2</sub> O <sub>3</sub> in HCl 7%   | 1.70302.0100                        | -                                    |
| Arsenic             | As      | H <sub>3</sub> AsO <sub>4</sub> in HNO <sub>3</sub> 2-3%   | 1.70303.0100                        | -                                    |
| <b>B</b> Barium     | Ba      | Ba(NO <sub>3</sub> ) <sub>2</sub> in HNO <sub>3</sub> 2-3%   | 1.70304.0100                        | -                                    |
| Beryllium           | Be      | Be <sub>4</sub> O(C <sub>2</sub> H <sub>3</sub> O <sub>2</sub> ) <sub>6</sub> in HNO <sub>3</sub> 2-3% | 1.70305.0100                        | -                                    |
| Bismuth             | Bi      | Bi(NO <sub>3</sub> ) <sub>3</sub> in HNO <sub>3</sub> 2-3%   | 1.70306.0100                        | -                                    |
| Boron               | B       | H <sub>3</sub> BO <sub>3</sub> in water  | 1.70307.0100                        | -                                    |
| <b>C</b> Cadmium    | Cd      | Cd(NO <sub>3</sub> ) <sub>2</sub> in HNO <sub>3</sub> 2-3%   | 1.70309.0100                        | -                                    |
| Calcium             | Ca      | Ca(NO <sub>3</sub> ) <sub>2</sub> in HNO <sub>3</sub> 2-3%   | 1.70308.0100                        | 1.70373.0100                         |
| Cerium              | Ce      | Ce(NO <sub>3</sub> ) <sub>3</sub> in HNO <sub>3</sub> 2-3%   | 1.70311.0100                        | -                                    |
| Cesium              | Cs      | CsNO <sub>3</sub> in HNO <sub>3</sub> 2-3%   | 1.70310.0100                        | -                                    |
| Chromium            | Cr      | Cr(NO <sub>3</sub> ) <sub>3</sub> in HNO <sub>3</sub> 2-3%   | 1.70312.0100                        | 1.70374.0100                         |
| Cobalt              | Co      | Co(NO <sub>3</sub> ) <sub>2</sub> in HNO <sub>3</sub> 2-3%   | 1.70313.0100                        | 1.70375.0100                         |
| Copper              | Cu      | Cu(NO <sub>3</sub> ) <sub>2</sub> in HNO <sub>3</sub> 2-3%   | 1.70314.0100                        | 1.70378.0100                         |
| <b>D</b> Dysprosium | Dy      | Dy <sub>2</sub> O <sub>3</sub> in HNO <sub>3</sub> 2-3%  | 1.70315.0100                        | -                                    |
| <b>E</b> Erbium     | Er      | Er <sub>2</sub> O <sub>3</sub> in HNO <sub>3</sub> 2-3%  | 1.70316.0100                        | -                                    |
| Europium            | Eu      | Eu <sub>2</sub> O <sub>3</sub> in HNO <sub>3</sub> 2-3%  | 1.70317.0100                        | -                                    |
| <b>G</b> Gadolinium | Gd      | Gd <sub>2</sub> O <sub>3</sub> in HNO <sub>3</sub> 2-3%  | 1.70318.0100                        | -                                    |
| Gallium             | Ga      | Ga(NO <sub>3</sub> ) <sub>3</sub> in HNO <sub>3</sub> 2-3%   | 1.70319.0100                        | -                                    |
| Germanium           | Ge      | (NH <sub>4</sub> ) <sub>2</sub> GeF <sub>6</sub> in water  | 1.70320.0100                        | -                                    |
| Gold                | Au      | H(AuCl <sub>4</sub> ) in HCl 7%  | 1.70321.0100                        | -                                    |
| <b>H</b> Hafnium    | Hf      | HfOCl <sub>2</sub> in HCl 7%   | 1.70322.0100                        | -                                    |
| Holmium             | Ho      | Ho <sub>2</sub> O <sub>3</sub> in HNO <sub>3</sub> 2-3%  | 1.70323.0100                        | -                                    |
| <b>I</b> Indium     | In      | In(NO <sub>3</sub> ) <sub>3</sub> in HNO <sub>3</sub> 2-3%   | 1.70324.0100                        | -                                    |
| Iridium             | Ir      | IrCl <sub>3</sub> in HCl 7%  | 1.70325.0100                        | -                                    |
| Iron                | Fe      | Fe(NO <sub>3</sub> ) <sub>3</sub> in HNO <sub>3</sub>  | 1.70326.0100                        | 1.70376.0100                         |
| <b>L</b> Lanthanum  | La      | La(NO <sub>3</sub> ) <sub>3</sub> in HNO <sub>3</sub> 2-3%   | 1.70327.0100                        | -                                    |
| Lead                | Pb      | Pb(NO <sub>3</sub> ) <sub>2</sub> in HNO <sub>3</sub> 2-3%   | 1.70328.0100                        | 1.70372.0100                         |
| Lithium             | Li      | LiNO <sub>3</sub> in HNO <sub>3</sub> 2-3%   | 1.70329.0100                        | -                                    |
| Lutetium            | Lu      | Lu <sub>2</sub> O <sub>3</sub> in HNO <sub>3</sub> 2-3%  | 1.70330.0100                        | -                                    |
| <b>M</b> Magnesium  | Mg      | Mg(NO <sub>3</sub> ) <sub>2</sub> in HNO <sub>3</sub> 2-3%   | 1.70331.0100                        | 1.70379.0100                         |
| Manganese           | Mn      | Mn(NO <sub>3</sub> ) <sub>2</sub> in HNO <sub>3</sub> 2-3%   | 1.70332.0100                        | 1.70380.0100                         |
| Mercury             | Hg      | Hg(NO <sub>3</sub> ) <sub>2</sub> in HNO <sub>3</sub> 10%  | 1.70333.0100                        | 1.70384.0100                         |
| Molybdenum          | Mo      | (NH <sub>4</sub> ) <sub>6</sub> Mo <sub>7</sub> O <sub>24</sub> in water                               | 1.70334.0100                        | -                                    |

## Certipur® ICP standards N-Z

|          | Designation  | Element   | Composition  | ICP 1000 mg/l<br>Order No. [100 ml]                       | ICP 10000 mg/l<br>Order No. [100 ml] |              |
|----------|--------------|-----------|--|---|--------------------------------------|--------------|
| N        | Neodymium    | Nd        | Nd <sub>2</sub> O <sub>3</sub> in HNO <sub>3</sub> 2-3%              | 1.70335.0100  | -                                    |              |
|          | Nickel       | Ni        | Ni(NO <sub>3</sub> ) <sub>2</sub> in HNO <sub>3</sub> 2-3%           | 1.70336.0100  | 1.70382.0100                         |              |
|          | Niobium      | Nb        | NH <sub>4</sub> NbF <sub>6</sub> in water                            | 1.70337.0100  | -                                    |              |
| O        | Osmium       | Os        | (NH <sub>4</sub> ) <sub>2</sub> OsCl <sub>6</sub> in HCl 7%          | 1.70338.0100  | -                                    |              |
| P        | Palladium    | Pd        | Pd(NO <sub>3</sub> ) <sub>2</sub> in HNO <sub>3</sub> 2-3%           | 1.70339.0100  | -                                    |              |
|          | Phosphorous  | P         | H <sub>3</sub> PO <sub>4</sub> in water                              | 1.70340.0100  | 1.70383.0100                         |              |
|          | Platinum     | Pt        | H <sub>2</sub> PtCl <sub>6</sub> in HCl 7%                           | 1.70341.0100  | -                                    |              |
|          | Potassium    | K         | KNO <sub>3</sub> in HNO <sub>3</sub> 2-3%                            | 1.70342.0100  | 1.70377.0100                         |              |
|          | Praseodymium | Pr        | Pr <sub>2</sub> O <sub>3</sub> in HNO <sub>3</sub> 2-3%              | 1.70343.0100  | -                                    |              |
|          | Rhenium      | Re        | NH <sub>4</sub> ReO <sub>4</sub> in water                            | 1.70344.0100  | -                                    |              |
| R        | Rhodium      | Rh        | Rh(NO <sub>3</sub> ) <sub>3</sub> in HNO <sub>3</sub> 2-3%           | 1.70345.0100  | -                                    |              |
|          | Rubidium     | Rb        | RbNO <sub>3</sub> in HNO <sub>3</sub> 2-3%                           | 1.70346.0100  | -                                    |              |
|          | Ruthenium    | Ru        | RuCl <sub>3</sub> in HCl 7%  | 1.70347.0100  | -                                    |              |
| S        | Samarium     | Sm        | Sm <sub>2</sub> O <sub>3</sub> in HNO <sub>3</sub> 2-3%              | 1.70348.0100  | -                                    |              |
|          | Scandium     | Sc        | Sc <sub>2</sub> O <sub>3</sub> in HNO <sub>3</sub> 7%                | 1.70349.0100  | -                                    |              |
|          | Selenium     | Se        | SeO <sub>2</sub> in HNO <sub>3</sub> 2-3%                            | 1.70350.0100  | -                                    |              |
|          | Silicon      | Si        | SiO <sub>2</sub> in NaOH 2%  | 1.70365.0100  | 1.70386.0100                         |              |
|          | Silver       | Ag        | AgNO <sub>3</sub> in HNO <sub>3</sub> 2-3%                           | 1.70352.0100  | -                                    |              |
|          | Sodium       | Na        | NaNO <sub>3</sub> in HNO <sub>3</sub> 2-3%                           | 1.70353.0100  | 1.70381.0100                         |              |
|          | Sulfur       | S         | H <sub>2</sub> SO <sub>4</sub> in water                              | 1.70355.0100  | 1.70385.0100                         |              |
|          | Strontium    | Sr        | Sr(NO <sub>3</sub> ) <sub>2</sub> in HNO <sub>3</sub> 2-3%           | 1.70354.0100  | -                                    |              |
|          | T            | Tantalum  | Ta   | (NH <sub>4</sub> ) <sub>2</sub> TaF <sub>7</sub> in water | 1.70356.0100                         | -            |
|          |              | Tellurium | Te   | H <sub>6</sub> TeO <sub>6</sub> in HNO <sub>3</sub> 2-3%  | 1.70357.0100                         | -            |
| Terbium  |              | Tb        | Tb(NO <sub>3</sub> ) <sub>3</sub> in HNO <sub>3</sub> 2-3%           | 1.70358.0100  | -                                    |              |
| Thallium |              | Tl        | TlNO <sub>3</sub> in HNO <sub>3</sub> 2-3%                           | 1.70359.0100  | -                                    |              |
| Thulium  |              | Tm        | Tm(NO <sub>3</sub> ) <sub>3</sub> in HNO <sub>3</sub> 2-3%           | 1.70361.0100  | -                                    |              |
| Tin      |              | Sn        | SnCl <sub>4</sub> in HCl 7%  | 1.70362.0100  | -                                    |              |
| Titanium |              | Ti        | (NH <sub>4</sub> ) <sub>2</sub> TiF <sub>6</sub> in water (trace HF) | 1.70363.0100  | -                                    |              |
| Tungsten |              | W         | (NH <sub>4</sub> ) <sub>2</sub> WO <sub>4</sub> in water             | 1.70364.0100  | -                                    |              |
| V        |              | Vanadium  | V  | NH <sub>4</sub> VO <sub>3</sub> in HNO <sub>3</sub>       | 1.70366.0100                         | 1.70388.0100 |
| Y        |              | Ytterbium | Yb   | Yb <sub>2</sub> O <sub>3</sub> in HNO <sub>3</sub> 2-3%   | 1.70367.0100                         | -            |
|          | Yttrium      | Y         | Y(NO <sub>3</sub> ) <sub>3</sub> in HNO <sub>3</sub> 2-3%            | 1.70368.0100  | -                                    |              |
| Z        | Zinc         | Zn        | Zn(NO <sub>3</sub> ) <sub>2</sub> in HNO <sub>3</sub> 2-3%           | 1.70369.0100  | 1.70389.0100                         |              |
|          | Zirconium    | Zr        | ZrOCl <sub>2</sub> in HCl 7%   | 1.70370.0100  | 1.70390.0100                         |              |

## Certipur® standards 10 mg/l

|   | Designation                        | Element | Composition  | ICP 10 mg/l<br>Order No. [100 ml] |
|---|------------------------------------|---------|--|-----------------------------------|
| M | Mercury*                           | Hg      | Hg(NO <sub>3</sub> ) <sub>2</sub> in HNO <sub>3</sub> 2-3%               | 1.08623.0100                      |
| R | Rhodium, internal standard for ICP | Rh      | Rh(NO <sub>3</sub> ) <sub>3</sub> in HNO <sub>3</sub> 2-3%               | 1.08525.0100                      |
| T | Thorium                            | Th      | Th(NO <sub>3</sub> ) <sub>4</sub> in HNO <sub>3</sub> 2-3%               | 1.70391.0100                      |
| U | Uranium                            | U       | UO <sub>2</sub> (NO <sub>3</sub> ) <sub>2</sub> in HNO <sub>3</sub> 2-3% | 1.70360.0100                      |

\*suppl. to multi-element standard XXI (1.09498)

## ICP multi-element standards

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

| Certipur®<br>Multi-element standards |            | ICP calibration standards | Multi-element standard I<br>19 elements, different concentrations<br>Order No. 1.15474.0100 | Multi-element standard IV<br>23 elements, 1000 mg/l<br>Order No. 1.11355.0100 | Multi-element standard VIII<br>24 elements, 100 mg/l<br>Order No. 1.09492.0100 | Multi-element standard IX<br>toxic elements, Chromium VI<br>Order No. 1.09494.0100 | Multi-element standard X<br>for surface water, equivalent to<br>NIST SRM 1643d   Order No.<br>1.09493.0100 | Multi-element standard XI<br>for sewage sludge<br>Order No. 1.09491.0100 |
|--------------------------------------|------------|---------------------------|---|---|--|--|--|--|
| Designation                          | Element    |                           |   |   |  |  |  |  |
| A                                    | Aluminium  | Al                        | 100 mg/l  | 1000 mg/l   | 100 mg/l   | -  | -  | -  |
|                                      | Arsenic    | As                        | -   | -   | -  | 100 mg/l   | 50 µg/l  | -  |
| B                                    | Barium     | Ba                        | 5 mg/l  | 1000 mg/l   | 100 mg/l   | -  | 50 µg/l  | -  |
|                                      | Beryllium  | Be                        | 1 mg/l  | -   | 100 mg/l   | 100 mg/l   | 20 µg/l  | -  |
|                                      | Bismuth    | Bi                        | 200 mg/l  | 1000 mg/l   | 100 mg/l   | -  | 10 µg/l  | -  |
|                                      | Boron      | B                         | 15 mg/l   | 1000 mg/l   | 100 mg/l   | -  | 100 µg/l   | -  |
| C                                    | Cadmium    | Cd                        | 20 mg/l   | 1000 mg/l   | 100 mg/l   | 100 mg/l   | 20 µg/l  | 10 mg/l  |
|                                      | Calcium    | Ca                        | -   | 1000 mg/l   | 100 mg/l   | -  | 35000 µg/l   | -  |
|                                      | Chromium   | Cr                        | 25 mg/l   | 1000 mg/l   | 100 mg/l   | 100 mg/l   | 20 µg/l  | 900 mg/l   |
|                                      | Cobalt     | Co                        | 20 mg/l   | 1000 mg/l   | 100 mg/l   | -  | 25 µg/l  | -  |
|                                      | Copper     | Cu                        | 20 mg/l   | 1000 mg/l   | 100 mg/l   | -  | 20 µg/l  | 800 mg/l   |
|                                      | Gallium    | Ga                        | 150 mg/l  | 1000 mg/l   | 100 mg/l   | -  | -  | -  |
| I                                    | Indium     | In                        | 200 mg/l  | 1000 mg/l   | -  | -  | -  | -  |
|                                      | Iron       | Fe                        | 15 mg/l   | 1000 mg/l   | 100 mg/l   | -  | 100 µg/l   | -  |
| L                                    | Lead       | Pb                        | 200 mg/l  | 1000 mg/l   | 100 mg/l   | 100 mg/l   | 25 µg/l  | 900 mg/l   |
|                                      | Lithium    | Li                        | -   | 1000 mg/l   | 100 mg/l   | -  | -  | -  |
| M                                    | Magnesium  | Mg                        | -   | 1000 mg/l   | 100 mg/l   | -  | 15000 µg/l   | -  |
|                                      | Manganese  | Mn                        | 5 mg/l  | 1000 mg/l   | 100 mg/l   | -  | 30 µg/l  | -  |
|                                      | Mercury    | Hg                        | -   | -   | -  | 100 mg/l   | -  | 8 mg/l   |
|                                      | Molybdenum | Mo                        | -   | -   | -  | -  | 100 µg/l   | -  |
| N                                    | Nickel     | Ni                        | 50 mg/l   | 1000 mg/l   | 100 mg/l   | 100 mg/l   | 50 µg/l  | 200 mg/l   |
| P                                    | Potassium  | K                         | -   | 1000 mg/l   | 100 mg/l   | -  | 3000 µg/l  | -  |
| S                                    | Selenium   | Se                        | -   | -   | 100 mg/l   | 100 mg/l   | 10 µg/l  | -  |
|                                      | Silver     | Ag                        | 50 mg/l   | 1000 mg/l   | -  | -  | -  | -  |
|                                      | Sodium     | Na                        | -   | 1000 mg/l   | 100 mg/l   | -  | 8000 µg/l  | -  |
|                                      | Strontium  | Sr                        | 1 mg/l  | 1000 mg/l   | 100 mg/l   | -  | 100 µg/l   | -  |
| T                                    | Tellurium  | Te                        | -   | -   | 100 mg/l   | -  | -  | -  |
|                                      | Thallium   | Tl                        | 400 mg/l  | 1000 mg/l   | 100 mg/l   | 100 mg/l   | 10 µg/l  | -  |
| V                                    | Vanadium   | V                         | -   | -   | -  | -  | 50 µg/l  | -  |
| Z                                    | Zinc       | Zn                        | 20 mg/l   | 1000 mg/l   | 100 mg/l   | -  | 50 µg/l  | 2500 mg/l  |
|                                      | Matrix     |                           | 1 mol/l HNO <sub>3</sub>  | 1 mol/l HNO <sub>3</sub>  | 1 mol/l HNO <sub>3</sub>   | 1 mol/l HNO <sub>3</sub>   | 1 mol/l HNO <sub>3</sub>   | 1 mol/l HNO <sub>3</sub>   |

**Certipur®**  
**Multi-element standards**

| Designation | Element    | ICP calibration standards  |   | ICP/MS calibration standards  |   | Tuning solution   |   |                     |
|-------------|------------|--|---|---|---|---|---|---------------------|
|             |            | Multi-element standard XIII<br>15 elements<br>Order No. 1.09480.0100 | Multi-element standard XVI<br>21 elements<br>Order No. 1.09487.0100 | Multi-element standard XVII<br>HCl soluble elements<br>Order No. 1.09495.0100 | Multi-element standard VI<br>calibration in ICP/MS, 30 elements<br>Order No. 1.10580.0100 | Multi-element standard XXI<br>set, contains 274473 and 108623<br>Order No. 1.09498.0001 | Multi-element standard XXIV<br>tuning solution 700 ES<br>Order No. 1.09411.0500 |                     |
| <b>A</b>    | Aluminium  | Al   | 500 mg/l  | -   | -   | 10 mg/l   | 10 mg/l   | 50 mg/l             |
|             | Antimony   | Sb   | -   | 100 mg/l  | 100 mg/l  | -   | -   | -                   |
|             | Arsenic    | As   | 100 mg/l  | 100 mg/l  | -   | 100 mg/l  | 10 mg/l   | 50 mg/l             |
| <b>B</b>    | Barium     | Ba   | -   | -   | -   | 10 mg/l   | 10 mg/l   | 50 mg/l             |
|             | Beryllium  | Be   | 100 mg/l  | 100 mg/l  | -   | 100 mg/l  | 10 mg/l   | -                   |
|             | Bismuth    | Bi   | -   | -   | -   | 10 mg/l   | 10 mg/l   | -                   |
|             | Boron      | B  | -   | -   | -   | 100 mg/l  | -   | -                   |
| <b>C</b>    | Cadmium    | Cd   | 25 mg/l   | 100 mg/l  | -   | 10 mg/l   | 10 mg/l   | 50 mg/l             |
|             | Calcium    | Ca   | -   | 100 mg/l  | -   | 1000 mg/l   | 10 mg/l   | -                   |
|             | Cesium     | Cs   | -   | -   | -   | -   | 10 mg/l   | -                   |
|             | Chromium   | Cr   | 100 mg/l  | 100 mg/l  | -   | 10 mg/l   | 10 mg/l   | 50 mg/l             |
|             | Cobalt     | Co   | 100 mg/l  | 100 mg/l  | -   | 10 mg/l   | 10 mg/l   | 50 mg/l             |
|             | Copper     | Cu   | 100 mg/l  | 100 mg/l  | -   | 10 mg/l   | 10 mg/l   | 50 mg/l             |
|             | Gallium    | Ga   | -   | -   | -   | 10 mg/l   | 10 mg/l   | -                   |
| <b>H</b>    | Hafnium    | Hf   | -   | -   | 100 mg/l  | -   | -   | -                   |
| <b>I</b>    | Indium     | In   | -   | -   | -   | -   | 10 mg/l   | -                   |
|             | Iridium    | Ir   | -   | -   | 100 mg/l  | -   | -   | -                   |
|             | Iron       | Fe   | 100 mg/l  | 100 mg/l  | -   | 100 mg/l  | 10 mg/l   | -                   |
| <b>L</b>    | Lead       | Pb   | 100 mg/l  | 100 mg/l  | -   | 10 mg/l   | 10 mg/l   | 50 mg/l             |
|             | Lithium    | Li   | -   | 100 mg/l  | -   | 10 mg/l   | 10 mg/l   | -                   |
| <b>M</b>    | Magnesium  | Mg   | -   | 100 mg/l  | -   | 10 mg/l   | 10 mg/l   | -                   |
|             | Manganese  | Mn   | 100 mg/l  | 100 mg/l  | -   | 10 mg/l   | 10 mg/l   | 50 mg/l             |
|             | Mercury    | Hg   | 5 mg/l  | -   | -   | -   | * 10 mg/l   | -                   |
|             | Molybdenum | Mo   | -   | 100 mg/l  | -   | 10 mg/l   | -   | 50 mg/l             |
| <b>N</b>    | Nickel     | Ni   | 100 mg/l  | 100 mg/l  | -   | 10 mg/l   | 10 mg/l   | 50 mg/l             |
| <b>P</b>    | Potassium  | K  | -   | -   | -   | 10 mg/l   | 10 mg/l   | 500 mg/l            |
| <b>R</b>    | Rubidium   | Rb   | -   | -   | -   | 10 mg/l   | 10 mg/l   | -                   |
| <b>S</b>    | Selenium   | Se   | 25 mg/l   | 100 mg/l  | -   | 100 mg/l  | 10 mg/l   | 50 mg/l             |
|             | Silver     | Ag   | -   | -   | -   | 10 mg/l   | 10 mg/l   | -                   |
|             | Sodium     | Na   | -   | -   | -   | 10 mg/l   | 10 mg/l   | -                   |
|             | Strontium  | Sr   | -   | 100 mg/l  | -   | 10 mg/l   | 10 mg/l   | 50 mg/l             |
|             | Tantalum   | Ta   | -   | -   | 100 mg/l  | -   | -   | -                   |
| <b>T</b>    | Tellurium  | Te   | -   | -   | -   | 10 mg/l   | -   | -                   |
|             | Thallium   | Tl   | -   | 100 mg/l  | -   | 10 mg/l   | 10 mg/l   | -                   |
|             | Tin        | Sn   | -   | -   | 100 mg/l  | -   | -   | -                   |
|             | Titanium   | Ti   | -   | 100 mg/l  | 100 mg/l  | -   | -   | -                   |
|             | <b>U</b>   | Uranium  | U   | -   | -   | -   | 10 mg/l   | 10 mg/l             |
| <b>V</b>    | Vanadium   | V  | 250 mg/l  | 100 mg/l  | -   | 10 mg/l   | 10 mg/l   | -                   |
| <b>Z</b>    | Zinc       | Zn   | 100 mg/l  | 100 mg/l  | -   | 100 mg/l  | 10 mg/l   | 50 mg/l             |
|             | Zirconium  | Zr   | -   | -   | 100 mg/l  | -   | -   | -                   |
|             | Matrix     |  | 5% HNO <sub>3</sub>   | 5% HNO <sub>3</sub>   | 15% HCl   | 1 mol/l HNO <sub>3</sub>  | 5% HNO <sub>3</sub>   | 1% HNO <sub>3</sub> |

\* = Hg in separate bottle (1.08623.0100)

**Certipur®**  
Multi-element standards

| Designation | Element     | ICP/MS mass calibration | ICP/MS plasma setup solution | Graphit furnace AAS stand. | Wavelength calibration stand. | Multi-element standard XIV HCl soluble elements | Multi-element standard XXIII for mass calibration | Multi-element standard XX to setup the plasma |
|-------------|-------------|-------------------------|------------------------------|----------------------------|-------------------------------|---|---|---|
|             |             |                         |                              |                            |                               | Order No. 1.10714.0500                          | Order No. 1.09410.0500                            | Order No. 1.09497.1000                        |
| A           | Aluminium   | Al                      | -                            | -                          | 100 mg/l                      | 20 mg/l   | -   | -   |
|             | Antimony    | Sb                      | -                            | -                          | 100 mg/l                      | -   | -   | -   |
|             | Arsenic     | As                      | -                            | -                          | 100 mg/l                      | 20 mg/l   | 20 mg/l   | -   |
| B           | Barium      | Ba                      | 1 µg/l                       | 10 µg/l                    | 50 mg/l                       | 2 mg/l  | -   | -   |
|             | Beryllium   | Be                      | -                            | -                          | 5 mg/l                        | 1 mg/l  | -   | -   |
|             | Boron       | B                       | 1 µg/l                       | -                          | -                             | 2 mg/l  | -   | -   |
| C           | Cadmium     | Cd                      | -                            | 10 µg/l                    | 5 mg/l                        | 2 mg/l  | -   | -   |
|             | Calcium     | Ca                      | -                            | -                          | -                             | 10 mg/l   | -   | -   |
|             | Cerium      | Ce                      | -                            | 10 µg/l                    | -                             | -   | -   | -   |
|             | Chromium    | Cr                      | -                            | -                          | 20 mg/l                       | 2 mg/l  | -   | -   |
|             | Cobalt      | Co                      | 1 µg/l                       | -                          | 50 mg/l                       | -   | -   | -   |
|             | Copper      | Cu                      | -                            | 10 µg/l                    | 50 mg/l                       | 2 mg/l  | -   | -   |
| G           | Gallium     | Ga                      | 1 µg/l                       | -                          | -                             | -   | -   | -   |
|             | Germanium   | Ge                      | -                            | 10 µg/l                    | -                             | -   | -   | -   |
| I           | Indium      | In                      | 1 µg/l                       | -                          | -                             | -   | -   | -   |
|             | Iron        | Fe                      | 1 µg/l                       | -                          | 20 mg/l                       | 2 mg/l  | -   | -   |
| L           | Lanthanum   | La                      | -                            | -                          | -                             | -   | 20 mg/l   | -   |
|             | Lead        | Pb                      | -                            | 10 µg/l                    | 100 mg/l                      | 20 mg/l   | -   | -   |
|             | Lithium     | Li                      | 1 µg/l                       | -                          | -                             | 2 mg/l  | 20 mg/l   | -   |
|             | Lutetium    | Lu                      | 1 µg/l                       | -                          | -                             | -   | -   | -   |
| M           | Magnesium   | Mg                      | -                            | 10 µg/l                    | -                             | 1 mg/l  | -   | -   |
|             | Manganese   | Mn                      | -                            | -                          | 20 mg/l                       | 1 mg/l  | 20 mg/l   | -   |
|             | Mercury     | Hg                      | -                            | -                          | -                             | 5 mg/l  | -   | -   |
|             | Molybdenum  | Mo                      | -                            | -                          | -                             | -   | 20 mg/l   | -   |
| N           | Nickel      | Ni                      | -                            | -                          | 50 mg/l                       | 5 mg/l  | 20 mg/l   | -   |
| P           | Phosphorous | P                       | -                            | -                          | -                             | 10 mg/l   | 100 mg/l  | -   |
|             | Potassium   | K                       | 1 µg/l                       | -                          | -                             | 100 mg/l  | 100 mg/l  | -   |
| R           | Rhodium     | Rh                      | 1 µg/l                       | 10 µg/l                    | -                             | -   | -   | -   |
| S           | Scandium    | Sc                      | 1 µg/l                       | 10 µg/l                    | -                             | 1 mg/l  | 20 mg/l   | -   |
|             | Selenium    | Se                      | -                            | -                          | 100 mg/l                      | 20 mg/l   | -   | -   |
|             | Silver      | Ag                      | -                            | -                          | 10 mg/l                       | -   | -   | -   |
|             | Sodium      | Na                      | 1 µg/l                       | -                          | -                             | 20 mg/l   | 20 mg/l   | -   |
|             | Strontium   | Sr                      | -                            | -                          | -                             | 1 mg/l  | -   | -   |
|             | Sulfur      | S                       | -                            | -                          | -                             | -   | 100 mg/l  | -   |
| T           | Tellurium   | Te                      | -                            | -                          | -                             | 20 mg/l   | -   | -   |
|             | Terbium     | Tb                      | -                            | 10 µg/l                    | -                             | -   | -   | -   |
|             | Thallium    | Tl                      | 1 µg/l                       | 10 µg/l                    | 100 mg/l                      | -   | -   | -   |
|             | Titanium    | Ti                      | -                            | -                          | -                             | 2 mg/l  | -   | -   |
| U           | Uranium     | U                       | 1 µg/l                       | -                          | -                             | -   | -   | -   |
| Y           | Yttrium     | Y                       | 1 µg/l                       | -                          | -                             | 1 mg/l  | -   | -   |
| Z           | Zinc        | Zn                      | -                            | -                          | -                             | 2 mg/l  | -   | -   |
|             | Matrix      |                         | 5% HNO <sub>3</sub>          | 1% HNO <sub>3</sub>        | 5% HNO <sub>3</sub>           | 5% HCl  | 2% HCl  |   |

## Titrisol® standards

Titrisol® standards are traceable to standard reference material from NIST. A batch specific Certificate of Analysis is available via internet ([www.merckmillipore.com](http://www.merckmillipore.com)).

### Dilution of Titrisol® 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. Titrisol® 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.

### Minimum shelf life of standard solutions

|                             |                            |
|-----------------------------|----------------------------|
| Unopened Titrisol® ampoules | 5 years                    |
| Solution of 1000 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          |

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

|                           |   |
|---------------------------|---|
| 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% sulfuric acid in a volumetric flask and make up to 1 l with distilled water.               |

### Titrisol® standards

| Designation        | Element         | Composition<br>[1000 mg of element per ampoule]  | Order No.    |
|--------------------|-----------------|--|--------------|
| <b>A</b> Aluminium | Al              | AlCl <sub>3</sub> in water   | 1.09967.0001 |
| Arsenic            | As              | As <sub>2</sub> O <sub>5</sub> in water  | 1.09939.0001 |
| <b>B</b> Barium    | Ba              | BaCl <sub>2</sub> in 7% HCl  | 1.09968.0001 |
| <b>C</b> Cadmium   | Cd              | CdCl <sub>2</sub> in water   | 1.09960.0001 |
| Calcium            | Ca              | CaCl <sub>2</sub> in 6.5% HCl  | 1.09943.0001 |
| Chloride           | Cl              | HCl in water   | 1.09871.0001 |
| Chromium           | Cr              | CrCl <sub>3</sub> in 4.2% HCl  | 1.09948.0001 |
| Cobalt             | Co              | CoCl <sub>2</sub> in water   | 1.09986.0001 |
| Copper             | Cu              | CuCl <sub>2</sub> in water   | 1.09987.0001 |
| <b>F</b> Fluoride  | F               | KF in water  | 1.09869.0001 |
| <b>G</b> Gold      | Au              | H(AuCl <sub>4</sub> ) in 12.72% HCl  | 1.09868.0001 |
| <b>I</b> Iron      | Fe              | FeCl <sub>3</sub> in 15% HCl   | 1.09972.0001 |
| <b>L</b> Lead      | Pb              | Pb(NO <sub>3</sub> ) <sub>2</sub> in water   | 1.09969.0001 |
| Lithium            | Li              | LiCl in water  | 1.09934.0001 |
| <b>M</b> Magnesium | Mg              | MgCl <sub>2</sub> in 6% HCl  | 1.09949.0001 |
| Manganese          | Mn              | MnCl <sub>2</sub> in water   | 1.09988.0001 |
| Molybdenum         | Mo              | (NH <sub>4</sub> ) <sub>6</sub> Mo <sub>7</sub> O <sub>24</sub> in 0.7% NH <sub>4</sub> OH | 1.09926.0001 |
| <b>N</b> Nickel    | Ni              | NiCl <sub>2</sub> in water   | 1.09989.0001 |
| Nitrite            | NO <sub>2</sub> | NaNO <sub>2</sub> in water   | 1.09866.0001 |
| <b>P</b> Phosphate | PO <sub>4</sub> | H <sub>3</sub> PO <sub>4</sub> in water  | 1.09870.0001 |
| Potassium          | K               | KCl in water   | 1.09924.0001 |
| <b>S</b> Selenium  | Se              | SeO <sub>2</sub> in 6.3% HNO <sub>3</sub>  | 1.09915.0001 |
| Silicon            | Si              | SiCl <sub>4</sub> in 14% NaOH  | 1.09947.0001 |
| Silver             | Ag              | AgNO <sub>3</sub> in 5% HNO <sub>3</sub>   | 1.09906.0001 |
| Sodium             | Na              | NaCl in water  | 1.09927.0001 |
| Strontium          | Sr              | SrCl <sub>2</sub> in 7% HCl  | 1.09993.0001 |
| Sulfate            | SO <sub>4</sub> | H <sub>2</sub> SO <sub>4</sub> in water  | 1.09872.0001 |
| <b>T</b> Titanium  | Ti              | (NH <sub>4</sub> ) <sub>2</sub> TiF <sub>6</sub> in water                                  | 1.09829.0001 |
| <b>V</b> Vanadium  | V               | VOSO <sub>4</sub> in 8.6% H <sub>2</sub> SO <sub>4</sub>                                   | 1.09994.0001 |
| <b>Z</b> Zinc      | Zn              | ZnCl <sub>2</sub> in 0.06% HCl   | 1.09953.0001 |

## AAS standards

Atomic absorption spectroscopy standards are traceable to standard reference material from NIST. Analysis of content is carried out by ICP-OES or titration. A batch specific Certificate of Analysis is available via internet ([www.merckmillipore.com](http://www.merckmillipore.com)).

### Certipur® AAS standards

|   | Designation | Element | Composition   | Concentration 1000 mg/l<br>Order No. [100 ml] | Concentration 1000 mg/l<br>Order No. [500 ml] |
|---|-------------|---------|---|---|---|
| A | Aluminium   | Al      | Al(NO <sub>3</sub> ) <sub>3</sub> in HNO <sub>3</sub> 0.5 mol/l   | 1.19770.0100                                  | 1.19770.0500                                  |
|   | Antimony    | Sb      | Sb <sub>2</sub> O <sub>3</sub> in HCl 2 mol/l   | 1.70204.0100                                  | 1.70204.0500                                  |
|   | Arsenic     | As      | H <sub>3</sub> AsO <sub>4</sub> in HNO <sub>3</sub> 0.5 mol/l   | 1.19773.0100                                  | 1.19773.0500                                  |
| B | Barium      | Ba      | Ba(NO <sub>3</sub> ) <sub>2</sub> in HNO <sub>3</sub> 0.5 mol/l   | 1.19774.0100                                  | 1.19774.0500                                  |
|   | Beryllium   | Be      | Be <sub>4</sub> O(C <sub>2</sub> H <sub>3</sub> O <sub>2</sub> ) <sub>6</sub> in HNO <sub>3</sub> 0.5 mol/l | 1.70207.0100                                  | 1.70207.0500                                  |
|   | Bismuth     | Bi      | Bi(NO <sub>3</sub> ) <sub>3</sub> in HNO <sub>3</sub> 0.5 mol/l   | 1.19804.0100                                  | 1.19804.0500                                  |
|   | Boron       | B       | H <sub>3</sub> BO <sub>3</sub> in water   | 1.19500.0100                                  | 1.19500.0500                                  |
| C | Cadmium     | Cd      | Cd(NO <sub>3</sub> ) <sub>2</sub> in HNO <sub>3</sub> 0.5 mol/l   | 1.19777.0100                                  | 1.19777.0500                                  |
|   | Calcium     | Ca      | Ca(NO <sub>3</sub> ) <sub>2</sub> in HNO <sub>3</sub> 0.5 mol/l   | 1.19778.0100                                  | 1.19778.0500                                  |
|   | Cesium      | Cs      | CsNO <sub>3</sub> in HNO <sub>3</sub> 0.5 mol/l   | 1.70212.0100                                  | -   |
|   | Chromium    | Cr      | Cr(NO <sub>3</sub> ) <sub>3</sub> in HNO <sub>3</sub> 0.5 mol/l   | 1.19779.0100                                  | 1.19779.0500                                  |
|   | Cobalt      | Co      | Co(NO <sub>3</sub> ) <sub>2</sub> in HNO <sub>3</sub> 0.5 mol/l   | 1.19785.0100                                  | 1.19785.0500                                  |
|   | Copper      | Cu      | Cu(NO <sub>3</sub> ) <sub>2</sub> in HNO <sub>3</sub> 0.5 mol/l   | 1.19786.0100                                  | 1.19786.0500                                  |
|   | Gold        | Au      | H(AuCl <sub>4</sub> ) in HCl 2 mol/l  | 1.70216.0100                                  | 1.70216.0500                                  |
| I | Indium      | In      | In(NO <sub>3</sub> ) <sub>3</sub> in HNO <sub>3</sub> 0.5 mol/l   | 1.19504.0100                                  | -   |
|   | Iron        | Fe      | Fe(NO <sub>3</sub> ) <sub>3</sub> in HNO <sub>3</sub> 0.5 mol/l   | 1.19781.0100                                  | 1.19781.0500                                  |
| L | Lead        | Pb      | Pb(NO <sub>3</sub> ) <sub>2</sub> in HNO <sub>3</sub> 0.5 mol/l   | 1.19776.0100                                  | 1.19776.0500                                  |
|   | Lithium     | Li      | LiNO <sub>3</sub> in HNO <sub>3</sub> 0.5 mol/l   | 1.70223.0100                                  | 1.70223.0500                                  |
| M | Magnesium   | Mg      | Mg(NO <sub>3</sub> ) <sub>2</sub> in HNO <sub>3</sub> 0.5 mol/l   | 1.19788.0100                                  | 1.19788.0500                                  |
|   | Manganese   | Mn      | Mn(NO <sub>3</sub> ) <sub>2</sub> in HNO <sub>3</sub> 0.5 mol/l   | 1.19789.0100                                  | 1.19789.0500                                  |
|   | Mercury     | Hg      | Hg(NO <sub>3</sub> ) <sub>2</sub> in HNO <sub>3</sub> 2 mol/l   | 1.70226.0100                                  | 1.70226.0500                                  |
|   | Molybdenum  | Mo      | (NH <sub>4</sub> ) <sub>6</sub> Mo <sub>7</sub> O <sub>24</sub> in water                                    | 1.70227.0100                                  | 1.70227.0500                                  |
| N | Nickel      | Ni      | Ni(NO <sub>3</sub> ) <sub>2</sub> in HNO <sub>3</sub> 0.5 mol/l   | 1.19792.0100                                  | 1.19792.0500                                  |
| P | Palladium   | Pd      | Pd(NO <sub>3</sub> ) <sub>2</sub> in HNO <sub>3</sub> 0.5 mol/l   | 1.14282.0100                                  | 1.14282.0500                                  |
|   | Platinum    | Pt      | H <sub>2</sub> PtCl <sub>6</sub> in HCl 2 mol/l   | 1.70219.0100                                  | 1.70219.0500                                  |
|   | Potassium   | K       | KNO <sub>3</sub> in HNO <sub>3</sub> 0.5 mol/l  | 1.70230.0100                                  | 1.70230.0500                                  |
| S | Scandium    | Sc      | Sc <sub>2</sub> O <sub>3</sub> in HNO <sub>3</sub> 1 mol/l  | 1.19513.0100                                  | 1.19513.0500                                  |
|   | Selenium    | Se      | SeO <sub>2</sub> in HNO <sub>3</sub> 0.5 mol/l  | 1.19796.0100                                  | 1.19796.0500                                  |
|   | Silicon     | Si      | (NH <sub>4</sub> ) <sub>2</sub> SiF <sub>6</sub> in water   | 1.12310.0100                                  | 1.12310.0500                                  |
|   | Silicon     | Si      | SiO <sub>2</sub> in NaOH 0.5 mol/l  | 1.70236.0100                                  | 1.70236.0500                                  |
|   | Silver      | Ag      | AgNO <sub>3</sub> in HNO <sub>3</sub> 0.5 mol/l   | 1.19797.0100                                  | 1.19797.0500                                  |
|   | Sodium      | Na      | NaNO <sub>3</sub> in HNO <sub>3</sub> 0.5 mol/l   | 1.70238.0100                                  | 1.70238.0500                                  |
|   | Strontium   | Sr      | Sr(NO <sub>3</sub> ) <sub>2</sub> in HNO <sub>3</sub> 0.5 mol/l   | 1.19799.0100                                  | 1.19799.0500                                  |
| T | Tellurium   | Te      | H <sub>6</sub> TeO <sub>6</sub> in HNO <sub>3</sub> 0.5 mol/l   | 1.19514.0100                                  | -   |
|   | Thallium    | Tl      | TlNO <sub>3</sub> in HNO <sub>3</sub> 0.5 mol/l   | 1.19801.0100                                  | 1.19801.0500                                  |
|   | Tin         | Sn      | SnCl <sub>4</sub> in HCl 2 mol/l  | 1.70242.0100                                  | 1.70242.0500                                  |
|   | Titanium    | Ti      | (NH <sub>4</sub> ) <sub>2</sub> TiF <sub>6</sub> in water   | 1.70243.0100                                  | 1.70243.0500                                  |
|   | Tungsten    | W       | (NH <sub>4</sub> ) <sub>2</sub> WO <sub>4</sub> in water  | 1.70244.0100                                  | 1.70244.0500                                  |
| V | Vanadium    | V       | NH <sub>4</sub> VO <sub>3</sub> in HNO <sub>3</sub> 0.5 mol/l   | 1.70245.0100                                  | 1.70245.0500                                  |
| Y | Yttrium     | Y       | Y(NO <sub>3</sub> ) <sub>3</sub> in HNO <sub>3</sub> 0.5 mol/l  | 1.19809.0100                                  | 1.19809.0500                                  |
| Z | Zinc        | Zn      | Zn(NO <sub>3</sub> ) <sub>2</sub> in HNO <sub>3</sub> 0.5 mol/l   | 1.19806.0100                                  | 1.19806.0500                                  |
|   | Zirconium   | Zr      | ZrOCl <sub>2</sub> in HCl 2 mol/l   | 1.70234.0100                                  | -   |



## AAS 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 Millipore standard oil or with non-polar solvents.

### 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       |
| 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   | Order No. [100 ml] |
|----------------------------|---|--------------------|
| Multi-element standard I   | 4 elements, different concentrations<br>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<br>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<br>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. [2.5 l] |
|-----------------------------------|-------------------|
| Standard oil for AAS (30–40 mPas) | 1.13898.2500      |



# Certipur<sup>®</sup> reference materials for reliable calibration in pH measurement

|  |      |
|--|------|
| <b>Certipur<sup>®</sup> products</b>               | Page |
| • Certified secondary standard reference materials | 192  |
| • Certified buffer solutions                       | 193  |
| • Titrisol <sup>®</sup> buffer concentrates        | 195  |
| • Certified buffer solutions in sachets            | 196  |

## Benefits

- Measured and qualified in Merck Millipore's ISO 17025 accredited lab
- Conducts always reliable and accurate results
- Traceable to NIST and PTB
- Available in convenient and safe packaging

Ready-to-use buffer solutions



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 for pH measurement

Merck Millipore offers a distinguished range of buffer solutions and substances for the calibration, monitoring and qualifying of pH instruments and buffer solutions. All buffer solutions and substances are measured and qualified in our DIN EN ISO 17025/IEC accredited laboratory for pH measurement and conductivity measurement. Buffer reference materials have a direct influence on the accuracy of measurement results and therefore they are important for modern quality management systems.

Our laboratory for pH measurement operate a comprehensive quality management system accredited by the German accreditation body to the current DIN EN ISO / IEC 17025 standard. For our customer, accreditation ensures state recognition of the reliability of our testing and calibration results, worldwide comparability of the results; independence and impartiality, international approval of our competence; high-level quality and transparency of our services.

## Quality control

Merck Millipore's laboratory for pH measurement is accredited according to DIN EN ISO / IEC 17025. We run our own accredited calibration laboratory for buffer reference material. Beside the accreditation of the pH method, Merck Millipore produces as well its own primary and secondary certified reference material, which is tested and certified from the German metrological institute (PTB; German Physical Technical Institute, Germany Braunschweig).

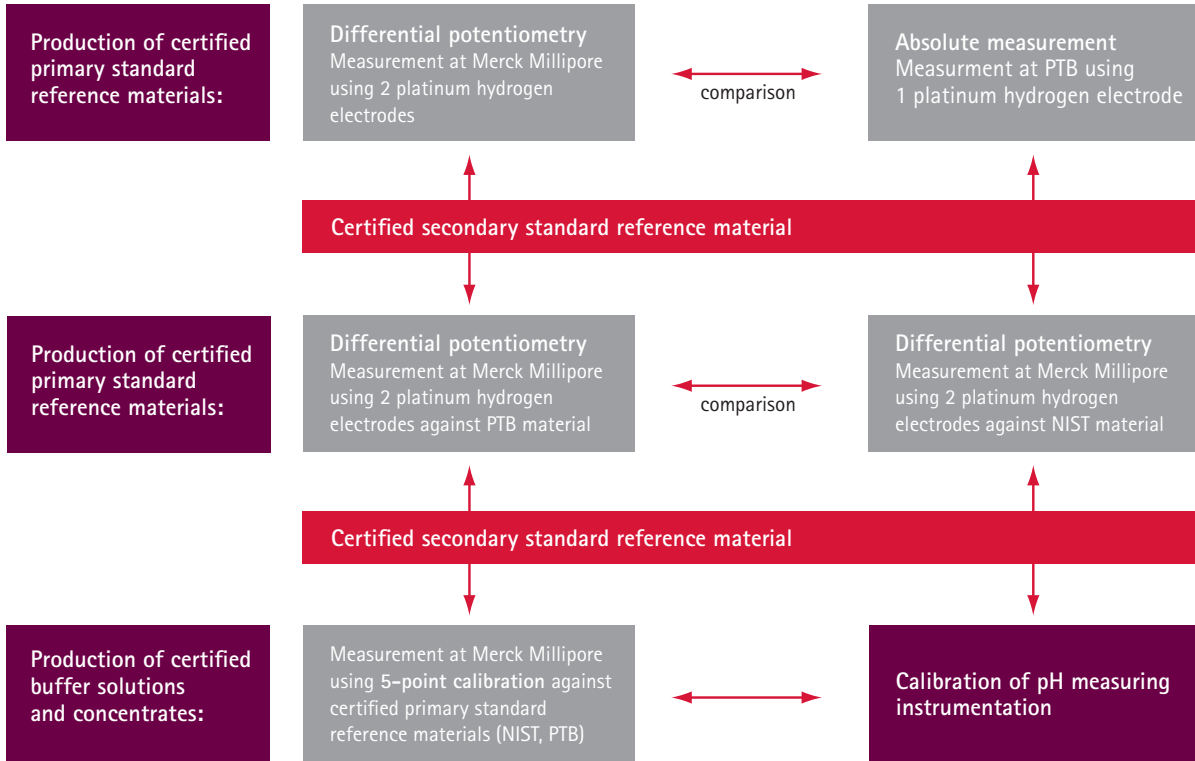
Therefore Merck Millipore's laboratory for pH measurement is not only an accredited calibration laboratory it is also an accredited testing laboratory. A testing laboratory has the permission to act as an independent authority to test samples and materials.



Certified secondary reference buffer solutions

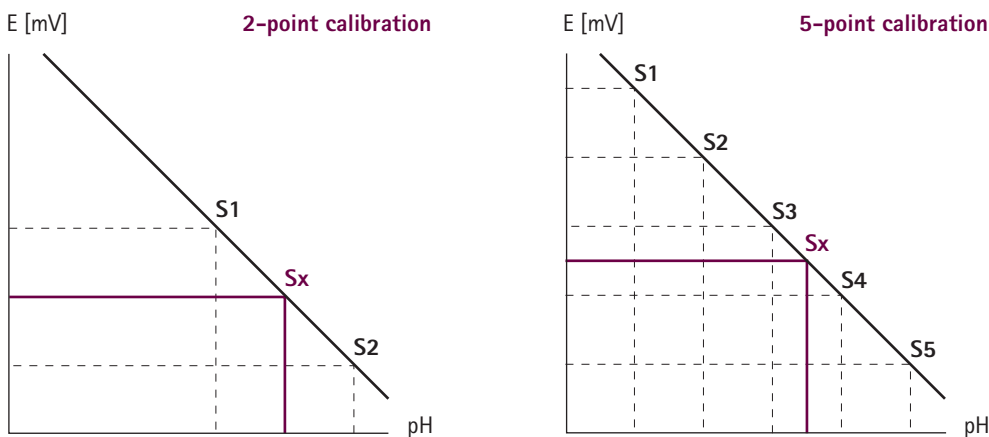
### Quality control of certified secondary reference buffers

Merck Millipore offers certified secondary standard reference buffer solution and substances which is at most used for extremely precise calibration, qualifying and monitoring of pH instruments and testing other buffer solutions. These certified secondary reference material is tested with two platinum hydrogen electrodes using a differential potentiometry. The uncertainty of this measuring method is +/-0.003 pH units.



### Quality control of ready-to-use buffer solutions for the daily calibration

For the precise measurement of our ready-to-use reference buffer solutions for the regularly calibration of pH instruments, Merck Millipore uses a 5-point calibration. The 5-point calibration is more accurate than a 2- or 3-point calibration.



## Certified secondary standard reference buffer solutions|substances

Certified secondary standard reference buffers are employed for precisely calibrating and monitoring of pH measurement instruments and buffers solutions. Deviation is max.  $\pm 0.003$  pH units. Every Certipur® product is delivered with a Certificate of Analysis showing the relevant data for every quality management system. The quality control is carried out in Merck Millipore'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 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 1.68 <sub>1</sub><br>Potassium tetroxalat dihydrate                                | 1.68 <sub>1</sub> | 5 x 100 ml   | 1.07204.0105 |
| Certipur® certified secondary standard reference buffer solution pH 4.00 <sub>5</sub><br>Potassium hydrogen phthalate                                  | 4.00 <sub>5</sub> | 5 x 100 ml   | 1.07200.0105 |
| Certipur® certified secondary standard reference buffer solution pH 6.86 <sub>3</sub><br>Potassium dihydrogen phosphate / di-Sodium hydrogen phosphate | 6.86 <sub>3</sub> | 5 x 100 ml   | 1.07202.0105 |
| Certipur® certified secondary standard reference buffer solution pH 7.41 <sub>6</sub><br>Potassium dihydrogen phosphate / di-Sodium hydrogen phosphate | 7.41 <sub>6</sub> | 5 x 100 ml   | 1.07205.0105 |
| Certipur® pH certified secondary standard reference buffer solution 9.18 <sub>4</sub><br>di-Sodium tetraborate decahydrate                             | 9.18 <sub>4</sub> | 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<br>Potassium tetroxalate dihydrate                             | 1.68 <sub>1</sub>                     | 25 g         | 1.01961.0025 |
| Certipur® certified secondary reference buffer substance<br>Potassium hydrogen tartate                                  | 3.63 <sub>9</sub>                     | 25 g         | 1.01963.0025 |
| Certipur® certified secondary reference buffer substance<br>Potassium hydrogen phthalate                                | 4.00 <sub>5</sub>                     | 25 g         | 1.01965.0025 |
| Certipur® certified secondary reference buffer substance<br>Potassium hydrogen phosphate / di-Sodium hydrogen phosphate | 6.86 <sub>3</sub> / 7.41 <sub>6</sub> | 2 x 25 g     | 1.01960.0001 |
| Certipur® certified secondary reference buffer substance<br>di-Sodium tetraborate decahydrate                           | 9.18 <sub>4</sub>                     | 25 g         | 1.01964.0025 |
| Certipur® certified secondary reference buffer substance<br>Sodium hydrogen carbonate / Sodium carbonate                | 10.01 <sub>4</sub>                    | 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 analyzed 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.

### 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                  | 1000 ml        | 1.09432.1000 |
| Certipur® buffer solution | 2.00            | Citric acid, Sodium hydroxide, Hydrogen chloride             | 1000 ml        | 1.09433.1000 |
|                           |                 |  | 10 l Titripac® | 1.09433.9010 |
| Certipur® buffer solution | 3.00            | Citric acid, Sodium hydroxide, Hydrogen chloride             | 1000 ml        | 1.09434.1000 |
| Certipur® buffer solution | 4.00            | Citric acid, Sodium hydroxide, Hydrogen chloride             | 1000 ml        | 1.09435.1000 |
|                           |                 |  | 4 l Titripac®  | 1.09435.4000 |
|                           |                 |  | 10 l Titripac® | 1.09435.9010 |
| Certipur® buffer solution | 4.66            | Acetic acid, Sodium acetate                                  | 1000 ml        | 1.07827.1000 |
| Certipur® buffer solution | 5.00            | Citric acid, Sodium hydroxide                                | 1000 ml        | 1.09436.1000 |
| Certipur® buffer solution | 6.00            | Citric acid, Sodium hydroxide                                | 1000 ml        | 1.09437.1000 |
| Certipur® buffer solution | 6.88            | di-Sodium hydrogen phosphate, Potassium dihydrogen phosphate | 1000 ml        | 1.07294.1000 |
| Certipur® buffer solution | 7.00s           | di-Sodium hydrogen phosphate, Potassium dihydrogen phosphate | 1000 ml        | 1.09439.1000 |
|                           |                 |  | 4 l Titripac®  | 1.09439.4000 |
|                           |                 |  | 10 l Titripac® | 1.09439.9010 |
| Certipur® buffer solution | 8.00            | Boric acid, Sodium hydroxide, Hydrogen chloride              | 1000 ml        | 1.09460.1000 |
| Certipur® buffer solution | 9.00            | Boric acid, Sodium hydroxide, Potassium chloride             | 1000 ml        | 1.09461.1000 |
|                           |                 |  | 4 l Titripac®  | 1.09461.4000 |
|                           |                 |  | 10 l Titripac® | 1.09461.9010 |
| Certipur® buffer solution | 9.22            | di-Sodium tetraborate  | 1000 ml        | 1.01645.1000 |
| Certipur® buffer solution | 10.00           | Boric acid, Sodium hydroxide, Potassium chloride             | 1000 ml        | 1.09438.1000 |
|                           |                 |  | 4 l Titripac®  | 1.09438.4000 |
|                           |                 |  | 10 l Titripac® | 1.09438.9010 |
| Certipur® buffer solution | 11.00           | Boric acid, Sodium hydroxide, Potassium chloride             | 1000 ml        | 1.09462.1000 |

### Certipur® buffer solutions [25°C]

| Designation               | pH value [25°C] | Composition                                      | Package size | Package   | Order No.  |
|---------------------------|-----------------|--|--------------|-----------|------------|
| Certipur® buffer solution | 1.00            | Glycine, Sodium chloride, Hydrogen chloride      | 500 ml       | PE bottle | 1094410500 |
|                           |                 |  | 4 l          | Titripac® | 1094414000 |
| Certipur® buffer solution | 2.00            | Citric acid, Sodium hydroxide, Hydrogen chloride | 500 ml       | PE bottle | 1094420500 |
|                           |                 |  | 4 l          | Titripac® | 1094424000 |
| Certipur® buffer solution | 3.00            | Citric acid, Sodium hydroxide, Hydrogen chloride | 500 ml       | PE bottle | 1094440500 |
|                           |                 |  | 4 l          | Titripac® | 1094444000 |
| Certipur® buffer solution | 4.00            | Citric acid, Sodium hydroxide, Hydrogen chloride | 500 ml       | PE bottle | 1094450500 |
|                           |                 |  | 4 l          | Titripac® | 1094454000 |
| Certipur® buffer solution | 4.01            | Potassium hydrogen phthalate                     | 500 ml       | PE bottle | 1094060500 |
|                           |                 |  | 1 l          | PE bottle | 1094061000 |
|                           |                 |  | 4 l          | Titripac® | 1094064000 |
| Certipur® buffer solution | 5.00            | Citric acid, Sodium hydroxide                    | 500 ml       | PE bottle | 1094460500 |
|                           |                 |  | 4 l          | Titripac® | 1094464000 |

**Certipur® buffer solutions [25°C] (continued)**

| Designation               | pH value [25°C] | Composition  | Package size | Package   | Order No.  |
|---------------------------|-----------------|--|--------------|-----------|------------|
| Certipur® buffer solution | 6.00            | Citric acid, Sodium hydroxide                                | 500 ml       | PE bottle | 1990364000 |
|                           |                 |  | 4 l          | Titripac® | 1990360500 |
| Certipur® buffer solution | 7.00            | di-Sodium hydrogen phosphate, Potassium dihydrogen phosphate | 500 ml       | PE bottle | 1094070500 |
|                           |                 |  | 1 l          | PE bottle | 1094071000 |
|                           |                 |  | 4 l          | Titripac® | 1094074000 |
| Certipur® buffer solution | 8.00            | Boric acid, Sodium hydrogen, Hydrogen chloride               | 500 ml       | PE bottle | 1990380500 |
|                           |                 |  | 4 l          | Titripac® | 1990384000 |
| Certipur® buffer solution | 9.00            | Boric acid, Sodium hydrogen, Potassium chloride              | 500 ml       | PE bottle | 1094080500 |
|                           |                 |  | 1 l          | PE bottle | 1094081000 |
|                           |                 |  | 4 l          | Titripac® | 1094084000 |
| Certipur® buffer solution | 10.00           | Boric acid, Sodium hydrogen, Potassium chloride              | 500 ml       | PE bottle | 1094090500 |
|                           |                 |  | 1 l          | PE bottle | 1094091000 |
|                           |                 |  | 4 l          | Titripac® | 1094094000 |
| Certipur® buffer solution | 11.00           | Boric acid, Sodium hydrogen, Potassium chloride              | 500 ml       | PE bottle | 1990410500 |
|                           |                 |  | 4 l          | Titripac® | 1990414000 |
| Certipur® buffer solution | 12.00           | di-Sodium hydrogen phosphate, Sodium hydroxide               | 4 l          | Titripac® | 1990224000 |

**Certipur® buffer solutions [20°C] – color 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         | 1.09475.0500 |
|                           |                 |  | 4 l Titripac®  | 1.09475.4000 |
|                           |                 |  | 10 l Titripac® | 1.09475.9010 |
| Certipur® buffer solution | 7.00 [green]    | di-Sodium hydrogen phosphate, Potassium dihydrogen phosphate | 500 ml         | 1.09477.0500 |
|                           |                 |  | 4 l Titripac®  | 1.09477.4000 |
|                           |                 |  | 10 l Titripac® | 1.09477.9010 |
| Certipur® buffer solution | 9.00 [blue]     | Boric acid, Potassium chloride, Sodium hydroxide             | 500 ml         | 1.09476.0500 |
|                           |                 |  | 4 l Titripac®  | 1.09476.4000 |
|                           |                 |  | 10 l Titripac® | 1.09476.9010 |
| Certipur® buffer solution | 10.00 [yellow]  | Boric acid, Potassium chloride, Sodium hydroxide             | 500 ml         | 1.09400.0500 |
|                           |                 |  | 4 l Titripac®  | 1.09400.4000 |
|                           |                 |  | 10 l Titripac® | 1.09400.9010 |





## Certipur® buffer solutions [25°C] – color coded

| Designation               | pH value [25°C] | Composition                       | Package size | Package   | Order No.   |
|---------------------------|-----------------|-----------------------------------|--------------|-----------|-------------|
| Certipur® buffer solution | 4.00            | color coded red measured 25 °C    | 500 ml       | PE bottle | 10990540500 |
|                           |                 |                                   | 1 l          | Titripac® | 10990544000 |
| Certipur® buffer solution | 7.00            | color coded yellow measured 25 °C | 500 ml       | PE bottle | 1990570500  |
|                           |                 |                                   | 1 l          | Titripac® | 1990574000  |
| Certipur® buffer solution | 10.00           | color coded blue measured 25 °C   | 500 ml       | PE bottle | 1990500500  |

## Titrisol® buffer concentrates

All Titrisol® buffer concentrates are traceable to standard reference materials from NIST and PTB. They are analyzed 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.



## 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            | di-Sodium hydrogen phosphate, Potassium dihydrogen phosphate | 1 ampoule    | 1.09887.0001 |
| Buffer Titrisol® acc. to Weise | 7.20            | di-Sodium 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           | di-Sodium hydrogen phosphate, Sodium hydroxide               | 1 ampoule    | 1.09892.0001 |
| Buffer Titrisol®               | 13.00           | Potassium chloride, Sodium hydroxide                         | 1 ampoule    | 1.09893.0001 |

## 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 analyzed 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.

### Advantages of Certipur® buffer sachets

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



**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 x 30 ml     | 1.99012.0001 |
| Certipur® buffer solution        | 4.01                  | Potassium hydrogen phthalate                                 | 30 sachets x 30 ml     | 1.99001.0001 |
| Certipur® buffer solution        | 6.00                  | Citric acid, sodium hydroxide                                | 30 sachets x 30 ml     | 1.99016.0001 |
| Certipur® buffer solution        | 7.00                  | Potassium dihydrogen phosphate, di-Sodium hydrogen phosphate | 30 sachets x 30 ml     | 1.99002.0001 |
| Certipur® buffer solution        | 9.00                  | Boric acid, Sodium hydroxide, Potassium chloride             | 30 sachets x 30 ml     | 1.99003.0001 |
| Certipur® buffer solution        | 9.18                  | di-Sodium tetraborate  | 30 sachets x 30 ml     | 1.99019.0001 |
| Certipur® buffer solution        | 10.00                 | Boric acid, Sodium hydroxide, Potassium chloride             | 30 sachets x 30 ml     | 1.99004.0001 |
| Certipur® buffer solution        | 11.00                 | Boric acid, Sodium hydroxide, Potassium chloride             | 30 sachets x 30 ml     | 1.99021.0001 |
| Certipur® buffer solution        | 12.00                 | di-Sodium hydrogen phosphate, Sodium hydroxide               | 30 sachets x 30 ml     | 1.99022.0001 |
| Certipur® buffer solution Set I  | 4.01<br>7.00<br>9.00  | –  | 3 x 10 sachets x 30 ml | 1.99005.0001 |
| Certipur® buffer solution Set II | 4.01<br>7.00<br>10.00 | –  | 3 x 10 sachets x 30 ml | 1.99006.0001 |



# Certipur<sup>®</sup> reference materials for reliable calibration in conductivity measurement

## ■ Certipur<sup>®</sup> products

- |   |     |
|---|-----|
| • Certified reference material for conductivity measurement | 200 |
| • Certipur <sup>®</sup> conductivity sachets                | 201 |

## ■ Benefits

### Certipur<sup>®</sup> conductivity sachets

- Solutions are always fresh and ready-to-use
- Available in suitable quantities
- Precise conductivity values
- No risk of contamination
- No residues
- Easy to use
- Includes batch-specific Certificate of Analysis
- Traceable to PTB and NIST



For precise conductivity measurement, Merck Millipore offers a distinguished range of conductivity standards. In conductivity measurement the reliable calibration of your instruments is the first indispensable step. Our laboratory for conductivity measurement operate like our laboratory for pH measurements a comprehensive quality management system accredited by the German accreditation body to the current DIN EN ISO / IEC 17025 standard.



Merck Millipore offers secondary reference materials for conductivity measurement, which are measured in our own ISO 17025 accredited lab.

## Reference material for conductivity

Merck Millipore offers certified secondary standard reference conductivity standards, which are at most used for extremely precise calibration, qualifying and monitoring of instruments for conductivity measurement. These certified secondary reference material is tested against own primary reference standards certified from the German metrological institute (PTB; German Physical Technical Institute, Germany Braunschweig). The Merck Millipore conductivity standards are then hence traceable to these primary reference materials. In addition, the Merck Millipore standards are measured against international conductivity standards from NIST (National Institute of Standards and Technology, Gaithersburg, Maryland, 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 | Package size          | Order No. [500 ml] |
|--|--------------------------------------|-----------------------|--------------------|
| Conductivity water                         | 0                                    | 5 PE bottles x 100 ml | 1.01810.0105       |
| Potassium chloride solution (0.0001 mol/l) | 0.015                                | 5 PE bottles x 100 ml | 1.01811.0105       |
| Potassium chloride solution (0.001 mol/l)  | 0.147                                | 1 PE bottle x 500 ml  | 1.01557.0500       |
| Potassium chloride solution (0.01 mol/l)   | 1.41                                 | 1 PE bottle x 500 ml  | 1.01203.0500       |
| Potassium chloride solution (0.1 mol/l)    | 12.8                                 | 1 PE bottle x 500 ml  | 1.01254.0500       |
| Potassium chloride solution (1 mol/l)      | 111                                  | 1 PE bottle x 500 ml  | 1.01255.0500       |





## Certipur® conductivity sachets

Ready-to-use conductivity standards can be used in laboratories or outside in the field. The package is convenient and easy to use and ensures accurate and reliable results. They are measured as well in our own accredited laboratory. 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, CO<sub>2</sub> 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. [500 ml] |
|---|--------------------------------------|--------------------|--------------------|
| 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       |

# Certipur® reference materials for reliable calibration in ion chromatography

## Certipur® products

|  |     |
|--|-----|
| • Ion chromatography standards                 | 203 |
| • Ion chromatography multi standards, anionic  | 203 |
| • Ion chromatography multi standards, cationic | 203 |

## Benefits

- Single-element standards as ready-to-use standards or as concentrates
- Multi-element standards available as anionic and cationic solution
- Traceable to NIST





## Ion chromatography

Ion chromatography requires the constant use of calibration solutions. Merck Millipore has a wide range of single- and multi-element solutions for this purpose. Recent additions are the multi-element solutions. All ion chromatography standards are traceable to NIST standard reference materials.

### Certipur® ion chromatography standards

| Designation | Item                  | Composition                                    | Concentration | Package size | Order No.    |
|-------------|-----------------------|--|---------------|--------------|--------------|
| Ammonium    | Ready-to-use solution | NH <sub>4</sub> Cl in water                    | 1000 mg/l     | 500 ml       | 1.19812.0500 |
| Bromide     | Ready-to-use solution | NaBr in water                                  | 1000 mg/l     | 500 ml       | 1.19896.0500 |
| Chloride    | Ready-to-use solution | NaCl in water                                  | 1000 mg/l     | 500 ml       | 1.19897.0500 |
|             | Titrisol®             | HCl in water                                   | 1000 mg       | 1 ampoule    | 1.09871.0001 |
| Chromate    | Ready-to-use solution | K <sub>2</sub> CrO <sub>4</sub> in water       | 1000 mg/l     | 500 ml       | 1.19780.0500 |
| Cyanide     | Ready-to-use solution | K <sub>2</sub> [Zn(CN) <sub>4</sub> ] in water | 1000 mg/l     | 500 ml       | 1.19533.0500 |
| Fluoride    | Ready-to-use solution | NaF in water                                   | 1000 mg/l     | 500 ml       | 1.19814.0500 |
|             | Titrisol®             | KF in water                                    | 1000 mg       | 1 ampoule    | 1.09869.0001 |
| Nitrate     | Ready-to-use solution | NaNO <sub>3</sub> in water                     | 1000 mg/l     | 500 ml       | 1.19811.0500 |
| Nitrite     | Ready-to-use solution | NaNO <sub>2</sub> in water                     | 1000 mg/l     | 500 ml       | 1.19899.0500 |
|             | Titrisol®             | NaNO <sub>2</sub> in water                     | 1000 mg       | 1 ampoule    | 1.09866.0001 |
| Phosphate   | Ready-to-use solution | KH <sub>2</sub> PO <sub>4</sub> in water       | 1000 mg/l     | 500 ml       | 1.19898.0500 |
|             | Titrisol®             | H <sub>3</sub> PO <sub>4</sub> in water        | 1000 mg       | 1 ampoule    | 1.09870.0001 |
| Sodium      | Ready-to-use solution | NaNO <sub>3</sub> in water                     | 1000 mg/l     | 500 ml       | 1.19507.0500 |
| Sulfate     | Ready-to-use solution | Na <sub>2</sub> SO <sub>4</sub> in water       | 1000 mg/l     | 500 ml       | 1.19813.0500 |
|             | Titrisol®             | H <sub>2</sub> SO <sub>4</sub> in water        | 1000 mg       | 1 ampoule    | 1.09872.0001 |

### Certipur® ion chromatography multi-element standards, anionic

| Designation                     | Composition   | Matrix | Package size | Order No.    |
|---------------------------------|---|--------|--------------|--------------|
| Anion multi-element standard I  | 1000 mg/l: F, Br, PO <sub>4</sub>   | Water  | 500 ml       | 1.11437.0500 |
| Anion multi-element standard II | 1000 mg/l: Cl, NO <sub>3</sub> , SO <sub>4</sub>  | Water  | 500 ml       | 1.11448.0500 |
| IC multi-element standard I     | 100 mg/l: F / 250 mg/l: Cl / 500 mg/l: NO <sub>3</sub> / 500 mg/l: SO <sub>4</sub> / 1000 mg/l: PO <sub>4</sub> | Water  | 500 ml       | 1.70398.0500 |
| IC multi-element standard V     | 10 mg/l: F, Br / 50 mg/l: NO <sub>3</sub> , PO <sub>4</sub> / 100 mg/l: Cl / 200 mg/l: SO <sub>4</sub>          | Water  | 100 ml       | 1.09032.0100 |

### Certipur® ion chromatography multi-element standards, cationic

| Designation   | Composition  | Matrix                       | Package size | Order No.    |
|---|--|------------------------------|--------------|--------------|
| IC multi-element standard VII<br>acc. to EN ISO 14911 | 100 mg/l: Li, Na, K, NH <sub>4</sub> , Mn, Ca, Mg, Sr, Ba    | 0.001 mol/l HNO <sub>3</sub> | 100 ml       | 1.10322.0100 |
| IC multi-element standard VI                          | 10 mg/l: NH <sub>4</sub> / 50 mg/l: K / 100 mg/l: Na, Ca, Mg | 0.01 mol/l HNO <sub>3</sub>  | 100 ml       | 1.09036.0100 |

# Certipur® reference materials for reliable calibration in UV-VIS spectroscopy

## Certipur® products

- UV-VIS standards

Page

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## Benefits

- Ready-to-use solutions
- Solutions are according to Reag. Ph Eur
- Stable solutions in glass ampoules



## UV-VIS spectroscopy

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 Ph Eur, but also when working according to GLP, GMP, USP, ASTM and DIN EN ISO 9001:2008.

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   | Package size  | Order No.    |
|--------------------|---|---|--------------|
| UV-VIS standard 1  | Potassium dichromate solution for the absorbance acc. to Ph Eur                     | 2 x 10 ml $K_2Cr_2O_7$ 60.06 mg/l in $H_2SO_4$ 0.01 N and<br>6 x 10 ml $H_2SO_4$ 0.01 N | 1.08160.0001 |
| UV-VIS standard 1A | Potassium dichromate solution for the absorbance at 430 nm acc. to Ph Eur           | 2 x 10 ml $K_2Cr_2O_7$ 600.6 mg/l in $H_2SO_4$ 0.01 N and<br>6 x 10 ml $H_2SO_4$ 0.01 N | 1.04660.0001 |
| UV-VIS standard 2  | Sodium nitrite solution for straylight testing acc. to Ph Eur                       | 3 x 10 ml $NaNO_2$ 50 g/l in $H_2O$   | 1.08161.0001 |
| UV-VIS standard 3  | Sodium iodide solution for straylight testing acc. to Ph Eur                        | 3 x 10 ml $NaI$ 10 g/l in $H_2O$  | 1.08163.0001 |
| UV-VIS standard 4  | Potassium chloride solution for straylight testing acc. to Ph Eur                   | 3 x 10 ml $KCl$ 12 g/l in $H_2O$  | 1.08164.0001 |
| UV-VIS standard 5  | Toluene solution in hexane for testing the spectral resolution power acc. to Ph Eur | 2 x 10 ml 0.02% (v/v) Toluol in n-Hexan and<br>6 x 10 ml n-Hexan                        | 1.08165.0001 |
| UV-VIS standard 6  | Holmium oxide solution reference material for the wavelength acc. to Ph Eur         | 3 x 10 ml $Ho_2O_3$ 40 g/l in $HClO_4$ (10% v/v)  | 1.08166.0001 |

### Auxiliaries

| Designation       | Content                    | Package size | Order No.    |
|-------------------|----------------------------|--------------|--------------|
| Rectangular cells | Quartz 10 mm Spectroquant® | 2 cells      | 1.00784.0001 |

# Certipur<sup>®</sup> reference materials for reliable calibration in volumetry

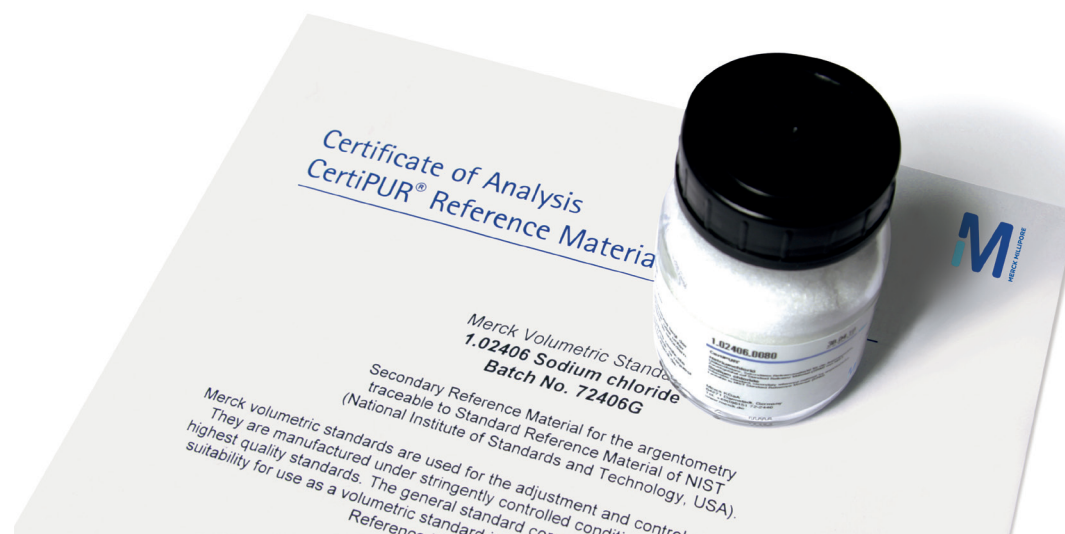
## ■ Certipur<sup>®</sup> products Page

Certipur<sup>®</sup> secondary reference materials ...

- ... for acidimetry 207
- ... for alkalimetry 207
- ... for argentometry 207
- ... for complexometry 207
- ... for iodometry 207
- ... for redox titration 207

## ■ Benefits

- Secondary reference material for accurate titer determination
- Highly pure materials traceable to NIST
- In accordance to the reagents part of Pharmacopoeias



## Certipur® secondary reference materials in volumetry

Certipur® primary substances are directly traceable to standard reference materials from the NIST (National Institute for Standard and Technology, Gaithersburg, Maryland, United States). Proper titer determination is an important prerequisite for accurate and comparable analysis in the titration laboratory. Influential factors such as temperature, instrument variances, different methods of handling, weighing errors, etc. and the volumetric solution itself can impact the titration results. To compensate for these factors, titer determination under working conditions is necessary in the respective laboratory. This is where Certipur® – secondary reference materials (volumetric standards) comes in. These are very pure, high-grade and stable solid substances. To ensure their high standard of quality, they are manufactured under the strictest control and measured with the highest possible precision.

### Volumetric standards

| Analysis        | Designation                                  | Package size | Order No.    |
|-----------------|--|--------------|--------------|
| Acidimetry      | Sodium carbonate <sup>1</sup>                | 80 g         | 1.02405.0080 |
|                 | Tris(hydroxymethyl)aminomethane <sup>2</sup> | 80 g         | 1.02408.0080 |
| Alkalimetry     | Potassium hydrogen phthalate <sup>1,2</sup>  | 80 g         | 1.02400.0080 |
|                 | Benzoic acid <sup>1,2</sup>                  | 60 g         | 1.02401.0060 |
| Argentometry    | Sodium chloride <sup>1,2</sup>               | 80 g         | 1.02406.0080 |
| Complexometry   | Zinc <sup>1</sup>                            | 100 g        | 1.02409.0100 |
|                 | Calcium carbonate <sup>2</sup>               | 50 g         | 1.02410.0050 |
| Iodometry       | Potassium iodate                             | 100 g        | 1.02404.0100 |
| Redox titration | Iron(II)ethylenediammonium sulfate           | 80 g         | 1.02402.0080 |
|                 | Potassium dichromate <sup>2</sup>            | 80 g         | 1.02403.0080 |
|                 | di-Sodium oxalate <sup>2</sup>               | 60 g         | 1.02407.0060 |

1: Solution according to Reag. Ph Eur | 2: Solution according to the reagents chapter of USP

# Certipur<sup>®</sup> reference materials for reliable calibration in special applications

## Certipur<sup>®</sup> products

|  |     |
|--|-----|
| • Ready-to-use colour comparison solutions according to Ph Eur | 209 |
| • Reference materials for refractometry                        | 209 |
| • Barium sulfate white standard DIN 5033                       | 210 |
| • TOC standard solution according to EN 1484                   | 210 |
| • 2-Propanol standard for the analysis of tobacco              | 210 |

## Benefits

- Ready-to-use solutions
- Solutions according to international norms
- Stable solutions with long minimum shelf lives



## Ready-to-use colour comparison solutions according to the Ph Eur

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

### Certipur® colour reference solutions acc. to Ph Eur

| Designation                  | For examination of the color of solutions | Package size      | Order No.    |
|------------------------------|---|-------------------|--------------|
| Colour reference solution B  | According to Ph Eur B1–B9                 | 1 set of cuvettes | 1.00265.0001 |
| Colour reference solution BY | According to Ph Eur BY1–BY7               | 1 set of cuvettes | 1.00266.0001 |
| Colour reference solution Y  | According to Ph Eur Y1–Y7                 | 1 set of cuvettes | 1.00267.0001 |
| Colour reference solution GY | According to Ph Eur GY1–GY7               | 1 set of cuvettes | 1.00268.0001 |
| Colour reference solution R  | According to Ph Eur R1–R7                 | 1 set of cuvettes | 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 range of different refractive index standards in order to perform calibration in the same range as the final measurement. These Certipur® standards are traceable to SRM from NIST and to PTB.

### Certipur® refractive index standards acc. to Ph Eur

| Designation                      | Composition                     | Refractive index (20°C) | Package size                 | Order No.    |
|----------------------------------|---------------------------------|-------------------------|------------------------------|--------------|
| Refractive index standard Kit 1, | (2,2,4-Trimethyl-pentane/water) | 1.3915                  | 1 box with 5 x 8 ml ampoules | 1.08962.0001 |
| Refractive index standard Kit 2, | (Toluene/water)                 | 1.4969                  | 1 box with 5 x 8 ml ampoules | 1.08961.0001 |
| Refractive index standard Kit 3, | (1-Methyl-naphthalene/water)    | 1.6160                  | 1 box with 5 x 8 ml ampoules | 1.08963.0001 |

## TOC analysis according to EN 1484-H3

Potassium hydrogen phthalate standard. The 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 1000 mg/l in water. The standard is stabilized 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  | Package size | Order No.    |
|--|--------------|--------------|
| TOC standard solution acc. to EN 1484 / DIN 38409-H3 as potassium hydrogen phthalate in water, stabilized, 1000 mg/l | 100 ml       | 1.09017.0100 |

## Color measurement and photometry according to DIN 5033, part 9

Color measurement according to this standard is possible using the primary reference material provided by Merck Millipore. This has been certified by the PTB. The Certificate of Analysis of barium sulfate white standard includes values for spectral density (reflection from 350-800 nm), reflection factor and standard color values.

### Certipur® white standard

| Designation                                    | Package size | Order No.    |
|--|--------------|--------------|
| Barium sulfate white standard acc. to DIN 5033 | 250 g        | 1.01748.0250 |



## Platinum Cobalt color reference solution (Hazen)

Color measurement according to DIN EN ISO 7887, ASTM D 1209-05, DIN EN ISO 6271-1 and APHA 2120 B + C can be done with the ready-to-use Hazen 500 reference solution.

### Certipur® Hazen color reference solution

| Designation                        | Package size | Order No.    |
|------------------------------------|--------------|--------------|
| Hazen 500 color reference solution | 250 ml       | 1.00246.0250 |


## Standard for analysis of tobacco

This standard is especially developed for the tobacco industry for extraction using isopropanol. The reference material includes an internal standard for subsequent gas chromatographic analysis.

### Standard for tobacco analysis

| Designation                              | Package size | Order No.    |
|--|--------------|--------------|
| 2-Propanol standard for tobacco analysis | 2.5 l        | 1.00272.2500 |





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.



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