Inorganic CRMs and calibration standards **2016**

Certified reference materials • ICP & ICP-MS standards • IC standards • AA standards • Wet chemistry • Speciation standards • Environmental standards • QC check samples

Welcome to the LGC catalogue of inorganic certified reference materials (CRMs) and calibration standards.

This catalog features our VHG Labs brand of high-purity single and multi-element aqueous standards and CRMs for spectrochemical analysis, IC, wet chemistry techniques, and QC applications.

A+ Single-element standards

The cornerstone of the VHG Labs brand is our A+ single-element standards line, which has been developed to provide the highest level of accuracy possible and offer you absolute confidence in your analysis.

Why choose A+ standards?

Ideal for ICP, ICP-MS, AA, GFAA or other elemental techniques

- Prepared from high purity raw materials, acids, and 18 M-ohm deionized water
- Manufactured in our ISO 9001, ISO Guide 34 facility, and certified in our ISO/IEC 17025 laboratory
- Certified using the NIST High Performance ICP-AES Protocol, a method developed by the National Institute of Standards and Technology.
- The NIST HP-ICP-AES method assures the highest accuracy and direct traceability to NIST SRMs
- Accompanied by NIST-traceable COA
- ICP-MS trace element scans included on the COA
- Packaged in acid-leached, triple-rinsed HDPE bottles
- Shipped in poly-sealed bags
- Most elements certified for 18 months shelf life

Multi-element standards

Because they are formulated from our A+ single-element standards, the multi-element aqueous products that we manufacture offer the same high quality, traceability, and dependability that our singles do.

Our multi-element standards line includes many common blends for general use, as well as a suite of pre-configured environmental standards that can be used for calibration, fortifying solutions, control checks, interference checks, and tuning solutions that are suitable for use with ICP, ICP-MS, AA and other spectroscopic techniques. We do, however, specialize in custom blends should our stock items not suit your specific needs.

Additional aqueous standards

To complement our A+ single-element and multi-element standards, we also offer a range of standards for ion chromatography, speciation, and isotope analysis. We have recently expanded our line of wet chemistry standards to include pH buffer reference materials.

Solid Standards

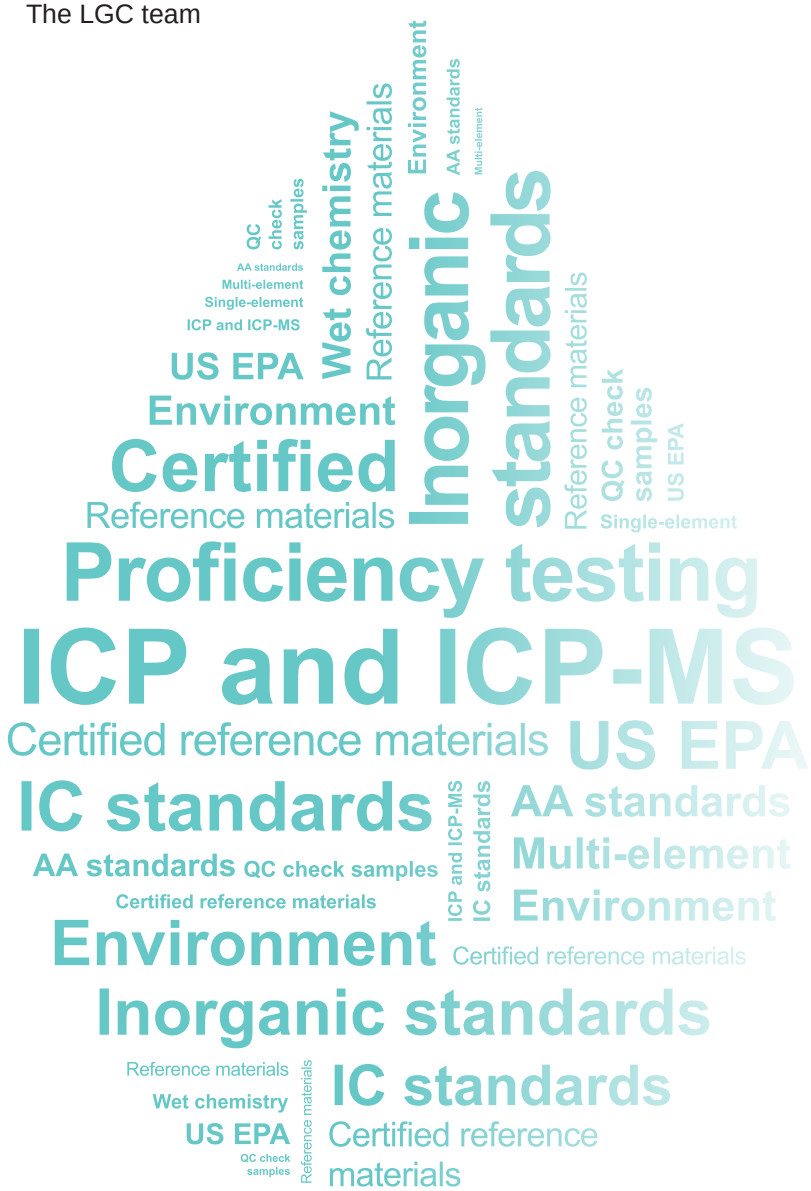
In addition to the standards that we manufacture, we offer a variety of solid standards and fluxes which can be found in Section 2.

Atomic Spectroscopy Consumables

Section 3 lists the consumables and replacement parts that we stock for AA, GFAA, ICP, ICP-MS and XRF instruments, so that customers may satisfy all of their spectroscopic needs from a single vendor.

Thank you to all of our customers. We appreciate your business and look forward to supporting your continued success.

The LGC team



About LGC Standards

LGC Standards is a leading global producer and distributor of reference materials and proficiency testing schemes. Headquartered in Teddington, Middlesex, UK, LGC Standards has a network of dedicated sales offices extending across 20 countries in 5 continents. We have an unparalleled breadth of ISO Guide 34 accredited reference material production in facilities at 4 sites across the UK, the US and Germany.

In addition to our petroleum product line, we manufacture CRMs and reference materials for the following sectors: pharmaceutical, forensic, clinical, food, beverage, environmental, pesticides and contaminants. We provide proficiency testing schemes in support of these sectors, as well as others, to more than 10,000 laboratories worldwide.

About our webshop

An up-to-date listing of all products is available on the LGC webshop: www.lgcstandards.com. Once registered, you can use the webshop to order products, check delivery times and access a range of resources for a wide variety of sectors.

Prices for the products listed, as well as detailed procedures and transport charges are available from your local sales office, where applicable. For products requiring special delivery procedures (dangerous goods, etc.), additional charges may be applied.

LGC Standards' technical staff are available to advise on the use and suitability of a particular product or to provide a quote for a custom product if a stock product does not suit your needs. Customers requiring assistance with the use or application of a particular reference material should contact their local office. Contact details for your local sales office are available at the back of this catalogue and on our website.

About LGC

LGC is an international life sciences measurement and testing company, building leading positions in sustainably growing markets.

We provide reference materials, genomics solutions and analytical testing products and services, based on our innovations and own intellectual property. We work with customers in the pharmaceuticals, agricultural, biotechnology, food, environment, security and sports sectors, as well as with governments and academia to achieve excellence in investigative, diagnostic and measurement science. For more information, please visit our website www.lgcgroup.com.

Dr. Ehrenstorfer

LGC

Reference standards for residue and environmental testing

Over 8000 pesticide and other organic reference materials

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- PAHs
- Dyes
- Phthalates
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- PCBs
- Phenols
- Chlorinated paraffins
- Pesticides and pesticide metabolites
- And many more

LGC Quality - ISO Guide 34 • GMP/GLP • ISO 9001 • ISO/IEC 17025 • ISO/IEC 17043

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Science for a safer world

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Inorganic Standards

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VHG Tips

Always pour a small amount from the standard solution to a suitable container for the purpose of volumetric pipette solution transfer. Do not add the removed sample back to the original standard solution container.

Avoid using glass pipettes or transfer devices with standard solutions containing HF. Free HF attacks glass.

When preparing solutions, don't underestimate the importance of good mixing. A simple swirl is not adequate. Invert and shake the container several times.

When making mixes of single-element standards, chemists should understand inter-element and matrix compatability issues.

Fortunately, most elements are soluble and stable in dilute nitric acid. Have any questions related to this? Call your local office and ask for Technical Support.

Try using HCl rather than HNO_3 as the matrix acid for Hg measurements using

ICP or ICP-MS. Stability of low level solutions is improved and washout times are faster.

Single-Element Standards

No analytical instrument can undo the costs created by poor accuracy of the stock standards. VHG Labs' line of A⁺ standards are manufactured to leave nothing to chance. They are tested and certified according to a protocol created by the US National Institute of Standards and Technology (NIST) that provides for accurate, precise and traceable certified concentration and uncertainty.

Features of VHG Labs A⁺ Standards:

- Ideal for ICP, ICP-MS, AA, GFAA or other elemental techniques
- Prepared from high purity raw materials, acids and 18Mohm DI water
- Manufactured in our ISO 9001, ISO Guide 34 facility, and certified in our ISO/IEC 17025 laboratory
- Assayed by NIST HP-ICP-AES method (see Page 11)
- Purity confirmed by ICP-MS
- Accompanied by NIST-traceable COA
- Packaged in acid-leached, triple-rinsed HDPE bottles
- Shipped in poly-sealed bags
- Most elements certified for 18 months shelf life

A⁺ High Purity Single Element Aqueous Calibration Standards			Concentration (10µg/mL)	Concentration (1,000µg/mL)	Concentration (10,000µg/mL)
Element	**Starting Material, Matrix**	**Vol. (mL)**	**Product No.**	**Product No.**	**Product No.**
Aluminum	Al, HCl	100 500	VHG-LALH-100	VHG-PALH-100 VHG-PALH-500	VHG-TALH-100 VHG-TALH-500
	$Al(NO_3)_3$, HNO_3	100 500	VHG-LALN-100	VHG-PALN-100 VHG-PALN-500	VHG-TALN-100 VHG-TALN-500
Antimony	Sb, HCl	100 500	VHG-LSBH-100	VHG-PSBH-100 VHG-PSBH-500	VHG-TSBH-100 VHG-TSBH-500
	Sb, HNO_3, Tartaric Acid	100 500	VHG-LSBWTN-100	VHG-PSBWTN-100 VHG-PSBWTN-500	VHG-WBTN-100 VHG-TSBWTN-500
Arsenic	As, HNO_3	100 500	VHG-LASN-100	VHG-PASN-100 VHG-PASN-500	VHG-TASN-100 VHG-TASN-500
More Info. (p. 13)	As^{+3}, As^{+5}				
Barium	$Ba(NO_3)_2$, HNO_3	100 500	VHG-LBAN-100	VHG-PBAN-100 VHG-PBAN-500	VHG-TBAN-100 VHG-TBAN-500
Beryllium	$Be_4O(C_2H_3O_2)_6$, HNO_3	100 500	VHG-LBEN-100	VHG-PBEN-100 VHG-PBEN-500	VHG-TBEN-100 VHG-TBEN-500
Bismuth	Bi, HNO_3	100 500	VHG-LBIN-100	VHG-PBIN-100 VHG-PBIN-500	VHG-TBIN-100 VHG-TBIN-500
Boron	H_3BO_3, NH_4OH	100 500	VHG-LBZ-100	VHG-PBZ-100 VHG-PBZ-500	VHG-TBZ-100 VHG-TBZ-500
	H_3BO_3, H_2O	100 500	VHG-LBW-100	VHG-PBW-100 VHG-PBW-500	NA N/A
Cadmium	Cd, HNO_3	100 500	VHG-LCDN-100	VHG-PCDN-100 VHG-PCDN-500	VHG-TCDN-100 VHG-TCDN-500
Calcium	$CaCO_3$, HNO_3	100 500		VHG-PCAN-100 VHG-PCAN-500	VHG-TCAN-100 VHG-TCAN-500
Cerium	Ce, HNO_3	100 500		VHG-PCEN-100 VHG-PCEN-500	VHG-TCEN-100 VHG-TCEN-500
Cesium	Cs_2CO_3, HNO_3	100 500		VHG-PCSN-100 VHG-PCSN-500	VHG-TCSN-100 VHG-TCSN-500
Chromium	Cr, HCl	100 500		VHG-PCRH-100 VHG-PCRH-500	VHG-TCRH-100 VHG-TCRH-500
	$Cr(NO_3)_3$, HNO_3	100 500	VHG-LCRN-100	VHG-PCRN-100 VHG-PCRN-500	VHG-TCRN-100 VHG-TCRN-500
More Info. (p. 13)	Cr^{+3}, Cr^{+6}				
Cobalt	Co, HNO_3	100 500	VHG-LCON-100	VHG-PCON-100 VHG-PCON-500	VHG-TCON-100 VHG-TCON-500

Single-Element Standards

A+ High Purity Single Element Aqueous Calibration Standards			Concentration (10µg/mL)	Concentration (1,000µg/mL)	Concentration (10,000µg/mL)
Element	**Starting Material, Matrix**	**Vol. (mL)**	**Product No.**	**Product No.**	**Product No.**
Copper	Cu, HNO_3	100 500	VHG-LCUN-100	VHG-PCUN-100 VHG-PCUN-500	VHG-TCUN-100 VHG-TCUN-500
Dysprosium	Dy_2O_3, HNO_3	100 500		VHG-PDYN-100 VHG-PDYN-500	VHG-TDYN-100 VHG-TDYN-500
Erbium	Er_2O_3, HNO_3	100 500		VHG-PERN-100 VHG-PERN-500	VHG-TERN-100 VHG-TERN-500
Europium	Eu_2O_3, HNO_3	100 500		VHG-PEUN-100 VHG-PEUN-500	VHG-TEUN-100 VHG-TEUN-500
Gadolinium	Gd_2O_3, HNO_3	100 500		VHG-PGDN-100 VHG-PGDN-500	VHG-TGDN-100 VHG-TGDN-500
Gallium	Ga, HNO_3, tr. HCl	100 500		VHG-PGANH-100 VHG-PGANH-500	VHG-TGANH-100 VHG-TGANH-500
Germanium	Ge, HNO_3, tr. HF	100 500	VHG-LGENF-100	VHG-PGENF-100 VHG-PGENF-500	VHG-TGENF-500 VHG-TGENF-500
	$(NH_4)_2GeF_6$, H_2O, tr. F-	100 500	VHG-LGEW-100	VHG-PGEW-100 VHG-PGEW-500	N/A N/A
Gold	Au, HCl	100 500		VHG-PAUH-100 VHG-PAUH-500	VHG-TAUH-100 VHG-TAUH-500
Hafnium	$HfCl_2O$, HCl	100 500		VHG-PHFH-100 VHG-PHFH-500	VHG-THFH-100 VHG-THFH-500
Holmium	Ho_2O_3 , HNO_3	100 500		VHG-PHON-100 VHG-PHON-500	VHG-THON-100 VHG-THON-500
Indium	In, HNO_3	100 500	VHG-LINN-100	VHG-PINN-100 VHG-PINN-500	VHG-TINN-100 VHG-TINN-500
Iridium	$IrCl_3$, HCl	100 500	VHG-LIRH-100	VHG-PIRH-100 VHG-PIRH-500	VHG-TIRH-100 VHG-TIRH-500
Iron	$Fe(NO_3)_3 \cdot 9H_2O$ HNO_3	100 500		VHG-PFEN-100 VHG-PFEN-500	VHG-TFEN-100 VHG-TFEN-500
Lanthanum	La_2O_3, HNO_3	100 500		VHG-PLAN-100 VHG-PLAN-500	VHG-TLAN-100 VHG-TLAN-500
Lead	Pb, HNO_3	100 500	VHG-LPBN-100	VHG-PPBN-100 VHG-PPBN-500	VHG-TPBN-100 VHG-TPBN-500
Lithium	Li_2CO_3, HNO_3	100 500	VHG-LLIN-100	VHG-PLIN-100 VHG-PLIN-500	VHG-TLIN-100 VHG-TLIN-500
More Info. (p. 14)	^6Li				
Lutetium	Lu_2O_3, HNO_3	100 500	VHG-LLUN-100	VHG-PLUN-100 VHG-PLUN-500	VHG-TLUN-100 VHG-TLUN-500
Magnesium	Mg, HNO_3	100 500		VHG-PMGN-100 VHG-PMGN-500	VHG-TMGN-100 VHG-TMGN-500
Manganese	Mn, HNO_3	100 500	VHG-LMNN-100	VHG-PMNN-100 VHG-PMNN-500	VHG-TMNN-100 VHG-TMNN-500
Mercury	Hg, HNO_3	100 500	VHG-LHGN-100	VHG-PHGN-100 VHG-PHGN-500	VHG-THGN-100 VHG-THGN-500
Methyl Mercury Chloride	CH_3HgCl More Info. (p. 13)				
Molybdenum	Mo, HNO_3, tr. HF	100 500	VHG-LMONF-100	VHG-PMONF-100 VHG-PMONF-500	VHG-TMONF-100 VHG-TMONF-500
	$(NH_4)_2MoO_4$, NH_4OH	100 500		VHG-PMOZ-100 VHG-PMOZ-500	VHG-TMOZ-100 VHG-TMOZ-500

VHG Tips

Try doing dilutions on a wt./wt. basis; the uncertainty of a balance is much lower than a pipette.

"Trace HF" refers to a small amount of HF added to stabilize some elements that require it. Concentrations are below 0.5%. When "F^-" is stated, the reference is to fluoride as part of a raw material compound. These have F^- at similarly low, dilute levels with no additional fluoride added.

"Matrix-matching" of major sample components can be of great benefit with many spectrometric techniques. Our 1% (10,000µg/mL) standards work well as stock materials for these purposes.

When working with osmium, only mix the standard with water and HCl. Do not use nitric acid. Nitric acid will slowly oxidize the Os to OsO_4, which is volatile and very toxic.

"Fall-out" or precipitation of an analyte will ruin your analysis.

Be especially aware of any mixing of Ag and Cl^-, Ba and SO_4^{-2}, and Mg, Sc (and other lanthanides/actinides) with F^-.

As a rule of thumb, the total concentration of all elements (metals) in a multi-element mixture should be kept below 20,000µg/mL (2%).

Silver is stable in HCl up to 100ppm. Add Ag concentrate to concentrated HCl to effect complexation, then bring to volume with dilute HCl.

Single-Element Standards

A⁺ High Purity Single Element Aqueous Calibration Standards			Concentration (10µg/mL)	Concentration (1,000µg/mL)	Concentration (10,000µg/mL)
Element	**Starting Material, Matrix**	**Vol. (mL)**	**Product No.**	**Product No.**	**Product No.**
Neodymium	Nd_2O_3, HNO_3	100 500		VHG-PNDN-100 VHG-PNDN-500	VHG-TNDN-100 VHG-TNDN-500
Nickel	Ni, HNO_3	100 500	VHG-LNIN-100	VHG-PNIN-100 VHG-PNIN-500	VHG-TNIN-100 VHG-TNIN-500
Niobium	$NbCl_5$, HF	100 500		VHG-PNBF-100 VHG-PNBF-500	VHG-TNBF-100 VHG-TNBF-500
Osmium	$(NH_4)_2OsCl_6$, HCl	100 500		VHG-POSH-100 VHG-POSH-500	N/A N/A
Palladium	Pd, HCl	100 500		VHG-PPDH-100 VHG-PPDH-500	VHG-TPDH-100 VHG-TPDH-500
	Pd, HNO_3	100 500		VHG-PPDN-100 VHG-PPDN-500	VHG-TPDN-100 VHG-TPDN-500
Phosphorus	H_3PO_4, HNO_3	100 500		VHG-PPN-100 VHG-PPN-500	VHG-TPN-100 VHG-TPN-500
Platinum	Pt, HCl	100 500	VHG-LPTH-100	VHG-PPTH-100 VHG-PPTH-500	VHG-TPTH-100 VHG-TPTH-500
Potassium	KNO_3, HNO_3	100 500		VHG-PKN-100 VHG-PKN-500	VHG-TKN-100 VHG-TKN-500
Praseodymium	Pr_6O_{11}, HNO_3	100 500		VHG-PPRN-100 VHG-PPRN-500	VHG-TPRN-100 VHG-TPRN-500
Rhenium	Re, HNO_3	100 500		VHG-PREN-100 VHG-PREN-500	VHG-TREN-100 VHG-TREN-500
Rhodium	$RhCl_3$, HCl	100 500	VHG-LRHH-100	VHG-PRHH-100 VHG-PRHH-500	VHG-TRHH-100 VHG-TRHH-500
Rubidium	Rb_2CO_3, HNO_3	100 500		VHG-PRBN-100 VHG-PRBN-500	VHG-TRBN-100 VHG-TRBN-500
Ruthenium	$RuCl_3$, HCl	100 500		VHG-PRUH-100 VHG-PRUH-500	VHG-TRUH-100 VHG-TRUH-500
Samarium	Sm_2O_3, HNO_3	100 500		VHG-PSMN-100 VHG-PSMN-500	VHG-TSMN-100 VHG-TSMN-500
Scandium More Info. (p. 41)	Sc_2O_3, HNO_3	100 500	VHG-LSCN-100	VHG-PSCN-100 VHG-PSCN-500	VHG-TSCN-100 VHG-TSCN-500
Selenium	Se, HNO_3	100 500	VHG-LSEN-100	VHG-PSEN-100 VHG-PSEN-500	VHG-TSEN-100 VHG-TSEN-500
More Info. (p.13)	Se^{+4}, Se^{+6}				
Silica More Info. (p. 20)					
Silicon	$(NH_4)_2SiF_6$, H_2O, tr. F^-	100 500		VHG-PSIW-100 VHG-PSIW-500	VHG-TSIW-100 VHG-TSIW-500
Silver	Ag, HNO_3	100 500	VHG-LAGN-100	VHG-PAGN-100 VHG-PAGN-500	VHG-TAGN-100 VHG-TAGN-500
Sodium	Na_2CO_3, HNO_3	100 500		VHG-PNAN-100 VHG-PNAN-500	VHG-TNAN-100 VHG-TNAN-500
Strontium	$Sr(NO_3)_2$, HNO_3	100 500	VHG-LSRN-100	VHG-PSRN-100 VHG-PSRN-500	VHG-TSRN-100 VHG-TSRN-500
Sulfur	$(NH_4)_2SO_4$, H_2O	100 500		VHG-PSW-100 VHG-PSW-500	VHG-TSW-100 VHG-TSW-500
Tantalum	$TaCl_5$, HF	100 500		VHG-PTAF-100 VHG-PTAF-500	VHG-TTAF-100 VHG-TTAF-500

Single-Element Standards

A+ High Purity Single Element Aqueous Calibration Standards			Concentration (10µg/mL)	Concentration (1,000µg/mL)	Concentration (10,000µg/mL)
Element	**Starting Material, Matrix**	**Vol. (mL)**	**Product No.**	**Product No.**	**Product No.**
Tellurium	Te, HCl	100 500		VHG-PTEH-100 VHG-PTEH-500	VHG-TTEH-100 VHG-TTEH-500
	Te, HNO_3	100 500		VHG-PTEN-100 VHG-PTEN-500	VHG-TTEN-100 VHG-TTEN-500
Terbium	Tb_4O_7, HNO_3	100 500	VHG-LTBN-100	VHG-PTBN-100 VHG-PTBN-500	VHG-TTBN-100 VHG-TTBN-500
Thallium	Tl, HNO_3	100 500		VHG-PTLN-100 VHG-PTLN-500	VHG-TTLN-100 VHG-TTLN-500
Thorium	$Th(NO_3)_4$, HNO_3	100 500		VHG-PTHN-100 VHG-PTHN-500	VHG-TTHN-100 VHG-TTHN-500
Thulium	Tm_2O_3, HNO_3	100 500		VHG-PTMN-100 VHG-PTMN-500	VHG-TTMN-100 VHG-TTMN-500
Tin	Sn, HCl	100 500	VHG-LSNH-100	VHG-PSNH-100 VHG-PSNH-500	VHG-TSNH-100 TSNH-500
	Sn, HNO_3, tr. HF	100 500	VHG-LSNNF-100	VHG-PSNNF-100 VHG-PSNNF-500	VHG-TSNNF-100 VHG-TSNNF-500
Titanium	Ti, HNO_3, tr. HF	100 500	VHG-LTINF-100	VHG-PTINF-100 VHG-VHG-PTINF-500	VHG-TTINF-100 VHG-TTINF-500
	$(NH_4)_2TiF_6$, H_2O, tr. F -	100 500		VHG-PTIW-100 VHG-PTIW-500	VHG-TTIW-100 VHG-TTIW-5000
Tungsten	W, HNO_3, tr. HF	100 500		VHG-PWNF-100 VHG-PWNF-500	VHG-TWNF-100 VHG-TWNF-500
	$(NH_4)_2WO_4$, H_2O	100 500		VHG-PWW-100 VHG-PWW-500	VHG-TWW-100 VHG-TWW-500
Uranium	U_3O_8, HNO_3	100 500	VHG-LUN-100	VHG-PUN-100 VHG-PUN-500	VHG-TUN-100 VHG-TUN-500
Vanadium	V_2O_5, HNO_3	100 500	VHG-LVN-100	VHG-PVN-100 VHG-PVN-500	VHG-TVN-100 VHG-TVN-500
Ytterbium	Yb_2O_3, HNO_3	100 500		VHG-PYBN-100 VHG-PYBN-500	VHG-TYBN-100 VHG-TYBN-500
Yttrium	Y_2O_3, HNO_3	100 500	VHG-LYN-100	VHG-PYN-100 VHG-PYN-500	VHG-TYN-100 VHG-TYN-500
Zinc	Zn, HNO_3	100 500	VHG-LZNN-100	VHG-PZNN-100 VHG-PZNN-500	VHG-TZNN-100 VHG-TZNN-500
Zirconium	$ZrCl_2O$, HCl	100 500		VHG-PZRH-100 VHG-PZRH-500	VHG-TZRH-100 VHG-TZRH-500
	$N_2O_7Zr \cdot xH_2O$, HNO_3	100 500		VHG-PZRN-100 VHG-PZRN-500	VHG-TZRN-100 VHG-TZRN-500

All of our A+ single-element standards are available in 250 mL bottles upon request. Please inquire through your local sales office.

NIST High Performance ICP-AES Protocol

VHG Labs' A+ Standards are certified to provide the highest possible confidence.

As part of our long-term commitment to continuous improvement, VHG participated in original research conducted by the National Institute of Standards and Technology (NIST) in 1999. The primary goal of this research was to provide a more accurate instrument-based method- ology for metals determinations. An additional goal of the NIST method was to have a complete and unbroken chain of traceability to standard reference materials. The result of this work is the **NIST High Performance ICP-AES method**[1] .

The NIST High Performance Method is the Core of VHG's A+ Single Element Standard Product Line

It is widely accepted that standards prepared gravimetrically in the classical manner provide reasonable concentration accuracy. Many commercial vendors stop there. At VHG Labs, we go several steps further — the NIST protocol prescribes that four independent dilutions of the gravimetric standard are made at a concentration optimized for the ICP-AES system. At the same time, four additional, independent preparations of a reference standard are made. We utilize NIST 300-Series SRM calibrants; thus providing direct, NIST SRM traceable certification. The eight (total) samples also have a method-specified internal reference spike added to provide additional control measurements for quantitative and statistical analysis. Once rigorous criteria are met for the array-based ICP-AES instrument, over 800 measurements are obtained on these samples. The raw data is processed with a program created by NIST and provides extremely accurate, traceable concentration results, as well as a meaningful expanded uncertainty that is also directly traceable to the NIST SRM. For additional technical information, please visit our website.

A+ Standards feature:

- Rigorous quality control
- Highest purity with minimal traces
- Complete traceability to NIST SRM
- Low, statistically meaningful, 'expanded uncertainty' provided on COA
- Superior packaging in pre-cleaned containers

Your analysis ultimately depends on the standard chosen to calibrate your instrument. Compromising on quality should not be an option.

1. M. Salit, G. Turk et. Al, Anal. Chem., 2001, 73, 4821-4829.

VHG Labs Certificate of Analysis

Single-Element Aqueous CRM

Silver (Ag) – 1000 µg/mL

Matrix: 5% HNO_3

Product #: VHG-PAGN-100 Lot #: Sample

Element	Certified Concentration & Uncertainty	
Ag	1001	± 3 µg/mL (w/v)
	985	± 3 µg/g (w/w)

Intended Use: This solution is intended for use as a certified reference material or calibration standard for inductively coupled plasma optical emission spectroscopy (ICP-OES), inductively coupled plasma mass spectrometry (ICP-MS), flame or furnace atomic absorption spectroscopy (AA or GFAA), x-ray fluorescence spectroscopy (XRF), and other techniques for elemental analysis.

Certification & Traceability: VHG CRMs are manufactured and certified under a quality management system that is accredited to ISO 9001, **ISO Guide 34** and ISO/IEC 17025. This CRM was prepared to a nominal concentration of 1000µg/mL by gravimetric methods using 99.999% pure silver (Ag) metal dissolved in high purity nitric acid (HNO_3) and diluted with filtered (0.22µm), 18 M-ohm deionized water. The balances used in the preparation of VHG CRMs are calibrated regularly with traceability to NIST. All volumetric dilutions are performed in Class A calibrated glassware. The certified concentration and uncertainty were determined by VHG Labs using the "High Performance ICP-OES" protocol developed by NIST (visit www.vhglabs.com for further information) and both the certified concentration and uncertainty values are traceable to **NIST SRM 3151, lot #992212**. The uncertainty associated with the certified concentration represents the expanded uncertainty at the 95% confidence level using a coverage factor of k=2.

Uncertified Values: ICP-MS was used to determine trace metal concentrations for this product (nd = not determined).

Trace Concentrations (µg/L)

Ag	Major	Ce	<0.2	Gd	<0.2	Lu	<0.2	Pb	<1	Se	<1	Tl	<0.5
Al	<1	Co	<0.5	Ge	<0.5	Mg	<5	Pd	<0.5	Si	<50	Tm	<0.2
As	<1	Cs	<0.5	Hf	<0.2	Mn	<2	Pr	<0.2	Sm	<0.2	U	<0.5
Au	<0.5	Cr	<0.5	Hg	<0.5	Mo	<0.5	Pt	<0.5	Sn	<0.5	V	<0.5
B	<2	Cu	<1	Ho	<0.2	Na	<10	Rb	<0.5	Sr	<1	W	<0.5
Ba	<1	Dy	<0.2	In	nd	Nb	<0.5	Re	<0.2	Ta	<0.5	Y	<0.5
Be	<0.5	Er	<0.2	Ir	<0.2	Nd	<0.2	Rh	<0.5	Tb	<0.5	Yb	<0.2
Bi	<0.2	Eu	<0.2	K	<25	Ni	<1	Ru	<0.5	Te	<1	Zn	<2
Ca	<25	Fe	<10	La	<0.5	Os	<0.5	Sb	<0.5	Th	<0.5	Zr	<0.5
Cd	<0.5	Ga	<0.5	Li	<1	P	<100	Sc	<5	Ti	<1		

Instructions for Use: We recommend that the solution be thoroughly mixed by repeated shaking or swirling of the bottle immediately prior to use. To achieve the highest accuracy the analyst should: (1) use only pre-cleaned containers and transferware, (2) not pipette directly from the CRM's original container, (3) use a minimum sub-sample size of 500µL, (4) make dilutions using calibrated balances or certified volumetric class A flasks and pipettes, (5) dilute with the same matrix as the original CRM, and (6) never pour used product back into the original container. The solution should be kept tightly capped and stored under normal laboratory conditions. Do not freeze, heat, or expose to direct sunlight. Minimize exposure to moisture or high humidity.

Period of Validity: VHG ensures the accuracy of this solution for **18 Months** from the Certification date shown below, provided the instructions for use are followed. During the period of validity, the purchaser will be notified if this product is recalled due to any significant changes in the stability of the solution.

ACCREDITED

REFERENCE MATERIALS
PRODUCER CERT #2848.02
CHEMICAL TESTING
CERT #2848.01

Susan Evans Norris, Certifying Officer

Certification Date

276 Abby Road, Manchester, NH 03103 USA
(603) 622-7660 Fax: (603) 622-5180 www.vhglabs.com

ISO 9001
ISO Guide 34
ISO/IEC 17025
ISO/IEC 17043

VHG Tips

^{6}Li is a well documented internal standard for ICP-MS. But did you know that other isotopic materials can be used as effective internal standards? Example: Try ^{61}Ni for the important transition metal range.

Speciation Standards

Is elemental concentration measurement enough? Analysis of environmental, biological and foodstuff samples now often involves chromatographic separation of certain elements according to their chemical species followed by detection using AA, ICP-AES or ICP-MS. In some cases, simple low pressure chromatography is adequate, while others require full HPLC separations followed by elemental detection.

Speciation Single-Element Standards

Element	Analyte	Matrix	Concentration (µg/mL)	Vol. (mL)	Product No.
Arsenic	As^{+3} (from As_2O_3)	2% HCl	100	50 100	VHG-SPAS3-50 VHG-SPAS3-10
	As^{+5} (from As_2O_5)	H_2O	100	50 100	VHG-SPAS5W-50 VHG-PAS5W-100
Chromium	Cr^{+3} (from $Cr(NO_3)_3$)	2% HNO_3	100	50 100	VHG-PCR3-50 VHG-SPCR3-100
	Cr^{+6} (from Na_2CrO_4)	H_2O	100	50 100	VHG-SPCR6-50 VHG-SPCR6-100
	Cr^{+6} (from Na_2CrO_4)	H_2O	1000	100 500	VHG-PCR6W-100 VHG-PCR6W-500
Selenium	Se^{+4} (from H_2SeO_3)	2% HNO_3	100	50 100	VHG-SPSE4-50 VHG-SPSE4-100
	Se^{+6} (from H_2SeO_4)	H_2O	100	50 100	VHG-SPSE6-50 VHG-SPSE6-100

Organic Mercury Standard

Element	Analyte	Matrix	Concentration	Vol. (mL)	Product
Organic Mercury	$CH_3Hg(II)Cl$ Methyl Mercury Chloride	H_2O	1000µg/mL	25	VHG-MMC-25

We can prepare custom standards of Methyl Mercury Chloride for your convenience.

Isotopic Standards

Mass spectrometry, in particular ICP-MS, is a powerful technique to measure elemental isotopes. The measurement of individual isotopes can reveal important information about the origin of the element in the sample. Isotope Dilution Mass Spectrometry (IDMS) is often touted as being the most accurate mode of sample 'unknown' analysis.

VHG offers a selection of isotope reference materials. These are non-radioactive, "stable" isotopes and can be handled like any aqueous metal standard. Each standard comes with a Certificate of Analysis (COA) that documents the certified isotopic abundances. Please inquire with requests for isotopes not found here.

Isotopic Single-Element Standards

Element	Matrix	Total Elemental Concentration (µg/mL)	Size (mL)	Product No.
Boron 10, ^{10}B	2% HNO_3	100	50	VHG-LIS10BN-50
Boron 11, ^{11}B	H_2O	100	50	VHG-LIS11B-50
Cadmium 106, ^{106}Cd	2% HNO_3	10	50	VHG-IS106CD-50
Chromium 50, ^{50}Cr	2% HNO_3	10	50	VHG-LIS50CR-50
Copper 65, ^{65}Cu	2% HNO_3	10	50	VHG-LIS65CU-50
Iron 57, ^{57}Fe	2% HNO_3	10	50	VHG-LIS57FE-50
Lead, "Natural" Pb	2% HNO_3	100	50	VHG-LISPB1-50
Lithium 6, ^{6}Li	2% HNO_3	100	100	VHG-LIS6LIZ-100
Neodymium, Natural Nd	2% HNO_3	10	50	VHG-LISND-50
Nickel 61, ^{61}Ni	2% HNO_3	10	50	VHG-LIS61NI-50
Selenium 78, ^{78}Se	2% HNO_3	10	50	VHG-LIS78SE-50
Selenium 82, ^{82}Se	2% HNO_3	10	50	VHG-LIS82SE-50
Strontium, Natural Sr	2% HNO_3	100	50	VHG-LISSR-50
Strontium 86, ^{86}Sr	2% HNO_3	10	50	VHG-LIS86SR-50
Tin 122, ^{122}Sn	2% HNO_3, tr. HF	10	50	VHG-IS122SN-50
Thallium 203, ^{203}Tl	2% HNO_3	10	50	VHG-IS203TL-50
Zinc 68, ^{68}Zn	2% HNO_3	10	50	VHG-LIS68ZN-50

We can supply other elements and/or other isotopes of the elements listed above. Contact your local sales office to inquire.

VHG Tips

To determine the mass of matrix modifier added to the furnace, multiply the concentration of the modifier by 0.005 for 5µL aliquots or 0.02 for 20µL aliquots.

Atomic Absorption Standards

- Suitable for all spectrometric techniques
- Manufactured from high purity raw materials
- Higher accuracy and lower uncertainty than competitive standards
- Certificate of Analysis provided with each standard
- Stocked for prompt shipment

AA Aqueous Calibration Standards
Concentration: (1,000µg/mL)

Element	Matrix	Vol. (mL)	Product No.
Aluminum Al	HCl	100 500	VHG-AALH-100 VHG-AALH-500
Antimony Sb	HCl	100 500	VHG-SBH-100 VHG-SBH-500
Arsenic As	HNO_3	100 500	VHG-ASN-100 VHG-ASN-500
Barium Ba	HNO_3	100 500	VHG-BAN-100 VHG-BAN-500
Beryllium Be	HNO_3	100 500	VHG-BEN-100 VHG-BEN-500
Bismuth Bi	HNO_3	100 500	VHG-ABIN-100 VHG-ABIN-500
Boron B	H_2O	100 500	VHG-ABW-100 VHG-ABW-500
Cadmium Cd	HNO_3	100 500	VHG-CDN-100 VHG-CDN-500
Calcium Ca	HNO_3	100 500	VHG-CAN-100 VHG-CAN-500
Chromium Cr	HCl	100 500	VHG-CRH-100 VHG-CRH-500
Cobalt Co	HNO_3	100 500	VHG-CON-100 VHG-CON-500
Copper Cu	HNO_3	100 500	VHG-CUN-100 VHG-CUN-500
Gold Au	HCl	100 500	VHG-AUH-100 VHG-AAUH-500
Iron Fe	HNO_3	100 500	VHG-AFEN-100 VHG-AFEN-500
Lead Pb	HNO_3	100 500	VHG-PBN-100 VHG-PBN-500
Lithium Li	HNO_3	100 500	VHG-ALIN-100 VHG-ALIN-500
Magnesium Mg	HNO_3	100 500	VHG-MGN-100 VHG-MGN-500

AA Aqueous Calibration Standards
Concentration: (1,000µg/mL)

Element	Matrix	Vol. (mL)	Product No.
Manganese Mn	HNO_3	100 500	VHG-MNN-100 VHG-MNN-500
Mercury Hg	HNO_3	100 500	VHG-HGN-100 VHG-HGN-500
Molybdenum Mo	HNO_3, tr. HF	100 500	VHG-AMONF-100 VHG-AMONF-500
Nickel Ni	HNO_3	100 500	VHG-ANIN-100 VHG-ANIN-500
Palladium Pd	HCl	100 500	VHG-APDH-100 VHG-APDH-500
Platinum Pt	HCl	100 500	VHG-APTH-100 VHG-APTH-500
Potassium K	HNO_3	100 500	VHG-AKN-100 VHG-AKN-500
Selenium Se	HNO_2	100 500	VHG-ASEN-100 VHG-ASEN-5000
Silicon Si	H_2O, tr. F^-	100 500	VHG-ASIW-100 VHG-ASIW-500
Silver Ag	HNO_3	100 500	VHG-AAGN-100 VHG-AAGN-500
Sodium Na	HNO_3	100 500	VHG-ANAN-100 VHG-ANAN-500
Strontium Sr	HNO_3	100 500	VHG-ASRN-100 VHG-ASRN-500
Thallium Tl	HNO_3	100 500	VHG-ATLN-100 VHG-ATLN-500
Tin Sn	HCl	100 500	VHG-ASNH-100 VHG-ASNH-500
Titanium Ti	HNO_3, tr. HF	100 500	VHG-ATINF-100 VHG-ATINF-500
Vanadium V	HNO_3	100 500	AVN-100 AVN-5000
Zinc Zn	HNO_3	100 500	AZNN-100 AZNN-500

Matrix Modifiers, Ionization Buffers and Releasing Agents

- Rigorous quality control of AA products
- Certificate of analysis supplied with each
- Matrix Modifier purity checked for over 70 elements

GFAA Matrix Modifiers

Modifer	Matrix	Volume (mL)	Product No.
Ammonium Phosphate	10% $NH_4H_2PO_4$, 2% HNO_3	100	VHG-MAP10P-100
Magnesium Nitrate	1% $Mg(NO_3)_2$, 2% HNO_3	100	VHG-MGN1P-100
Nickel Nitrate	1% $Ni(NO_3)_2$, 2% HNO_3	100	VHG-MNIN1P-100
Palladium Nitrate	0.1% Pd, 5% HNO_3 1% Pd, 5% HNO_3	100 100	VHG-MPDN1K-100 VHG-MPDN1P-100

Pre-Mixed GFAA Matrix Modifiers

Modifer	Matrix	Volume (mL)	Product No.
Pd + Mg	750µg/mL Pd & 500µg/mL $Mg(NO_3)_2$, 2% HNO_3	250	VHG-MPM1-250
Pd + Mg	1000µg/mL Pd & 600µg/mL $Mg(NO_3)_2$, 2% HNO_3	250	VHG-MPM2-250
Amm. Phos + Mg	10mg/mL $NH_4H_2PO_4$ & 600µg/mL $Mg(NO_3)_2$, 2% HNO_3	250	VHG-MPM3-250

Ionization Buffers

Material	Matrix	Volume (mL)	Product No.
Lithium Nitrate	1% Li (from carbonate), 5% HNO_3	100	VHG-MLIN1P-100
Cesium Nitrate	1% Cs (from carbonate), 5% HNO_3	100	VHG-MCSN1P-100

Lanthanum Releasing Agents

Material	Matrix	Volume (mL)	Product No.
Lanthanum Chloride	1% La (from oxide), 2% HCl	100	VHG-MLAH1P-100
Lanthanum Nitrate	1% La (from oxide), 5% HNO_3	100	VHG-MLAN1P-100

See Page 73 for Hydride and Cold Vapor AA Supplies.

Single-Element Standards
A+ Single-Element
Speciation
Isotopic
▶ Atomic Absorption
Ion Chromatography and Wet Chemistry Standards
Multi-Element Standards for ICP-AES and ICP-MS

VHG Tips

We also prepare custom IC standards to your specifications. Call VHG Labs' Customer Service to submit a request.

Gravimetric Factors for IC Standards:
1,000µg/mL NO_3^-=226mg/L N
1,000µg/mL NO_2^-=305mg/L N
1,000µg/mL PO_4^{-3}=326mg/L P
1,000µg/mL SO_4^{-2}=334mg/L S

Ion Chromatography Standards

- Prepared from high purity raw materials and 18Mohm DI water
- Manufactured in our ISO 9001 facility
- Accompanied by NIST-traceable COA

Anions			Concentration (100µg/mL)	Concentration (1,000µg/mL)	Concentration (10,000µg/mL)
Ion	**Raw Material, Matrix**	**Vol. (mL)**	**Product No.**	**Product No.**	**Product No.**
Acetate $CH_3CO_2^-$	CH_3CO_2Na, H_2O	100 500		VHG-IACET-100 VHG-IACET-500	 VHG-I1PACET-500
Bromate BrO_3^-	$NaBrO_3$, H_2O	100 500		VHG-IBRO3-100 VHG-IBRO3-500	
Bromide Br^-	KBr, H_2O NH_4Br, H_2O	100 500 100 500		VHG-IBR-100 VHG-IBR-500	 VHG-I1PBR-500 VHG-I1PABR-100 VHG-I1PABR-500
Chlorate ClO_3^-	$NaClO_3$, H_2O	100 500		VHG-ICLO3-100 VHG-ICLO3-500	
Chloride Cl^-	KCl, H_2O NH_4Cl, H_2O	100 500 100 500	VHG-ICL100-500	VHG-ICL1K-100 VHG-ICL1K-500	VHG-I1PCL-100 VHG-I1PCL-500 VHG-I1PACL-100 VHG-I1PACL-500
Chlorite ClO_2^-	$NaClO_2$, H_2O	100 500		VHG-ICLO2-100 VHG-ICLO2-500	
Chromate CrO_4^{-2}	K_2CrO_4, H_2O	100 500		VHG-ICRO-100 VHG-ICRO-500	VHG-I1PCRO-100 VHG-I1PCRO-500
Dichromate $Cr_2O_7^{-2}$	$Na_2Cr_2O_7$, H_2O	100 500		VHG-IDCRO-100 VHG-IDCRO-500	VHG-I1PDCRO-100 VHG-I1PDCRO-500
Fluoride F^-	NaF, H_2O	100 500	VHG-IF100-500	VHG-IF1K-100 VHG-IF1K-500	 VHG-I1PF-500
Formate HCO_2^-	HCO_2Na, H_2O	100 500		VHG-IFORM-100 VHG-IFORM-500	
Glycolate $C_2H_3O_3^-$	$NaC_2H_3O_3$, H_2O	100 500		VHG-IGLY-100 VHG-IGLY-500	
Iodide I^-	NaI, H_2O NH_4I, H_2O	100 500 100 500		VHG-II-100 VHG-II-500	 VHG-I1PI-500 VHG-I1PAI-100 VHG-I1PAI-500
Molybdate MoO_4^{-2}	Na_2MoO_4, H_2O	100 500	VHG-IMOLB100-500	VHG-IMOLB-100 VHG-IMOLB-500	
Nitrate NO_3^-	$NaNO_3$, H_2O	100 500		VHG-INO3-100 VHG-INO3-500	VHG-I1PNO3-100 VHG-I1PNO3-500
Nitrate as N NO_3^-	$NaNO_3$, H_2O	100 500		VHG-INO3N-100 VHG-INO3N-500	VHG-I1PNO3N-100 VHG-I1PNO3N-500
Nitrite NO_2^-	$NaNO_2$, H_2O	100 500		VHG-INO2-100 VHG-INO2-500	VHG-I1PNO2-100 VHG-I1PNO2-500
Nitrite as N NO_2^-	$NaNO_2$, H_2O	100 500		VHG-INO2N-100 VHG-INO2N-500	VHG-I1PNO2N-100 VHG-I1PNO2N-500
Oxalate $C_2O_4^{-2}$	$Na_2C_2O_4$, H_2O	100 500		VHG-IOXAL-100 VHG-IOXAL-500	 VHG-I1POXAL-500
Perchlorate ClO_4^-	$NaClO_4$, H_2O	100 500		VHG-ICLO4-100 VHG-ICLO4-500	 VHG-I1PCLO4-500
Phosphate PO_4^{-3}	KH_2PO_4, H_2O	100 500		VHG-IPO4-100 VHG-IPO4-500	 VHG-I1PPO4-500
Phosphate as P, PO_4^{-3}	KH_2PO_4, H_2O	100 500		VHG-IPO4P-100 VHG-IPO4P-500	 VHG-I1PPO4P-500
Silica SiO_2	Na_2SiO_3, H_2O	100 500	VHG-ISIO2100-500	VHG-ISIO21K-100 VHG-ISIO21K-500	
Sulfate SO_4^{-2}	K_2SO_4, H_2O	100 500	VHG-ISO4100-500	VHG-ISO41K-100 VHG-ISO41K-500	VHG-I1PSO4-100 VHG-I1PSO4-500

Ion Chromatography Standards

Single-Element Standards
Ion Chromatography and Wet Chemistry Standards
▶ Ion Chromatography
Wet Chemistry
QC Checks for Water
Multi-Element Standards for ICP-AES and ICP-MS

Cations			Concentration (100µg/mL)	Concentration (1,000µg/mL)	Concentration (10,000µg/mL)
Ion	**Raw Material, Matrix**	**Vol. (mL)**	**Product No.**	**Product No.**	**Product No.**
Ammonium NH_4^+	$(NH_4)_2SO_4$, H_2O	100 500	 VHG-INH4100-500	VHG-INH41K-100 VHG-INH41K-500	VHG-I1PNH4-100 VHG-I1PNH4-500
Barium Ba^{+2}	$Ba(NO_3)_2$, dil. HNO_3	100 500		VHG-IBA-100 VHG-IBA-500	
Calcium Ca^{+2}	$CaCO_3$, dil. HNO_3	100 500		VHG-ICA-100 VHG-ICA-500	
Ethanolamine	$HOCH_2CH_2NH_2$, H_2O	100 500		VHG-IETA1K-100 VHG-IETA1K-500	 VHG-IETA1P-500
Lithium Li^+	Li_2CO_3, dil. HNO_3	100 500	 VHG-ILI100-500	VHG-ILI1K-100 VHG-ILI1K-500	
Magnesium Mg^{+2}	Mg, dil. HNO_3	100 500		VHG-IMG-100 VHG-IMG-500	
Potassium K^+	KNO_3, dil. HNO_3	100 500		VHG-IK-100 VHG-IK-500	
Sodium Na^+	Na_2CO_3, dil. HNO_3	100 500		VHG-INAN-100 VHG-INAN-500	
	NaCl, H_2O	100 500	 VHG-INAW100-500	VHG-INAW1K-100 VHG-INAW1K-500	

Ammonia				
Ion	**Raw Material, Matrix**	**Concentration (µg/mL)**	**Volume (mL)**	**Product No.**
Ammonia NH_3	$(NH_4)_2SO_4$, H_2O	1	100 500	VHG-INH3-1-100 VHG-INH3-1-500
Ammonia NH_3	$(NH_4)_2SO_4$, H_2O	10	100 500	VHG-INH3-10-100 VHG-INH3-10-500
Ammonia NH_3	$(NH_4)_2SO_4$, H_2O	100	100 500	VHG-INH3-100-100 VHG-INH3-100-500
Ammonia NH_3	$(NH_4)_2SO_4$, H_2O	1000	100 500	VHG-INH3-1K-100 VHG-INH3-1K-500
Ammonia NH_3	$(NH_4)_2SO_4$, H_2O	10,000	100 500	VHG-INH3-1P-100 VHG-INH3-1P-500

For other anion and cation single-element standards at 100µg/mL or 1%, please inquire.

VHG Tips

Use only glass containers for IC multi-element standards containing nitrite ion in order to maximize shelf life.

Call us if you'd like "ready-to-go" cubitainers of eluent solutions.

Eluents

Eluent Concentrates (ready to dilute by 100 for most applications)			
Product	**Description**	**Size**	**Product No.**
Eluent 1	0.18M Na_2CO_3 and 0.17M $NaHCO_3$	500mL	VHG-IELUENT1-500
Eluent 3	0.5M Na_2CO_3	500mL	VHG-IELUENT3-500
Eluent 4	0.5M $NaHCO_3$	500mL	VHG-IELUENT4-500
Methanesulfonic Acid	CH_3SO_3H	500g	VHG-JMSA-500G

Multi-Ion Standards

For Ion Chromatography

Multi-Anion Standards				
Ions	**Volume (mL)**	**Conc. (µg/mL)**	**Matrix**	**Product No.**
Multi-Anion Standard 1	100	100	H_2O	VHG-ICM1-100
F^-, Cl^-, Br^-, NO_3^-, PO_4^{-3}, SO_4^{-2}				
Multi-Anion Standard 2	100	100	H_2O	VHG-ICM2-100
F^-, Cl^-, SO_4^{-2}				
Multi-Anion Standard 3	100		H_2O	VHG-ICM3-100
F^-		20		
Cl^-		30		
NO_3^-		100		
PO_4^{-3}, SO_4^{-2}		150		
Multi-Anion Standard 4	**100**		H_2O	VHG-ICM4-100
F^-		100		
Cl^-		200		
Br^-, NO_3^-, SO_4^{-2}		400		
PO_4^{-3}		600		
Multi-Anion Standard 7A	100	1000	H_2O	VHG-ICM7A-100
F^-, Cl^-, NO_3^- as N, Br^-, SO_4^{-2}, PO_4^{-3} as P				
Multi-Anion Standard 8	100	1000	H_2O	VHG-ICM8-100
Cl^-, F^-, NO_3^-, SO_4^{-2}				

Multi-Cation Standards				
Ions	**Volume (mL)**	**Conc. (µg/mL)**	**Matrix**	**Product No.**
Multi-Cation Standard 1	100	100	dil. HNO_3	VHG-ICM5A-100
Ca^{+2}		500		
K^+		500		
Li^+		50		
Mg^{+2}		250		
Na^+		200		
NH_4^+		250		

Wet Chemistry Standards

For Water Analysis

Standard Tests for Waters

Analyte	Concentration	Matrix	Size	Product No.
Biochemical Oxygen Demand (BOD)	200mg/L	H_2O, tr. HCl	100mL	VHG-BOD200A-100
Biochemical Oxygen Demand (BOD) Seeds	N/A	N/A	50 Capsules, 100mg each	VHG-BODSEED-50
Boron Titration Standard	1000mg/L	H_2O	500mL	VHG-B1K-500
Chemical Oxygen Demand (COD)	1000mg/L	H_2O, 0.5% H_2SO_4	100mL	VHG-COD1K-100
Conductivity (from NaCl)	100µmho/cm	H_2O	1 Liter	VHG-CONDNA100-1L
	1000µmho/cm			VHG-CONDNA1K-1L
	10,000µmho/cm			VHG-CONDNA10K-1L
Cyanide, CN^- (from KCN)	1000mg/L	0.1% NaOH	100mL	VHG-CN-100
		500mL		VHG-CN-500
Hydrazine, N_2H_4 (from N_2H_4-2HCl)	100mg/L	1% Acetic Acid	100mL	VHG-IHYD100-100
		500mL		VHG-IHYD100-500
	1000mg/L	100mL		VHG-IHYD1K-100
		500mL		VHG-IHYD1K-500
Methylene Blue Active Substance (MBAS)	1000mg/L	H_2O, tr.H_2SO_4	100mL	VHG-MBAS-100
Silica, SiO_2 (from Na_2SiO_3)	100mg/L	H_2O	500mL	VHG-ISIO2100-500
	1000mg/L		100mL	VHG-ISIO21K-100
			500mL	VHG-ISIO21K-500
Total Kjeldahl Nitrogen - TKN (from glycine)	1000mg/L	1% HCl	100mL	VHG-TOTKJN1K-100
			500mL	VHG-TOTKJN1K-500
Total Organic Carbon - TOC (from $KHC_8H_4O_4$)	100mg/L	H_2O	500mL	VHG-TOC100-500
	1000mg/L		100mL	VHG-TOC1K-100
			500mL	VHG-TOC1K-500

pH Buffer Standards

Product Name	Color Code	Matrix	Size	Product No.
pH 4.01 Buffer Standard	Red	H_2O	500mL	VHG-PH4-500
pH 7.00 Buffer Standard	Yellow	H_2O	500mL	VHG-PH7-500
pH 10.01 Buffer Standard	Blue	H_2O	500mL	VHG-PH10-500

VHG Tips

Our QC check samples are NIST-traceable and verified by an interlaboratory program. Laboratories using these products as part of their internal quality program can monitor their performance against both EPA acceptance criteria and results from other well-respected laboratories.

QC reference standards are useful as controls and/or to represent your real-world samples for method development.

WS and WP certified reference standards offer great values too! Many ship as concentrates in screw-topped vials, which can then be diluted to yield a liter or more. Exact directions are included on the Certificate of Analysis.

QC Check Samples for Water Supply

- Designed for analyses of drinking water, ground water, and clean surface water
- Tested in compliance with appropriate US EPA, NIST, NELAC, and ISO protocols
- Certificate of Analysis includes two sets of acceptance limits to evaluate your performance
- Traceable to NIST SRMs (whenever available)
- For use in analyzing alongside US EPA, NELAC or state accreditation PT samples or as part of your own internal quality control program

Water Supply (WS) Check Samples

Product & Range	Vial Size	Yields	Product No.
WS Cyanide Total Cyanide: 0.1-0.5 mg/L	15mL	2 L	QWSCN-15
WS Inorganics Alkalinity as $CaCO_3$: 25-200mg/L Chloride: 20-160mg/L Fluoride: 1-8mg/L Nitrate as N: 3-10mg/L Nitrate + Nitrite, as N: 3-10mg/L Potassium: 10-40mg/L Sodium: 10-400mg/L Specific Conductance at 25°C: 130-1300µmhos/cm Sulfate: 25-250mg/L Total Filterable Residue (TDS) at 180°C: 100-1000mg/L	500mL	N/A	QWSIN-500
WS Hardness Calcium: 30-90mg/L Calcium Hardness as $CaCO_3$: 75-375mg/L Total Hardness as $CaCO_3$: 83-307mg/L Magnesium: 2-20mg/L Sodium: 12-24mg/L	250mL	N/A	QWSHRD-250
WS o-Phosphate Nutrients ortho-Phosphate as P: 0.5-5.5mg/L	15mL	2 L	QWSONUT-15
WS Nitrite Nitrite as N: 0.4-2mg/L	15mL	2 L	QWSNO2-15
WS pH pH: 5-10 units	250mL	N/A	QCPH-250
WS Residual Chlorine Total Residual Chlorine: 0.5-3mg/L Free Residual Chlorine: 0.5-3mg/L	2mL	2 L	QWSRCL-2
WS Solids Total Filterable Residue (TDS) at 180°C: 200-450mg/L Total Solids: 223-550mg/L Non-Filterable Residue (TSS) at 105°C: 23-100mg/L	23mL	1 L	QWSSOL-23
WS Organic Carbon Total Organic Carbon (TOC): 1.2-4.9mg/L Dissolved Organic Carbon (DOC): 1.2-4.9mg/L	15mL	1 L	QWSOC-15
WS Turbidity Turbidity: 0.5-8 NTU	15mL	1 L	QWSTURB-15

For Trace Metals Check Samples, see Page 29

QC Check Samples for Water Pollution

- Designed for analyses of waste water, surface water, and contaminated ground water
- Tested in compliance with appropriate US EPA, NIST, NELAC, and ISO protocols
- Certificate of Analysis includes two sets of acceptance limits to evaluate your performance
- Traceable to NIST SRMs (whenever available)
- For use in analyzing alongside US EPA, NELAC or state accreditation PT samples or as part of your own internal quality control program

Water Pollution (WP) Check Samples

Product & Range	Vial Size	Yields	Product No.
WP Cyanide Total Cyanide: 0.1-1mg/L	15mL	2 L	VHG-QWPCN-15
WP Demand 5-day BOD: 15-250mg/L Carbonaceous BOD: 15-250mg/L COD: 30-250mg/L TOC: 6-100mg/L	15mL	2 L	VHG-QWPDEM-15
WP Hexavalent Chromium Cr^{+6}: 45-880µg/L	15mL	2 L	VHG-QWPCR6-15
WP Minerals Total Alkalinity as $CaCO_3$: 10-120mg/L Chloride: 35-275mg/L Fluoride: 0.3-4mg/L Potassium: 4-40mg/L Sodium: 6-100mg/L Specific Conductance at 25°C: 200-930µmhos/cm Sulfate: 5-125mg/L Total Dissolved Solids at 180°C: 140-650mg/L Total Solids at 105°C: 140-675mg/L	500mL	N/A	VHG-QWPMIN-500
WP Hardness Calcium: 3.5-110mg/L Calcium Hardness as $CaCO_3$: 8.7-275mg/L Total Hardness as $CaCO_3$: 17-440mg/L Magnesium: 2-40mg/L Non-Filterable Residue (TSS): 23-100mg/L	500mL	N/A	VHG-QWPHRD-500
WP Simple Nutrients Ammonia as N: 0.65-19mg/L Nitrate as N: 0.25-40mg/L Nitrate + Nitrite, as N: 0.25-40mg/L ortho-Phosphate as P: 0.5-5.5mg/L	15mL	2 L	VHG-QWPSNUT-15
WP Complex Nutrients Total Kjeldahl Nitrogen as N: 1.5-35mg/L Total Phosphorus as P: 0.5-10mg/L	15mL	2 L	VHG-QWPCNUT-15
WP Oil and Grease Concentrate Oil and Grease: 20-100 mg/L	23mL	2 L	VHG-QWPOG-23
WP pH pH: 5-10 units	250mL	N/A	VHG-QCPH-250
WP Total Phenolics Total Phenolics by 4-AAP: 0.06-5mg/L	2mL	2 L	VHG-QWPPHEN-2
WP Total Residual Chlorine Total Residual Chlorine: 0.5-3mg/L	2mL	2 L	VHG-QWPRCL-2
WP Solids Concentrate Total Solids at 105°C: 140-800mg/L Total Dissolved Solids at 180°C: 140-800mg/L Non-Filterable Residue (TSS): 20-100mg/L	23mL	1 L	VHG-QWPSOL-23

For Trace Metals Check Samples, see Page 29

VHG Tips

Ever encounter difficult samples or analysis that you can't perform? Consider using VHG's Analytical Services or Consultation Services Divisions. We're the only leading manufacturer of spectroscopic samples and supplies that also operates a commercial testing laboratory: Call +1 603.622.7660.

VHG multi-element standards are made from our A+ certified single-element standards which are certified by the NIST HP-ICP-AES Protocol (see Page 11).

ICP-MS user note: Comprehensive Mix A and B can be combined for semi-quantitative analysis or as a control. Indium and ^{6}Li can be added as internal standards (see Pages 41-42).

Multi-Element Standards

For Calibration or QC Controls of ICP-AES or ICP-MS

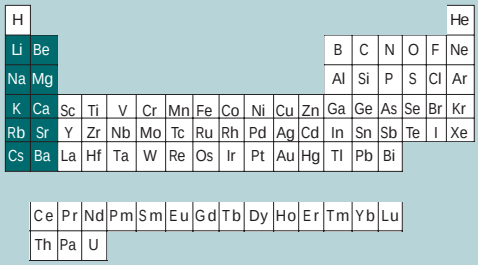
VHG's certified NIST-traceable multi-element mixes have elements conveniently grouped to provide nearly comprehensive coverage of the entire periodic table.

Multi-Element mixes that are associated with a method, such as EPA or ASTM, can be found later in this section. Our extensive quality control makes them the clear choice for value.

Alkalis & Alkaline Earths

Ba, Be, Ca, Cs, K, Li, Mg, Na, Rb, Sr @100µg/mL
Matrix: 5% HNO_3

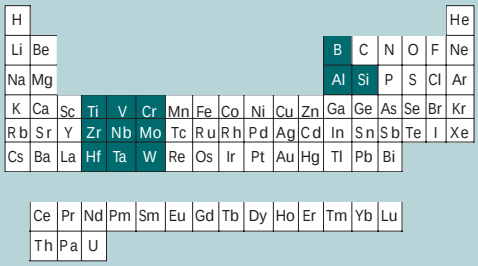
Volume	Product No.
100mL	VHG-SM10-100
500mL	VHG-SM10-500



Refractory Elements

Al, B, Cr, Hf, Mo, Nb, Si, Ta, Ti, V, W, Zr @100µg/mL
Matrix: 5% HCl, tr. HF

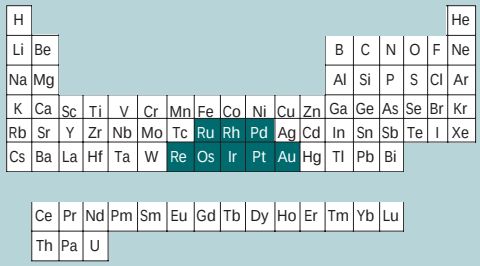
Volume	Product No.
100mL	VHG-SM30A-100
500mL	VHG-SM30A-500



Noble Metals

Au, Ir , Os, Pd, Pt, Re, Rh, Ru @100µg/mL
Matrix: 20% HCl

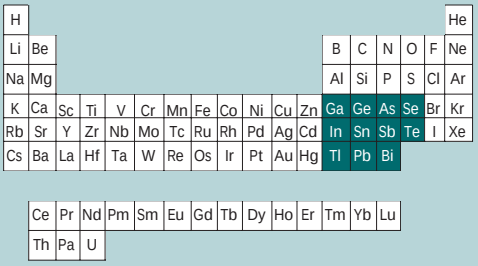
Volume	Product No.
100mL	VHG-SM40-100
500mL	VHG-SM40-500



Metalloids/Hydride Elements

As, Bi, Ga, Ge, In, Pb, Sb, Se, Sn,Te, Tl @100µg/mL
Matrix: 20% HCl, tr. HF

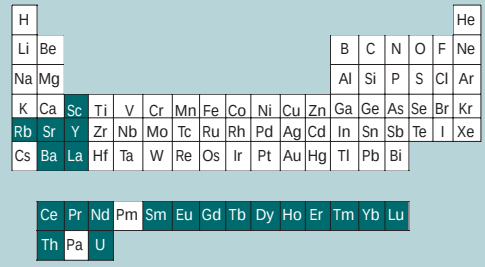
Volume	Product No.
100mL	VHG-SM50B-100
500mL	VHG-SM50B-500



Rare Earth and 'Geo' Elements

Ba, Ce, Dy, Er, Eu, Gd, Ho, La, Lu, Nd, Pr,
Rb, Sc, Sm, Sr , Tb, Th, Tm, U, Y, Yb @100µg/mL
Matrix: 5% HNO_3

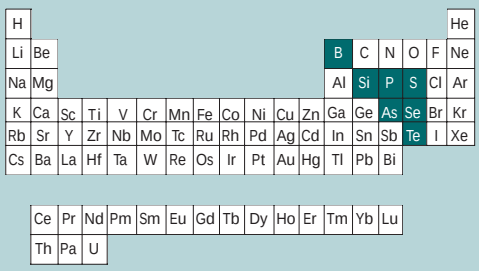
Volume	Product No.
100mL	VHG-SM60A-100
500mL	VHG-SM60A-500



Non-Metals

As, B, P, S, Se, Si, Te @100µg/mL
Matrix: 5% HCl, tr. HF

Volume	Product No.
100mL	VHG-SM25A-100
500mL	VHG-SM25A-500



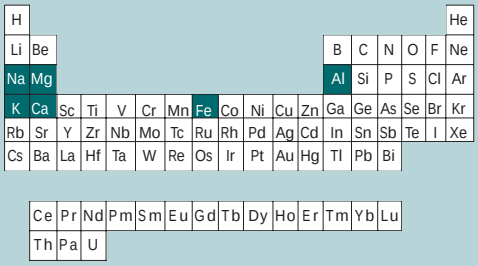
Multi-Element Standards

For Calibration or QC Controls of ICP-AES or ICP-MS

Major Cations Mix

Al, Ca, Fe, K, Mg, Na @ 1000µg/mL
Matrix: 5% HNO_3

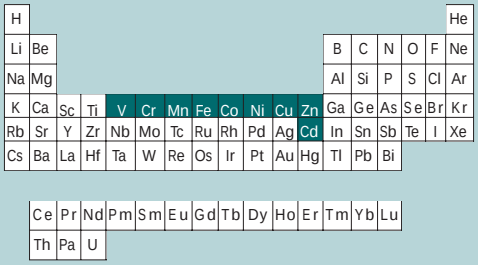
Volume	Product No.
100mL	VHG-SM16-100
500mL	VHG-SM16-500



Common Elements Mix 1

Cd, Co, Cr, Cu, Fe, Mn, Ni, V, Zn @ 100µg/mL
Matrix: 5% HNO_3

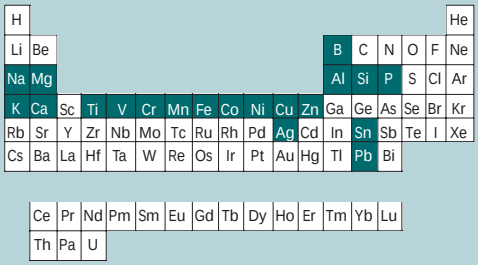
Volume	Product No.
100mL	VHG-SM35A-100
500mL	VHG-SM35A-500



Common Elements Mix 2

Ag, Al, B, Ca, Co, Cr, Cu, Fe, K, Mg,
Mn, Na, Ni, P, Pb, Si, Sn, Ti, V, Zn @ 100µg/mL
Matrix: 5% HNO_3 tr. HF

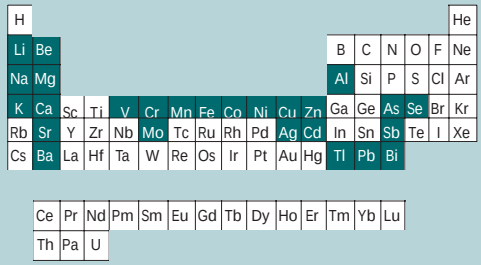
Volume	Product No.
100mL	VHG-SM70B-100
500mL	VHG-SM70B-500



Common & Transition – Multi Conc.

Ag, Al, As, Ba, Be, Bi, Cd, Cr, Co, Cu, Fe, Li, Mn,
Mo, Ni, Pb, Sb, Se, Sr, Tl, V, Zn @ 100 µg/mL;
Ca, K, Mg, Na @ 1000 µg/mL
Matrix: 5% HNO_3/0.2% HF

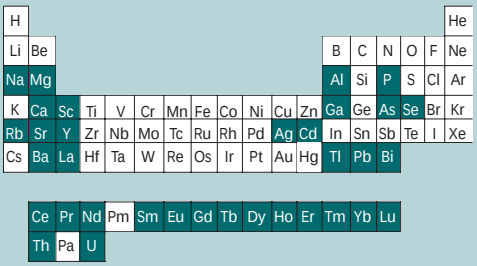
Volume	Product No.
100mL	VHG-SM75B-100
500mL	VHG-SM75B-500



Comprehensive Mix A

Ag, Al, As, Ba, Bi, Ca, Cd, Ce, Dy, Er, Eu, Ga,
Gd, Ho, La, Lu, Mg, Na, Nd, P, Pb, Pr, Rb,
Sc, Se, Sm, Sr, Tb, Th, Tl, Tm, U, Y, Yb @ 10µg/mL
Matrix: 40% aq. regia

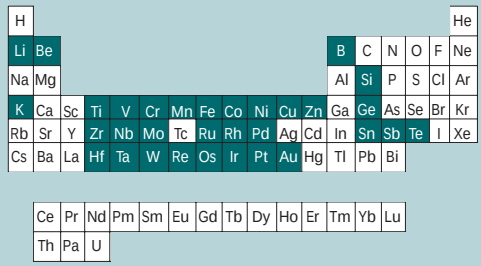
Volume	Product No.
100mL	VHG-SM80C-100
500mL	VHG-SM80C-500



Comprehensive Mix B

Au, B, Be, Co, Cr, Cu, Fe, Ge, Hf, Ir, K, Li, Mn,
Mo, Nb, Ni, Os, Pd, Pt, Re, Rh, Ru, Sb, Si, Sn, Ta,
Te, Ti, V, W, Zn, Zr @ 10µg/mL
Matrix: 40% aq. regia, tr. HF

Volume	Product No.
100mL	VHG-SM90C-100
500mL	VHG-SM90C-500



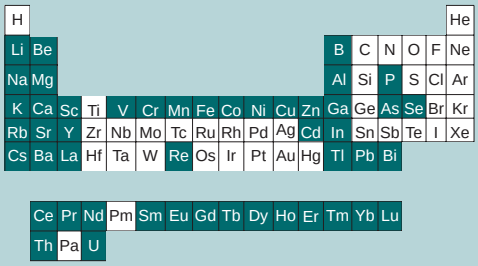
Multi-Element Standards

For Calibration or QC Controls of ICP-AES or ICP-MS

68 Element Multi Standard (48 elements in Std. 1)

Al, As, B, Ba, Be, Bi, Ca, Cd, Ce, Co, Cr, Cs, Cu, Dy, Er, Eu, Fe, Ga, Gd, Ho, In, K, La, Li, Lu, Mg, Mn, Na, Nd, Ni, P, Pb, Pr, Rb, Re, Sc, Se, Sm, Sr, Tb, Th, Tl, Tm, U, V, Y, Yb, Zn
@ 100 µ g/mL
Matrix: 5% HNO_3

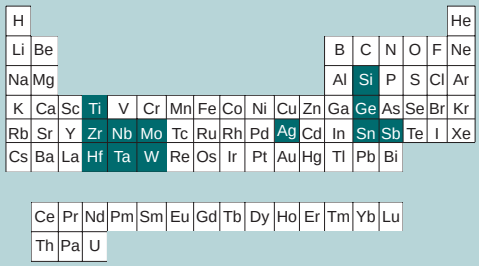
Volume	Product No.
100mL	VHG-SM68-1-100
500mL	VHG-SM68-1-500



68 Element Multi Standard 2 (12 elements in Std. 2)

Ag, Ge, Hf, Mo, Nb, Sb, Si, Sn, Ta, Ti, W, Zr @ 100µg/mL
Matrix: 5% HNO_3, tr. HF

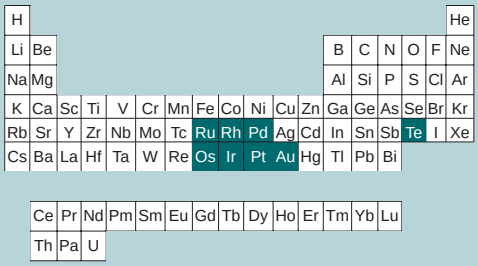
Volume	Product No.
100mL	VHG-SM68-2-100
500mL	VHG-SM68-2-500



68 Element Multi Standard 3 (8 elements in Std. 3)

Au, Ir, Os, Pd, Pt, Rh, Ru, Te @ 100µg/mL
Matrix: 10% HCl

Volume	Product No.
100mL	VHG-SM68-3-100
500mL	VHG-SM68-3-500



General Use Environmental Standards

For Calibration, QC Controls or Spiking

VHG Labs manufactures accurate, NIST-traceable standards for the analysis of environmental waters, soils, sludges and other samples by ICP-AES, ICP-MS, AA and other spectroscopic techniques.

We offer a range of pre-configured environmental standards that can be used for calibration, fortifying solutions, control checks and interference checks. While these standards may meet all of your requirements, VHG also specializes in NIST-traceable custom blends. Please inquire.

US EPA 23 Metals

Ag, Al, As, Ba, Be, Ca, Cd, Co, Cr, Cu, Fe, K, Mg, Mn, Mo, Na, Ni, Pb, Sb, Se, Tl, V, Zn @ 100µg/mL
Matrix: 5% HNO_3, tr. Tartaric Acid, tr. HF

Volume (mL)	Product No.
100	VHG-SM23-100
500	VHG-SM23-500

US EPA RCRA Elements

Ag, As, Ba, Cd, Cr, Hg, Pb, Se @ 100µg/mL
Matrix: 5% HNO_3

Volume (mL)	Product No.
100	VHG-SM45-100
500	VHG-SM45-500

QC Standard '7'

Matrix: 5% HNO_3, tr. F^-

Volume (mL)	Product No.
100	VHG-QC7-100
500	VHG-QC7-500

Element	Conc. (µg/mL)	Element	Conc. (µg/mL)
Ag	100	K	1000
Al	100	Na	100
B	100	Si	50
Ba	100		

QC Standard '7A'

Matrix: 5% HNO_3, tr. F^-

Volume (mL)	Product No.
100	VHG-QC7A-100
500	VHG-QC7A-500

Element	Conc. (µg/mL)	Element	Conc. (µg/mL)
Ag	50	K	1000
Al	100	Na	100
B	100	Si	500
Ba	100		

QC Standard '19'

Matrix: 5% HNO_3, tr. F^-, tr. Tartaric Acid

Volume (mL)	Product No.
100	VHG-QC19-100
500	VHG-QC19-500

Element	Conc. (µg/mL)	Element	Conc. (µg/mL)
As	100	Mo	100
Be	100	Ni	100
Ca	100	Pb	100
Cd	100	Sb	100
Co	100	Se	100
Cr	100	Ti	100
Cu	100	Tl	100
Fe	100	V	100
Mg	100	Zn	100
Mn	100		

QC Standard '20'

Matrix: 5% HNO_3, tr. F^-, tr. Tartaric Acid

Volume (mL)	Product No.
100	VHG-ISQC20-100
500	VHG-ISQC20-500

Element	Conc. (µg/mL)	Element	Conc. (µg/mL)
Ag	10	Mo	10
Al	10	Ni	10
As	10	Pb	10
Ba	10	Sb	10
Be	10	Se	10
Cd	10	Th	10
Co	10	Tl	10
Cr	10	U	10
Cu	10	V	10
Mn	10	Zn	10

Second Source: QC Standard '20' is prepared from independent raw materials relative to any VHG single element or multi-element standard except those designated as second source standards.

VHG Tips

VHG's multi-element standards undergo extensive QC and are traceable to NIST SRMs. Not all suppliers make this important investment in quality.

Spikes of environmental samples with silver (Ag) are prone to poor recoveries due to AgCl precipitation. Free Cl^- can come from a nearby beaker of HCl or other volatile chlorides.

Remember to keep spiking levels within the calibration range. For "unknowns", the use of two spikes (estimated and of different concentration) may actually be the simplest way to hit a good target spike concentration.

General Use Environmental Standards

For Calibration, QC Controls or Spiking

TCLP

TCLP Standard 1
Matrix: 2% HNO_3

Volume (mL)	Product No.
100	VHG-TCLP1-100
500	VHG-TCLP1-500

Element	Conc. (µg/mL)	Element	Conc. (µg/mL)
Ag	25	Cr	25
As	25	Pb	25
Ba	500	Se	5
Cd	5		

See Mercury Standard 20 listed below

General Memory & Interference Check Sample

Environmental Sample Interferents
Matrix: 2% HNO_3

Volume (mL)	Product No.
500	VHG-LMCS1Z-500

Element	Conc. (µg/mL)	Element	Conc. (µg/mL)
Al	1000	K	1000
C	5000	Mg	1000
Ca	1000	Na	1000
Cl	5000	P	1000
Fe	1000	S	1000

Spiking Solutions

Waters - Trace Elements

Spiking Solution EG1
Dilute as needed; configured for use with Environmental Waters
Matrix: 5% HNO_3, tr. HF, tr. Tartaric Acid

Volume (mL)	Product No.
100	VHG-SSEG1-100
500	VHG-SSEG1-500

Element	Conc. (µg/mL)	Element	Conc. (µg/mL)
Ag	5	Mn	40
Al	100	Mo	40
As	200	Ni	40
Ba	200	Pb	40
Be	5	Sb	40
Cd	5	Se	100
Co	20	SiO_2	200
Cr	40	Tl	40
Cu	40	V	40
Fe	100	Zn	100

Soils

Spiking Solution EG2
Dilute as needed; configured for use with Environmental Soils
Matrix: 5% HNO_3, tr. HF, tr. Tartaric Acid

Volume (mL)	Product No.
100	VHG-SSEG2-100
500	VHG-SSEG2-500

Element	Conc. (µg/mL)	Element	Conc. (µg/mL)
Ag	25	Mn	200
Al	2000	Mo	200
As	1000	Ni	200
Ba	1000	Pb	200
Be	25	Sb	200
Cd	25	Se	1000
Co	100	Tl	200
Cr	200	V	200
Cu	200	Zn	500
Fe	2000		

See Page 39 for additional Spiking Standards for EPA Methods

Waters - Major Elements

Spiking Solution EG3
Dilute as needed; configured for use with Environmental Waters
Matrix: 5% HNO_3

Volume (mL)	Product No.
100	VHG-SSEG3-100
500	VHG-SSEG3-500

Element	Conc. (µg/mL)	Element	Conc. (µg/mL)
B	1000	Mg	10,000
Ca	10,000	Na	10,000
K	10,000	P	1000
Li	1000	Sr	1000

Mercury Standard 20
Matrix: 5% HNO_3

Volume (mL)	Product No.
100	VHG-HG20-100

Element	Conc. (µg/mL)
Hg	20

Water Pollution Standards

US EPA Standards for Clean Water Act

Water Pollution Standard 1
Matrix: 5% HNO_3

Volume (mL)	Product No.
100	VHG-WPS1-100
500	VHG-WPS1-500

Element	Conc. (µg/mL)	Element	Conc. (µg/mL)
Al	500	Hg	5
As	100	Mn	100
Be	100	Ni	100
Cd	25	Pb	100
Co	100	Se	25
Cr	100	V	250
Cu	100	Zn	100
Fe	100		

Water Pollution Standard 3
Matrix: 2% HNO_3

Volume (mL)	Product No.
100	VHG-WPS3-100
500	VHG-WPS3-500

Element	Conc. (µg/mL)	Element	Conc. (µg/mL)
Ba	500	Mg	100
Ca	500	Mo	500
K	100	Na	500

Water Pollution Standard 5
Matrix: 2% HNO_3

Volume (mL)	Product No.
100	VHG-WPS5-100
500	VHG-WPS5-500

Element	Conc. (µg/mL)	Element	Conc. (µg/mL)
Ca	500	Mg	100
Na	500	K	100

Synthetic Surface Water Certified Reference Material

- Metals in water matrix representative of typical natural water sample
- Certified by an inter-laboratory study
- Excellent control sample for environmental testing

Natural Water Matrix Reference
Matrix: 1% HNO_3, 1% HCl, tr HF

Volume (mL)	Product No.
100	VHG-NWMR-100
500	VHG-NWMR-500

Element	Conc. Range (µg/mL)	Element	Conc. Range (µg/mL)
Ag	0.005-0.05	Mo	0.005-0.05
Al	0.05-0.25	Na	10-25
As	0.005-0.05	Ni	0.005-0.05
Ba	0.05-0.25	Pb	0.005-0.05
Be	0.005-0.05	Rb	0.005-0.05
Ca	10-25	Se	0.005-0.05
Cd	0.005-0.05	Sn	0.005-0.05
Co	0.005-0.05	Sr	0.05-0.25
Cr	0.005-0.05	Ti	0.005-0.05
Cu	0.05-0.25	Tl	0.005-0.05
Fe	0.05-0.25	U	0.005-0.05
K	0.5-3	V	0.005-0.05
Mg	1-10	Zn	0.05-0.25
Mn	0.005-0.05		

VHG Tips

See Pages 21-22 for QC check samples for Wet Chemistry Methods such as Water Supply Hardness and Water Pollution Minerals.

Our QC Check Samples are NIST traceable and verified by an interlaboratory program. Laboratories using these products as part of their internal quality program can monitor their performance against both EPA acceptance criteria and results from other well-respected laboratories.

QC Reference Standards are useful as controls and/or to represent your real-world samples for method development.

QC Check Samples for Trace Metals

WS and WP Concentrates

- Designed for analyses of water supply and water pollution samples
- Tested in compliance with appropriate US EPA, NIST, NELAC, and ISO protocols
- Certificate of Analysis includes two sets of acceptance limits to evaluate your performance
- Traceable to NIST SRMs (whenever available)
- For use in analyzing alongside US EPA, NELAC or state accreditation PT samples or as part of your own internal quality control program

Water Supply (WS) Samples

Product & Range	Vial Size	Yields	Product No.
WS Trace Metals Aluminum Al: 130-2500µg/L Antimony Sb: 6-50µg/L Arsenic As: 5-50µg/L Barium Ba: 500-3000µg/L Beryllium Be: 1-10µg/L Boron B: 800-2000µg/L Cadmium Cd: 2-50µg/L Chromium Cr: 10-200µg/L Copper Cu: 50-2000µg/L Iron Fe: 100-1800µg/L Lead Pb: 5-100µg/L Manganese Mn: 40-900µg/L Molybdenum Mo: 15-130µg/L Nickel Ni: 10-500µg/L Selenium Se: 10-100µg/L Silver Ag: 20-300µg/L Thallium Tl: 2-10µg/L Vanadium V: 315-2500µg/L Zinc Zn: 400-2500µg/L	15mL	2 L	VHG-QWSTM-15
WS Mercury Total Mercury: 0.5-10µg/L	15mL	1 L	VHG-QWSHG-15

Water Pollution (WP) Samples

Product & Range	Vial Size	Yields	Product No.
WP Trace Metals Aluminum Al: 200-4000µg/L Antimony Sb: 95-900µg/L Arsenic As: 70-900µg/L Barium Ba: 100-2500µg/L Beryllium Be: 8-900µg/L Boron Be: 800-2000µg/L Cadmium Cd: 8-750 µg/L Chromium Cr: 17-1000µg/L Cobalt Co: 28-1000µg/L Copper Cu: 40-900µg/L Iron Fe: 200-4000µg/L Lead Pb: 70-3000µg/L Manganese Mn: 70-4000µg/L Molybdenum Mo: 60-600µg/L Nickel Ni: 80-3000µg/L Selenium Se: 90-2000µg/L Silver Ag: 26-600µg/L Strontium Sr: 30-300µg/L Thallium Tl: 60-900µg/L Vanadium V: 55-2000µg/L Zinc Zn: 100-2000µg/L	15mL	1 L	VHG-QWPTM-15
WP Mercury Total Mercury: 2-30µg/L	15mL	1 L	VHG-QWPHG-15
WP Tin & Titanium Tin Sn: 1000-5000µg/L Titanium Ti: 80-300µg/L	15mL	1 L	VHG-QWPSNTI-15

International Environmental Standards

Canadian Regulated Inorganics

Regmet Standard 1
Matrix: 5% HNO_3

Volume (mL)	Product No.
100	VHG-RMS1Z-100

Element	Conc. (µg/mL)	Element	Conc. (µg/mL)
Ag	100	Mn	100
As	100	Ni	100
B	100	P	100
Ba	100	Pb	100
Be	100	Rb	100
Ca	100	Se	100
Cd	100	Sr	100
Co	100	Th	100
Cr	100	Tl	100
Cu	100	V	100
Mg	100	Zn	100

Regmet Standard 2
Matrix: 20% HCl, tr. HF

Volume (mL)	Product No.
100	VHG-RMS2Z-100

Element	Conc. (µg/mL)	Element	Conc. (µg/mL)
Al	100	Si	100
Fe	100	Sn	100
K	100	Ti	100
Mo	100	U	100
Na	100	Zr	100
Sb	100		

Mercury Standard 10
Matrix: 5% HNO_3

Volume (mL)	Product No.
100	VHG-LHGN-100

Element	Conc. (µg/mL)
Hg	10

U. S. Environmental Protection Agency (EPA) methods and guidelines have widespread application both inside and outside the U.S. Other governmental organizations have also established guidelines, each with unique listings of monitored elements and quality control criteria.

Europe

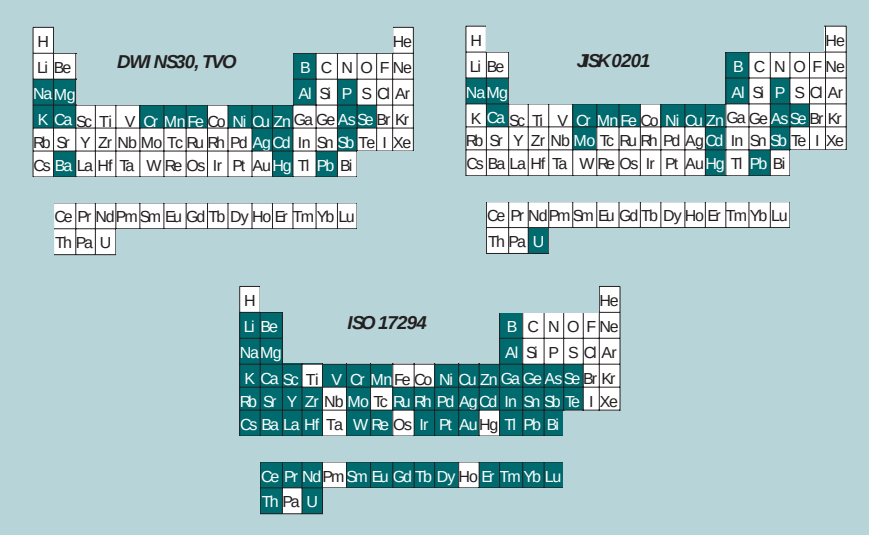
UK "DWI NS30" program standards prevail and these are similar to German "TVO" standards. They establish a "Prescribed Concentration Value" for regulated metals in the environment.

Also, a central European standard in the International Organization of Standards (ISO), has ICP-MS specified for the monitoring of over 60 metals.

Japan & Asia

The "JISK0102" method has been created for environmental metal monitoring.

VHG has numerous standards that are useful calibration standards for these analyses. Try our "Common & Transition Elements" that contain the DWI, TVO and JISK element listings (see Page 24). For more comprehensive multi-element mixes, VHG's "Comprehensive Mix A" and "Comprehensive Mix B" will meet the need.



The shaded periodic tables show regulated metals under some of these guidelines.

Single-Element Standards

Ion Chromatography and Wet Chemistry Standards

Multi-Element Standards for ICP-AES and ICP-MS

Multi-Element
General Environmental
Spiking Solutions
Water Pollution Standards
QC Check Samples for Water
▶ QC Checks for Trace Metals
▶ International Environmental Standards
EPA Method Ref Chart
Second Source (pair-matched) Standards
EPA 200.7, 6010, CLP
ICP-MS Standards
EPA 200.8, 6020 CLP
USP Elemental Impurities

International Environmental Standards

Canadian Regulated Inorganics

VHG is now offering standards for the Municipal/Industrial Strategy for Abatement (MISA) program, a set of Canadian regulations. The MISA program focuses on monitoring toxic contaminants in nine industrial sectors: petroleum, pulp and paper, metal mining, industrial minerals, metal casting, organic chemical manufacturing, inorganic chemical, iron and steel, and electric power generation. These 6 standards can be used for metals analysis in various MISA test groups, or as general use standards.

MISA1 Standard
Matrix: H_2O/tr. HF

Volume (mL)	Product No.
100	VHG-MISA1-100
500	VHG-MISA1-500

Element	Conc. (µg/mL)	Element	Conc. (µg/mL)
Ge	100	Ta	100
Hf	100	Ti	100
Mo	100	W	100
Nb	100	Zr	100
Si	100		

MISA2 Standard
Matrix: 20% HCl

Volume (mL)	Product No.
100	VHG-MISA2-100
500	VHG-MISA2-500

Element	Conc. (µg/mL)	Element	Conc. (µg/mL)
Au	100	Pt	100
Ir	100	Re	100
Os	100	Rh	100
Pd	100	Ru	100

MISA3 Standard
Matrix: 20% HCl

Volume (mL)	Product No.
100	VHG-MISA3-100
500	VHG-MISA3-500

Element	Conc. (µg/mL)	Element	Conc. (µg/mL)
Sb	100	Te	100
Sn	100		

MISA4 Standard
Matrix: 10% HNO_3

Volume (mL)	Product No.
100	VHG-MISA4-100
500	VHG-MISA4-500

Element	Conc. (µg/mL)	Element	Conc. (µg/mL)
As	100	Re	100
Be	100	S	100
Bi	100	Se	100
Hg	100		

MISA5 Standard
Matrix: 2% HNO_3

Volume (mL)	Product No.
100	VHG-MISA5-100
500	VHG-MISA5-500

Element	Conc. (µg/mL)	Element	Conc. (µg/mL)
Ce	100	Pr	100
Dy	100	Sc	100
Er	100	Sm	100
Eu	100	Tb	100
Gd	100	Th	100
Ho	100	Tm	100
La	100	Y	100
Lu	100	Yb	100
Nd	100		

MISA6 Standard
Matrix: 2% HNO_3

Volume (mL)	Product No.
100	VHG-MISA6-100
500	VHG-MISA6-500

Element	Conc. (µg/mL)	Element	Conc. (µg/mL)
Ag	100	Li	100
Al	100	Mg	100
B	100	Mn	100
Ba	100	Na	100
Ca	100	Ni	100
Cd	100	P	100
Co	100	Pb	100
Cr	100	Rb	100
Cs	100	Sr	100
Cu	100	Tl	100
Fe	100	U	100
Ga	100	V	100
In	100	Zn	100
K	100		

EPA Method Standards Cross Reference Chart

Also Good for General Sample Sequencing

Description: Purpose	Number	Sample Acronym	Name	200.7 ICP-AES	200.8 ICP-MS	CLP6010 (ILM 05.2)	CLP6020 (ILM 05.2)	AA, Hg, Cr VI use same general CLP seq.
optimization block	1	Set-up Sample	Tuning, mass cal., detector cal., wave-length cal.	For listings of these standards and mixes, refer to pgs. 35, 40-43				
calibration block	2	Calib. Blank	Blank	*Remember: internal standards need to be included in blanks (See pgs. 37, 43)*				
calibration block	3	Calib. Grp A Std 1	Quant Std	See VHG's Extensive list of EPA calibration standards or our Single & Multi-Element Standards				
calibration block	4	Calib. Grp A Std "n"	Quant Std	See VHG's Extensive list of EPA calibration standards or our Single & Multi-Element Standards				
calibration block	5	(optnl.-Calib. "Grp B" Stds)	Quant Std	*(Use if elements isolated in separate solutions. May be useful for stability or convenience reasons.)*				
calibration check	7	Initial Calib. Verif. Grp A (ICV, IPC)	QC	Refer to Catalogue pgs. 33-34, 36-37, 44 or VHG's Extensive List of Single-Element or Multi-Element Standards.				
calibration check	8	(optnl. ICV for "Grp B")	QC	*(If elements isolated in separate solutions. May be useful for stability or convenience reasons.)*				
calibration check	9	ICB	QC	*Remember: Blank preparation should match those for standards*				
interference check	10	ICS-A (SIC)	QC	ICS solns (see p. 36)		ICSA (see p. 38)	ICSA (see p. 46)	
interference check	11	ICS-AB (SIC)	QC			ICSAB (see p. 38)	ICSAB (see p. 46)	
interference mem. check	12	Memory Check, MEM	QC	Refer to Method			Refer to Meth (see p. 46)	
detn. limit test	13	(CRQL,CRI, MDL, CRDL)	QC	Refer to Method	Refer to Method	(See p. 39)	Refer to Meth (see p. 45)	Refer to Method.
blank background	14	Reagent Blk (LRB)	QC	*Remember: Blank preparation should match those for standards*				
spike recovery in Blank	15	Reagent Blk Spk (LFB)	QC	Refer to pgs. 27, 34, 45 or VHG's Extensive List of Single Element or Multi-Element Standards.				
accuracy	16	(QCS, LCS)	QC	Use VHG's Quality Control Reference Standards, pgs. 26, 28-29, 36				
begin sample block	17	Sample 1	Sample Unknown	Measurement Data				
spike recovery in Blank	18	Sample 1 SPK (LFM)	QC	For Spiking Standards refer to pgs. 27, 34, 45 VHG's Multi-Element Standards.				
calibration verification	19	CCV Grp A-1	QC	See VHG's Extensive list of EPA calibration standards or our Single & Multi-Element Standards				
calibration verification	20	(opt.-CCV Grp B-1)	QC	See #8 Above				
blank verification	21	CCB-1	QC	See #2 Above				
continue sample block	22	Sample 2	Sample Unknown	Measurement Data. (Sample 2 -> n may possibly be prior to first CCV/ CCB block)				
continue sample block	23	Sample 2 Duplicate	QC	Refer to Method				
continue sample block	24	Sample 2 Dilution	QC	Refer to Method				
continue sample block	25->	Samples…n	Sample Unknowns	Measurement Data				
calibration verification	x	CCV Grp A-2	QC	See #19 Above				
calibration verification	x	(optnl.-CCV Grp B-2)	QC	See #8 Above				
blank verification	x	CCB-2	QC	See #2 Above				
POST RUN QC	x	see method	QC	Refer to Method				

**Refer to method documentation for elaboration of sample sequence requirements. Grey block signifies that this test block may not exist in method*

VHG Tips

We recommend you use a QC Check Sample or other labratory control standard with each analytical run.

Second Source Standards Pair-Matched

The following VHG's Standards are pair-matched (by element) with one being 100% independent of the other. These are designed for CAL and ICV or LCS checks. All VHG second source standards are prepared from independent raw materials relative to any VHG single element or multi-element standard except those designated as second source standards.

Primary Standards

QC Standard '21'

Matrix: 5% HNO_3, tr. F^-, tr. Tartaric Acid

Volume (mL)	Product No.
100	VHG-QC21-100
500	VHG-QC21-500

Element	Conc. (µg/mL)	Element	Conc. (µg/mL)
As	100	Mo	100
Be	100	Ni	100
Ca	100	Pb	100
Cd	100	Sb	100
Co	100	Se	100
Cr	100	Sr	100
Cu	100	Ti	100
Fe	100	Tl	100
Li	100	V	100
Mg	100	Zn	100
Mn	100		

Second Source Standards

ISQC Standard '21'

Matrix: 5% HNO_3, tr. F^-, tr. Tartaric Acid

Volume (mL)	Product No.
100	VHG-ISQC21-100
500	VHG-ISQC21-500

Element (µg/mL)		Conc. (µg/mL)	
As	100	Mo	100
Be	100	Ni	100
Ca	100	Pb	100
Cd	100	Sb	100
Co	100	Se	100
Cr	100	Sr	100
Cu	100	Ti	100
Fe	100	Tl	100
Li	100	V	100
Mg	100	Zn	100
Mn	100		

Major Elements Standards

Matrix: 5% HNO_3

Volume (mL)	Product No.
100	VHG-LMES-100
500	VHG-LMES-500

Element	Conc. (µg/mL)	Element	Conc. (µg/mL)
Ca	2000	Mg	2000
Fe	2000	Na	2000
K	2000		

6020 SS-High Level Element ICV Stock

Matrix: 5% HNO_3

Volume (mL)	Product No.
100	VHG-LICVMES-100
500	VHG-ICVMES-500

Element	Conc. (µg/mL)	Element	Conc. (µg/mL)
Ca	2000	Mg	2000
Fe	2000	Na	2000
K	2000		

Mercury Standard 10

Matrix: 5% HNO_3

Volume (mL)	Product No.
100	VHG-LHGN-100

Element	Conc. (µg/mL)
Hg	10

Mercury ICV Standard

Matrix: 5% HNO_3

Volume (mL)	Product No.
100	VHG-ISHG-100

Element	Conc. (µg/mL)
Hg	10

We carry the most extensive line of "second source" (independent) standards available. If you don't find the mixture that you require listed here, please contact your local sales office to request a custom standard from independent raw materials.

Second Source Standards Pair-Matched

Primary Standards

Second Source Standards

Environmental Calibration Standard A / Environmental ICV Standard A

Matrix: 5% HNO_3, tr. Tartaric Acid, tr. HF

Volume (mL)	Product No.
100	VHG-LCAL1A-100

Element	Conc. (µg/mL)	Element	Conc. (µg/mL)
Ag	10	Mn	10
Al	10	Mo	10
As	10	Na	1000
Ba	10	Ni	10
Be	10	Pb	10
Ca	1000	Sb	10
Cd	10	Se	10
Co	10	Sr	10
Cr	10	Ti	10
Cu	10	Tl	10
Fe	1000	U	10
K	1000	V	10
Mg	1000	Zn	10

Volume (mL)	Product No.
100	VHG-LICV1A-100

Element	Conc. (µg/mL)	Element	Conc. (µg/mL)
Ag	10	Mn	10
Al	10	Mo	10
As	10	Na	1000
Ba	10	Ni	10
Be	10	Pb	10
Ca	1000	Sb	10
Cd	10	Se	10
Co	10	Sr	10
Cr	10	Ti	10
Cu	10	Tl	10
Fe	1000	U	10
K	1000	V	10
Mg	1000	Zn	10

200.8 Stock Calibration Standard CS1 / 200.8 Stock Calibration Standard SQC1

Matrix: 5% HNO_3, tr. Tartaric Acid

Volume (mL)	Product No.
100	VHG-L2008CS1-100

Element	Conc. (µg/mL)	Element	Conc. (µg/mL)
Al	10	Ni	10
As	10	Pb	10
Be	10	Sb	10
Cd	10	Se	10
Co	10	Tl	10
Cr	10	Th	10
Mn	10	U	10
Mo	10	V	10

Volume (mL)	Product No.
100	VHG-L2008SQC1-100

Element	Conc. (µg/mL)	Element	Conc. (µg/mL)
Al	10	Ni	10
As	10	Pb	10
Be	10	Sb	10
Cd	10	Se	10
Co	10	Tl	10
Cr	10	Th	10
Mn	10	U	10
Mo	10	V	10

200.8 Stock Calibration Standard CS2 / 200.8 Stock Calibration Standard SQC2

Matrix: 2% HNO_3

Volume (mL)	Product No.
100	VHG-L2008CS2-100

Element	Conc. (µg/mL)	Element	Conc. (µg/mL)
Ag	10	Fe	100
Ba	100	Zn	100
Cu	100		

Volume (mL)	Product No.
100	VHG-L2008SQC2-100

Element	Conc. (µg/mL)	Element	Conc. (µg/mL)
Ag	10	Fe	100
Ba	100	Zn	100
Cu	100		

200.8 Stock Calibration Standard CS3 / 200.8 Stock Calibration Standard SQC3

Matrix: 2% HNO_3

Volume (mL)	Product No.)
100	VHG-L2008CS3-100

Element	Conc. (µg/mL)	Element	Conc. (µg/mL)
Ca	10,000	Mg	1000
K	1000	Na	10,000

Volume (mL)	Product No.
100	VHG-L2008SQC3-100

Element	Conc. (µg/mL)	Element	Conc. (µg/mL)
Ca	10,000	Mg	1000
K	1000	Na	10,000

EPA Methods 200.7 & 6010A for ICP-AES

Tuning/Optimization

US EPA Method 200.7 ICP Tuning
Matrix: 5% HNO_3

Volume (mL)	Product No.
100	VHG-TNG-100
500	VHG-TNG-500

Element	Conc. (µg/mL)	Element	Conc. (µg/mL)
Cu	10	Pb	10

US EPA Method 200.7 ICP Plasma Solution
Matrix: 5% HNO_3

Volume (mL)	Product No.
100	VHG-PLS-100
500	VHG-PLS-500

Element	Conc. (µg/mL)	Element	Conc. (µg/mL)
As	10	Se	10
Pb	10	Tl	10

Mixed Calibration Standards 200.7 Rev. 4.4

Calibration Standard 1
Matrix: 5% HNO_3

Volume (mL)	Product No.
100	44CS1Y-100
500	44CS1Y-500

Element	Conc. (µg/mL)	Element	Conc. (µg/mL)
Ag	50	K	1000
As	500	Mg	1000
B	200	Mn	200
Ba	200	Ni	200
Be	200	P	1000
Ca	1000	Pb	200
Cd	200	Se	500
Ce	200	Sr	200
Co	200	Tl	500
Cr	200	V	200
Cu	200	Zn	500

Calibration Standard 2
Matrix: 20% HCl, tr. HF

Volume (mL)	Product No.
100	VHG-44CS2Z-100
500	VHG-44CS2Z-500

Element	Conc. (µg/mL)	Element	Conc. (µg/mL)
Al	1000	Sb	500
Fe	1000	SiO_2	1000
Li	500	Sn	200
Mo	1000	Ti	1000
Na	1000		

Mixed Calibration Standards 200.7 Rev. 3.3, 6010A

Mixed Calibration Standard 1
Matrix: 2% HNO_3

Volume (mL)	Product No.
100	VHG-MCS1-100

Element	Conc. (µg/mL)	Element	Conc. (µg/mL)
Be	50	Pb	500
Cd	150	Se	200
Mn	100	Zn	150

Mixed Calibration Standard 2
Matrix: 5% HNO_3

Volume (mL)	Product No.
100	VHG-MCS2-100

Element	Conc. (µg/mL)	Element	Conc. (µg/mL)
Ba	100	Fe	10,000
Co	100	V	100
Cu	100		

Mixed Calibration Standard 3
Matrix: 2% HNO_3, tr. F^-

Volume (mL)	Product No.
100	VHG-MCS3-100

Element	Conc. (µg/mL)	Element	Conc. (µg/mL)
As	500	Si	100
Mo	100		

Mixed Calibration Standard 4
Matrix: 5% HNO_3

Volume (mL)	Product No.
100	VHG-MCS4-100

Element	Conc. (µg/mL)	Element	Conc. (µg/mL)
Al	200	K	400
Ca	1000	Na	200
Cr	20	Ni	20

Mixed Calibration Standard 5
Matrix: 5% HNO_3, tr. Tartaric Acid

Volume (mL)	Product No.
100	VHG-MCS5-100

Element	Conc. (µg/mL)	Element	Conc. (µg/mL)
Ag	50	Sb	200
B	100	Tl	200
Mg	1000		

EPA Methods 200.7 & 6010 for ICP-AES

Interference Checks

Interference Check Solution 1
Matrix: 5% HNO_3

Volume (mL)	Product No.
100	VHG-INT1-100
500	VHG-INT1-500

Element	Conc. (µg/mL)	Element	Conc. (µg/mL)
Ag	300	K	20,000
As	1000	Mn	200
Ba	300	Ni	300
Be	100	Pb	1000
Cd	300	Se	500
Co	300	Tl	1000
Cr	300	V	300
Cu	300	Zn	300
Hg	50		

Interference Check Solution 2
Matrix: 2% HNO_3, tr. HF

Volume (mL)	Product No.
100	VHG-INT2-100
500	VHG-INT2-500

Element	Conc. (µg/mL)	Element	Conc. (µg/mL)
B	500	Si	230
Mo	300	Ti	1000

Interference Check Solution 3
Matrix: H_2O, Tartaric Acid, tr. HNO_3

Volume (mL)	Product No.
100	VHG-INT3-100
500	VHG-INT3-500

Element	Conc. (µg/mL)
Sb	1000

Interference Check Solution 4
Matrix: 5% HNO_3

Volume (mL)	Product No.
100	VHG-INT4-100
500	VHG-INT4-500

Element	Conc. (µg/mL)	Element	Conc. (µg/mL)
Al	1200	Mg	3000
Ca	6000	Na	1000
Fe	5000		

QCS Solution 2
Matrix: 20% HCl, tr. HF

Volume (mL)	Product No.
100	VHG-44QCS2Z-100
500	VHG-44QCS2Z-500

Element	Conc. (µg/mL)	Element	Conc. (µg/mL)
Al	100	Na	100
Fe	100	Sb	100
K	100	SiO_2	100
Li	100	Sn	100
Mo	100	Ti	100

Instrument Performance Checks

IPC Solution 1
Matrix: 5% HNO_3

Volume (mL)	Product No.
100	VHG-IPC1Y-100
500	VHG-IPC1Y-500

Element	Conc. (µg/mL)	Element	Conc. (µg/mL)
Ag	20	K	500
As	100	Mg	100
B	100	Mn	100
Ba	100	Ni	100
Be	100	P	500
Ca	100	Pb	100
Cd	100	Se	100
Ce	100	Sr	100
Co	100	Tl	100
Cr	100	V	100
Cu	100	Zn	100

IPC Solution 2
Matrix: 20% HCl, tr. HF

Volume (mL)	Product No.
100	VHG-IPC2Y-100
500	VHG-IPC2Y-500

Element	Conc. (µg/mL)	Element	Conc. (µg/mL)
Al	100	Na	100
Fe	100	Sb	100
Hg	100	SiO_2	500
Li	100	Sn	100
Mo	100	Ti	100

Quality Control

QCS Solution 1
Matrix: 5% HNO_3

Volume (mL)	Product No.
100	VHG-44QCS1Z-100
500	VHG-44QCS1Z-500

Element	Conc. (µg/mL)	Element	Conc. (µg/mL)
Ag	50	Hg	100
As	100	Mg	100
B	100	Mn	100
Ba	100	Ni	100
Be	100	P	100
Ca	100	Pb	100
Cd	100	Se	100
Ce	100	Sr	100
Co	100	Tl	100
Cr	100	V	100
Cu	100	Zn	100

VHG Tips

US EPA CLP standards ICL1 & ICL2, ICV1 & ICV2, and CCV1 & CCV2 are generally mixed and diluted as follows: To a 100mL volumetric flask containing 5mL concentrated HCl and 1mL concentrated HNO_3, aliquot 1mL each of Solutions 1 & 2. Swirl to effect complexation and dilute to 100mL with D.I. water. Hg can be added as required.

EPA Methods 6010 & CLP for ICP-AES

- VHG Labs has manufactured reliable standards for US EPA Methods since 1984.
- Full coverage of method-specified standards, controls and spikes.
- Standards are manufactured in our ISO 9001 and ISO Guide 34 facility.
- Certificate of Analysis from our ISO/IEC 17025 laboratory provided, showing NIST traceability.

US EPA Methods: Acid Matrix/Blank Solutions

Blank Water and Acid Matrices
ASTM Type I water and Trace Metal Grade acids used. HDPE bottles are acid leached and rinsed with DI water.
Volume: 500 mL

Name	Matrix	Product No.
Nitric Acid Blank	5% HNO_3	VHG-HNO3-BLK-500
Hydrochloric Acid Blank	5% HCl	VHG-HCL-BLK-500
Hydrochloric/Nitric Blank	5% HCl, 1% HNO_3	VHG-ICB/CCB-500

CLP Instrument Calibration Standards - ICAL

Instrument Calibration Standard 1
Matrix: 5% HNO_3

Volume (mL)	Product No.
100	VHG-ICL1-100
500	VHG-ICL1-500

Element	Conc. (µg/mL)	Element	Conc. (µg/mL)
Ag	200	Fe	1000
Ba	1000	Mn	1000
Be	400	Ni	1000
Cd	500	Pb	1000
Co	1000	Tl	1000
Cu	1000	Zn	1000

Instrument Calibration Standard 2
Matrix: 20% HCl

Volume (mL)	Product No.
100	VHG-ICL2-100
500	VHG-ICL2-500

Element	Conc. (µg/mL)	Element	Conc. (µg/mL)
Al	1000	Mg	10,000
As	1000	Na	10,000
Ca	10,000	Sb	1000
Cr	1000	Se	1000
K	10,000	V	1000

Mercury Standard 10
Matrix: 5% HNO_3

Volume (mL)	Product No.
100	VHG-LHGN-100

Element	Conc. (µg/mL)
Hg	10

CLP Initial Calibration Verification Standards - ICV (Second Source)

Initial Calibration Verification Standard 1
Matrix: 5% HNO_3

Volume (mL)	Product No.
100	VHG-ICV1-100
500	VHG-ICV1-500

Element	Conc. (µg/mL)	Element	Conc. (µg/mL)
Ag	20	Fe	100
Ba	100	Mn	100
Be	40	Ni	100
Cd	50	Pb	100
Co	100	Tl	100
Cu	100	Zn	100

Initial Calibration Verification Standard 2
Matrix: 20% HCl

Volume (mL)	Product No.
100	VHG-ICV2-100
500	VHG-ICV2-500

Element	Conc. (µg/mL)	Element	Conc. (µg/mL)
Al	100	Mg	1000
As	100	Na	1000
Ca	1000	Sb	100
Cr	100	Se	100
K	1000	V	100

Mercury ICV Standard 10
Matrix: 5% HNO_3

Volume (mL)	Product No.
100	VHG-ISHG-100

Element	Conc. (µg/mL)
Hg	10

Second Source: ICV1 & ICV2 and ISHG are prepared from independent raw materials relative to any VHG single element or multi-element standard except those designated as second source standards.

EPA Methods 6010 & CLP for ICP-AES

CLP Interference Checks - ICS

ICS Interference A
Matrix: 20% HCl

Volume (mL)	Product No.
500	VHG-ICSA-500

Element	Conc. (µg/mL)	Element	Conc. (µg/mL)
Al	5000	Fe	2000
Ca	5000	Mg	5000

ICS Analytes B
Matrix: 5% HNO_3, tr. Tartaric Acid

Volume (mL)	Product No.
100	VHG-4ICSAB-100

Element	Conc. (µg/mL)	Element	Conc. (µg/mL)
Ag	20	Mn	50
As	10	Ni	100
Ba	50	Pb	5
Be	50	Sb	60
Cd	100	Se	5
Co	50	Tl	10
Cr	50	V	50
Cu	50	Zn	100

ICS Analytes Sub-B1
Matrix: 5% HNO_3

Volume (mL)	Product No.
100	VHG-ICSAB1-100
500	VHG-ICSAB1-500

Element	Conc. (µg/mL)	Element	Conc. (µg/mL)
Ag	100	Mn	50
Be	50	Ni	100
Cd	100	Pb	100
Co	50	Zn	100
Cu	50		

ICS Analytes Sub-B2
For ICP-AES CLP
Matrix: 20% HCl

Volume (mL)	Product No.
100	VHG-ICSAB2-100
500	VHG-ICSAB2-500

Element	Conc. (µg/mL)	Element	Conc. (µg/mL)
Ba	50	V	50
Cr	50		

CLP Continuing Calibration Verification - CCV

Continuing Calibration Verification Std. 1
Matrix: 5% HNO_3

Volume (mL)	Product No.
100	VHG-CCV1-100
500	VHG-CCV1-500

Element	Conc. (µg/mL)	Element	Conc. (µg/mL)
Ag	100	Fe	500
Ba	500	Mn	500
Be	200	Ni	500
Cd	250	Pb	500
Co	500	Tl	500
Cu	500	Zn	500

Continuing Calibration Verification Std. 2
Matrix: 20% HCl

Volume (mL)	Product No.
100	VHG-CCV2-100
500	VHG-CCV2-500

Element	Conc. (µg/mL)	Element	Conc. (µg/mL)
Al	500	Mg	5000
As	500	Na	5000
Ca	5000	Sb	500
Cr	500	Se	500
K	5000	V	500

EPA Methods 6010 & CLP for ICP-AES

CLP Spiking Solutions

CLP Spiking Solution 1
Matrix: 5% HNO_3

Volume (mL)	Product No.
100	VHG-W1-100
500	VHG-W1-500

Element	Conc. (µg/mL)	Element	Conc. (µg/mL)
Ag	5	Mn	50
Be	5	Ni	50
Cd	5	Pb	50
Co	50	Tl	200
Cu	25	Zn	50
Fe	100		

CLP Spiking Solution 2
Matrix: 20% HCl

Volume (mL)	Product No.
100	VHG-W2-100
500	VHG-W2-500

Element	Conc. (µg/mL)	Element	Conc. (µg/mL)
Al	200	Sb	50
As	200	Se	200
Ba	200	V	50
Cr	20		

CLP ILM05.2 Contract Required Quantitation Limit for Water and Soil

ICP-AES CRQL Solution 1
Matrix: 5% HNO_3, tr. tartaric acid

Volume (mL)	Product No.
100	VHG-CRQL1AES-100

Element	Conc. (µg/mL)	Element	Conc. (µg/mL)
Ag	10	Fe	100
Al	200	Mn	15
As	15	Ni	40
Ba	200	Pb	10
Be	5	Sb	60
Cd	5	Se	35
Co	50	Tl	25
Cr	10	V	50
Cu	25	Zn	60

ICP-AES CRQL Solution 2
Matrix: 5% HNO_3

Volume (mL)	Product No.
100	VHG-CRQL2AES-100
500	VHG-CRQL2AES-500

Element	Conc. (µg/mL)	Element	Conc. (µg/mL)
Ca	5000	Mg	5000
K	5000	Na	5000

Mercury Standard 20
Matrix: 5% HNO_3

Volume (mL)	Product No.
100	VHG-HG20-100

Element	Conc. (µg/mL)
Hg	20

CLP Contract Required Detection Limit – CRDL

CRDL Solution 1
Matrix: 5% HNO_3, tr. tartaric acid

Volume (mL)	Product No.
100	VHG-CRDL-100

Element	Conc. (µg/mL)	Element	Conc. (µg/mL)
Ag	20	Ni	80
As	20	Pb	6
Be	10	Sb	120
Cd	10	Se	10
Co	100	Tl	20
Cr	20	V	100
Cu	50	Zn	40
Mn	30		

ICP-MS Tuning Solutions

◆ Tuning solutions are designed to meet ICP-MS manufacturers' specifications

Ready to Use Solutions

Tuning Solution for Agilent Instruments
Matrix: 2% HNO_3, Volume: **500mL**

Elements	Conc. (µg/L)	Product No.
^{7}Li, Co, Y, Ce, Tl	10	VHG-LMSTNG5DIL-500

Tuning Solution for Agilent 7500cs Instrument
Matrix: 2% HNO_3, Volume: **500mL**

Elements	Conc. (µg/L)	Product No.
Ce, Co, Li, Mg, Tl, Y	1	VHG-LMSTNG101-500

Cobalt in HCl Tuning Solution for Agilent Instruments
Matrix: 2% Ultrapure HCl, Volume: **500mL**

Elements	Conc. (µg/L)	Product No.
Co	1	VHG-LMSTNG4-500

Tuning Solution for PerkinElmer Instruments
Matrix: 2% HNO_3, Volume: **500mL**

Elements	Conc. (µg/L)	Product No.
^{7}Li, Be, Mg, Co, Y, In, Ba, Ce, Tl, Pb, U	10	VHG-LMSTNG7-500

Tuning Solution for PerkinElmer DRC Instruments
Matrix: 2% HNO_3, Volume: **500mL**

Elements	Conc. (µg/L)	Product No.
Ba	10	VHG-LMSTNG8-500
Be, Mg, Fe, Co, In, Ce Pb, Th, U	1	

Tuning Solution for Thermo Instruments
Matrix: 2% HNO_3, Volume: **500mL**

Elements	Conc. (µg/L)	Product No.
^{7}Li, Be, Mg, Co, In, Ba, Ce, Pb, Bi, U	10	VHG-LMSTNG6-500

Tuning Solution for Varian Instruments
Matrix: 2% HNO_3, Volume: **500mL**

Elements	Conc. (µg/L)	Product No.
Be, Mg, Co, In, Ba, Ce, Tl, Pb, Th	250	VHG-LMSTNG9-500

Concentrates - Ready to Dilute

Tuning/Mass Calibration Multi-Element Mix 1
Matrix: 5% HNO_3, Volume: **100mL or 500mL**

Elements	Conc. (µg/mL)	Product No.
^{7}Li, Y, Ce, Tl	10	VHG-LMSTNG1-100 VHG-LMSTNG1-500

Item suitable for use with Agilent instruments as well as others

Tuning/Mass Calibration Multi-Element Mix 1A
Matrix: 1% HNO_3, 0.5% HCl, Volume: **100mL or 500mL**

Elements	Conc. (µg/mL)	Product No.
^{7}Li, Co, Y, Ce, Tl	10	VHG-LMSTNG5CONC-100 VHG-LMSTNG5CONC-500

Tuning/Mass Calibration Multi-Element Mix 2
Matrix: 1% HNO_3, Volume: **100mL or 500mL**

Elements	Conc. (µg/mL)	Product No.
Be, Mg, Co, In, Ce, Pb	10	VHG-LMSTNG2Z-100 VHG-LMSTNG2Z-500

Item suitable for use with Thermo instruments as well as others

Tuning/Mass Calibration Multi-Element Mix 3
Matrix: 5% HNO_3, Volume: **100mL or 500mL**

Elements	Conc. (µg/mL)	Product No.
^{7}Li, Be, Mg, Co, Y, In, Ba, Ce, Tb, Pb, U	10	VHG-LMSTNG3Z-100 VHG-LMSTNG3Z-500

Item suitable for use with Thermo instruments as well as others

VHG Tips

Instrument manufacturers often suggest special instrument tuning and optimization solutions. We can provide custom solutions for this purpose. Please submit a request.

Our "Internal Standard Multi-Element Mix 2" is recommended for ICP-MS environmental sample analysis. It contains common, method suggested elements and has the additional advantage of a higher concentration for ^{6}Li and ^{45}Sc--this aids in reducing error in results due to slight interferences or contamination evident at masses 6 and 45.

ICP-MS Tuning and Detector Optimization Solutions

- Tuning solutions are designed to meet ICP-MS manufacturers' specifications

Detector Calibration Multi-Element Mix

Matrix	Volume (mL)	Product No.
5% HNO_3	100	VHG- LDCAL-100

Element	Conc. (µg/mL)	Element	Conc. (µg/mL)
^{7}Li	50	In	10
Be	100	Ce	10
Mg	25	Tb	5
Sc	25	Tl	10
Co	20	U	5
Y	10		

Item is suitable for use with Thermo instruments as well as others.

Oxide & Doubly Charged Ion Test Mix

Matrix: 2% HNO_3, Volume: **100 mL**

Elements	Conc. (µg/mL)	Product No.
Ba, Ce	1	VHG-LOD-100

See Page 7 for single-element Barium and Cerium standards.

P/A Tuning Multi-Element Mix 1

Matrix	Volume (mL)	Product No.
20% HCl, tr. HF	100	VHG-LDPA1-100

Element	Conc. (µg/mL)	Element	Conc. (µg/mL)
^{6}Li	5	Y	2.5
Be	20	Mo	10
Na	5	Ru	10
Mg	10	Pd	10
Al	5	Cd	20
Sc	5	In	5
Ti	5	Sn	10
V	5	Sb	10
Cr	5	Ba	5
Mn	5	Tb	2.5
Co	5	Lu	5
Ni	10	Ir	5
Cu	5	Pb	10
Zn	20	Bi	5
Ge	10	Tl	5
As	20	Th	5
Sr	5	U	5

Item is suitable for use with Agilent instruments as well as others.

ICP-MS Internal Standard Stock Solutions

- Single and Multi-element internal standard stock solutions are manufactured to be free of impurities.
- These solutions are shipped with a comprehensive Certificate of Analysis.

Single-Element Stock Standards

Volume: **100mL**

Element	Matrix	Conc. (µg/mL)	Product No.
^{6}Li	2% HNO_3	100	VHG-LISC6LI-100
^{6}Li	2% HNO_3	10	VHG-LISA6LI-100
Sc	2% HNO_3	10	VHG-LISASC-100
Co	2% HNO_3	10	VHG-LISACO-100
Ge	2% HNO_3, tr. HF	10	VHG-LISAGE-100
Y	2% HNO_3	10	VHG-LISAY-100
Rh	2% HCl	10	VHG-LISARH-100
In	2% HNO_3	10	VHG-LISAIN-100
Tb	2% HNO_3	10	VHG-LISATB-100
Lu	2% HNO_3	10	VHG-LISALU-100
Ir	2% HCl	10	VHG-LISAIR-100
Pt	5% HCl	10	VHG-LISAPT-100
Bi	2% HNO_3	10	VHG-LISABI-100

ICP-MS Internal Standard Stock Solutions

- Made of pure materials and free of contaminating elements
- Blends include the most common and effective elements for ICP-MS
- Sold in convenient concentrations for sample diluting into working solutions or as the stock blend for automated addition of internal standards

Internal Standard Multi-Element Mix 1

Matrix	Volume (mL)	Product No.
5% HNO_3	100	VHG-LIS1-100

Element	Conc. (µg/mL)	Element	Conc. (µg/mL)
^6Li	100	In	100
Sc	100	Tb	100
Ga	100	Bi	100
Y	100		

Internal Standard Multi-Element Mix 2

Matrix	Volume (mL)	Product No.
2% HNO_3	100	VHG-LIS2-100

Element	Conc. (µg/mL)	Element	Conc. (µg/mL)
^6Li	100	In	20
Sc	100	Tb	20
Ga	20	Bi	20
Y	20		

Internal Standard Multi-Element Mix 3

Matrix	Volume (mL)	Product No. No.
5% HNO_3, tr. HF	100	VHG-LIS3-100

Element	Conc. (µg/mL)	Element	Conc. (µg/mL)
^6Li	100	Tb	100
Sc	100	Lu	100
Ge	100	Bi	100
In	100		

Internal Standard Multi-Element Mix 4

Matrix	Volume (mL)	Product No.
5% HNO_3, tr. HF	100	VHG-LIS4-100

Element	Conc. (µg/mL)	Element	Conc. (µg/mL)
^6Li	50	In	10
Sc	50	Tb	10
Ge	25	Bi	10
Te	25		

Internal standards for EPA Methods can be found on Pages 43 and 45.

CCT/DRC/ORS Multi-Element Mix 1

Matrix	Volume (mL)	Product No.
2% HNO_3	100	VHG-LCELL-100

Element	Conc. (µg/mL)	Element	Conc. (µg/mL)
Cr	100	As	100
Fe	100	Se	100

Gold Stabilizer for Hg (Single Element)

Matrix: 5% HCl Conc: **100µg/mL**

Element	Volume (mL)	Product No.
Au	100	VHG-LSAU-100

VHG's Mixing Tees

ICP and ICP-MS users can save both time and money by using an inexpensive mixing tee to introduce internal standards to their solutions. See Page 63 for additional information.

VHG Tips

We offer gold stabilizer in solution form for Hg analysis. EPA Method 200.8 for ICP-MS explains the use of gold stabilizer. We recommend an aqueous matrix including HCl and HNO_3. Note that our Au stabilizer includes Cl^-.

We offer gold stabilizer in solution form for Hg analysis. EPA Method 200.8 for ICP-MS explains the use of gold stabilizer. We recommend an aqueous matrix including HCl and HNO_3. Note that our Au stabilizer includes Cl^-.

EPA Method 200.8 for ICP-MS

- Standards designed for US EPA published methods

Acid Matrix/Blank Solutions

Blank Water and Acid Matrices
ASTM Type I water and Trace Metal Grade acids used. HDPE bottles are acid leached and rinsed with DI water.
Volume: 500mL

Name	Matrix	Product No.
Nitric Acid Blank	5% HNO_3	VHG-HNO3-BLK-500
Hydrochloric Acid Blank	5% HCl	VHG-HCL-BLK-500
Hydrochloric/Nitric Blank	5% HCl, 1% HNO_3	VHG-ICB/CCB-500

Internal Standard

Internal Standard Stock Solution for Methods 200.8 & CLP ILM05.2
Matrix: 5% HNO_3

Volume (mL)	Product No.
100	VHG-LIS2008Z-100

Element	Conc. (µg/mL)	Element	Conc. (µg/mL)
^6Li	10	Tb	10
Sc	10	Lu	10
Y	10	Bi	10
In	10		

Tuning Solution

Tune & Resolution Solution 1 for Method 200.8 & ILM05.2
Matrix: 5% HNO_3

Volume (mL)	Product No.
100	VHG-LTS2008D-100

Element	Conc. (µg/mL)	Element	Conc. (µg/mL)
Be	10	In	10
Mg	10	Pb	10
Co	10		

Calibration Standards - See 200.8 Section 7.4 (Cal) & 7.9 (LFB)

Standard A1
Matrix: 5% HNO_3, tr. Tartaric Acid

Volume (mL)	Product No.
100	VHG-L53SSA1-100

Element	Conc. (µg/mL)	Element	Conc. (µg/mL)
Al	10	Ni	10
As	10	Pb	10
Be	10	Sb	10
Cd	10	Se	10
Co	10	Th	10
Cr	10	Tl	10
Cu	10	U	10
Mn	10	V	10
Mo	10	Zn	10

Standard A2
Matrix: 5% HNO_3, tr. Tartaric Acid

Volume (mL)	Product No.
100	VHG-L54SSA2-100

Element	Conc. (µg/mL)	Element	Conc. (µg/mL)
Al	10	Ni	10
As	10	Pb	10
Be	10	Sb	10
Cd	10	Se	50
Co	10	Th	10
Cr	10	Tl	10
Cu	10	U	10
Mn	10	V	10
Mo	10	Zn	10

** NOTE VHG-L54SSA2 is the same asVHG-L53SSA1 but with Se at 50µg/mL*

Standard B
Matrix: 1% HNO_3

Volume (mL)	Product No.
100	VHG-LSSB-100

Element	Conc. (µg/mL)	Element	Conc. (µg/mL)
Ag	10	Ba	10

EPA Method 200.8 for ICP-MS

Single-Element Standards
Ion Chromatography and Wet Chemistry Standards
Multi-Element Standards for ICP-AES and ICP-MS
Multi-Element
General Environmental
Spiking Solutions
QC Check Samples for Water
Water Pollution Standards
QC Checks for Trace Metals
International Environmental Standards
EPA Method Ref Chart
Second Source (pair-matched) Standards
EPA 200.7, 6010, CLP
ICP-MS Standards
▶ EPA 200.8, 6020 CLP
USP Elemental Impurities

Calibration Standards

200.8 Stock Calibration Standard CS1
Matrix: 5% HNO_3, tr. Tartaric Acid

Volume (mL)	Product No.
100	VHG-L2008CS1-100

Element	Conc. (µg/mL)	Element	Conc. (µg/mL)
Al	10	Ni	10
As	10	Pb	10
Be	10	Sb	10
Cd	10	Se	10
Co	10	Th	10
Cr	10	Tl	10
Mn	10	U	10
Mo	10	V	10

200.8 Stock Calibration Standard CS2
Matrix: 2% HNO_3

Volume (mL)	Product No.
100	VHG-L2008CS2-100

Element	Conc. (µg/mL)	Element	Conc. (µg/mL)
Ag	10	Fe	100
Ba	100	Zn	100
Cu	100		

200.8 Stock Calibration Standard CS3
Matrix: 2% HNO_3

Volume (mL)	Product No.
100	VHG-L2008CS3-100

Element	Conc. (µg/mL)	Element	Conc. (µg/mL)
Ca	10,000	Mg	1000
K	1000	Na	10,000

For second source standards, see Page 34

Primary Standard

Environmental Calibration Standard A
Matrix: 5% HNO_3, tr. Tartaric Acid, tr. HF

Volume (mL)	Product No.
100	VHG-LCAL1A-100

Element	Conc. (µg/mL)	Element	Conc. (µg/mL)
Ag	10	Mn	10
Al	10	Mo	10
As	10	Na	1000
Ba	10	Ni	10
Be	10	Pb	10
Ca	1000	Sb	10
Cd	10	Se	10
Co	10	Sr	10
Cr	10	Ti	10
Cu	10	Tl	10
Fe	1000	U	10
K	1000	V	10
Mg	1000	Zn	10

Second Source Standard

Environmental ICV Standard A
←1 | 2→
Matrix: 5% HNO_3, tr. Tartaric Acid, tr. HF

Volume (mL)	Product No.
100	VHG-LICV1A-100

Element	Conc. (µg/mL)	Element	Conc. (µg/mL)
Ag	10	Mn	10
Al	10	Mo	10
As	10	Na	1000
Ba	10	Ni	10
Be	10	Pb	10
Ca	1000	Sb	10
Cd	10	Se	10
Co	10	Sr	10
Cr	10	Ti	10
Cu	10	Tl	10
Fe	1000	U	10
K	1000	V	10
Mg	1000	Zn	10

Mercury Standard 10
Matrix: 5% HNO_3

Volume (mL)	Product No.
100	VHG-LHGN-100

Element	Conc. (µg/mL)
Hg	10

Gold Stabilizer for Hg (Single Element)
Matrix: 5% HCl

Volume (mL)	Product No.
100	VHG-LSAU-100

Element	Conc. (µg/mL)
Au	100

VHG Tips

With ICP-MS, an internal standard should not be in the unknown or in a spike mix.

Some commercial spiking standards have indium, lithium or bismuth added. We have a range of multi-element solutions absent these elements or others commonly used as ICP-MS internal standards.

EPA Methods 6020 & CLP for ICP-MS

◆ Standards designed for US EPA published methods

US EPA 6020 Internal Standard Stock Solution

Matrix: 5% HNO_3

Volume (mL)	Product No.
100	VHG-LIS6020-100

Element	Conc. (µg/mL)	Element	Conc. (µg/mL)
^{6}Li	10	Tb	10
Sc	10	Ho	10
Y	10	Bi	10
In	10		

Calibration Standard For 6020 CLP-M

Matrix: 2% HNO_3, tr. Tartaric Acid

Volume (mL)	Product No.
100	VHG-CAL6020-100

Element	Conc. (µg/mL)	Element	Conc. (µg/mL)
Ag	10	K	10
Al	10	Mg	10
As	10	Mn	10
Ba	10	Na	10
Be	10	Ni	10
Ca	10	Pb	10
Cd	10	Sb	10
Co	10	Se	10
Cr	10	Tl	10
Cu	10	V	10
Fe	10	Zn	10

US EPA 6020 Tune & Resolution Solution

For method 200.8 & ILM05.2

Matrix: 5% HNO_3

Volume (mL)	Product No.
100	VHG-LTS6020D-100

Element	Conc. (µg/mL)	Element	Conc. (µg/mL)
Li	10	In	10
Co	10	Tl	10

Major Elements Standard

Matrix: 5% HNO_3

Volume (mL)	Product No.
100	VHG-LMES-100
500	VHG-LMES-500

Element	Conc. (µg/mL)	Element	Conc. (µg/mL)
Ca	2000	Mg	2000
Fe	2000	Na	2000
K	2000		

For second source standard, see VHG-LICVMES-100 on Pg. 33

CLP ILM05.2 for ICP-MS Spiking Solution

Matrix: 5% HNO_3, tr. Tartaric Acid

Dilute as prescribed by the method for both waters and soils

Volume (mL)	Product No.
100	VHG-52SS3Z-100
500	VHG-52SS3Z-500

Element	Conc. (µg/mL)	Element	Conc. (µg/mL)
Ag	50	Mn	500
Al	2000	Ni	500
As	40	Pb	20
Ba	2000	Sb	100
Be	50	Se	10
Cd	50	Tl	50
Co	500	V	500
Cr	200	Zn	500
Cu	250		

CLP ILM05.2 Contract Required Quantitation Limit For Water

ICP-MS CRQL Solution 1

Matrix : 5% HNO_3, tr. Tartaric Acid

Volume (mL)	Product No.
100	VHG-CRQL1MS-100

Element	Conc. (µg/mL)	Element	Conc. (µg/mL)
Ag	10	Mn	5
Al	300	Ni	10
As	10	Pb	10
Ba	100	Sb	20
Be	10	Se	50
Cd	10	Tl	10
Co	5	V	10
Cr	20	Zn	10
Cu	20		

ICP-MS CRQL Solution 2

Matrix: 5% HNO_3, tr. Tartaric Acid

Volume (mL)	Product No.
100	VHG-CRQL2MS-100

Element	Conc. (µg/mL)	Element	Conc. (µg/mL)
Ag	10	Mn	10
As	10	Ni	10
Ba	100	Pb	10
Be	10	Sb	20
Cd	10	Se	50
Co	10	Tl	10
Cr	20	V	10
Cu	20	Zn	20

EPA Methods 6020 & CLP for ICP-MS

Interference Checks

US EPA ICP-MS ICS A Mix 1
For method 6020, ILM05.2 and ILMO5.3
Matrix: 5% HNO_3/1.5% HCl

Volume (mL)	Product No.
500	VHG-LICSA1Z-500

Element	Conc. (µg/mL)	Element	Conc. (µg/mL)
Al	500	K	500
C	1000	Mg	500
Ca	500	Na	500
Cl	5000	P	500
Fe	500	S	500

US EPA ICP-MS ICS Interferents A Mix 2
For method 6020, ILM05.2 and ILMO5.3
Matrix: 5% HNO_3/1.5% HCl

Volume (mL)	Product No.
500	VHG-LICSA2-500

Element	Conc. (µg/mL)	Element	Conc. (µg/mL)
Mo	10	Ti	10

Method 6020 ICS: Analytes B
Matrix: 5% HNO_3

Volume (mL)	Product No.
100	VHG-LICSB1-100

Element	Conc. (µg/mL)	Element	Conc. (µg/mL)
Ag	10	Cu	10
Al	10	Mn	10
As	10	Ni	10
Cd	10	Se	10
Co	10	V	10
Cr	10	Zn	10

Method 6020 ICS-A mixes are to be diluted 1:5 and ICS-B by 1:500 in order to achieve prescribed concentrations.

ICS Target Analytes B
For ILM 05.2 & ILM 05.3
Matrix: 5% HNO_3, tr. Tartaric Acid

Volume (mL)	Product No.
100	VHG-LICSB2Z-100

Element	Conc. (µg/mL)	Element	Conc. (µg/mL)
Ag	10	Mn	10
Al	10	Ni	10
As	10	Pb	10
Ba	10	Sb	10
Be	10	Se	10
Cd	10	Tl	10
Co	10	V	10
Cr	10	Zn	10
Cu	10		

6020A ICS Interferents A
Matrix: 2% HNO_3/6.5% HCl/tr. HF
To be diluted by 1:10 to achieve prescribed concentrations

Volume (mL)	Product No.
500	VHG-LINTA6020A-500

Element	Conc. (µg/mL)	Element	Conc. (µg/mL)
Al	1000	Mg	1000
C	2000	Mo	20
Ca	3000	Na	2500
Cl	20,000	P	1000
Fe	2500	S	1000
K	1000	Ti	20

6020A & CLP-M ICS Analytes B
Matrix: 5% HNO_3
To be diluted by 1:1000 to achieve prescribed concentrations

Volume (mL)	Product No.
100	VHG-LINTB6020-100

Element	Conc. (µg/mL)	Element	Conc. (µg/mL)
Ag	5	Mn	20
As	10	Ni	20
Cd	10	Se	10
Co	20	V	20
Cr	20	Zn	10
Cu	20		

General Memory & Interference Check Sample Mix

Environmental Sample Interferents
Matrix: 2% HNO_3/1.5% HCl

Volume (mL)	Product No.
500	VHG-LMCS1Z-500

Element	Conc. (µg/mL)	Element	Conc. (µg/mL)
Al	1000	K	1000
C	5000	Mg	1000
Ca	1000	Na	1000
Cl	5000	P	1000
Fe	1000	S	1000

USP Elemental Impurities Standards

For ICP-OES, ICP-MS and other analytical techniques

Our elemental impurities in pharmaceutical products were developed to ensure compliance with United States Pharmacopeia (USP) chapters <232> *Elemental Impurities - Limits* and <233> *Elemental Impurities - Procedures.*

- Suitable for ICP and ICP-MS, or other elemental techniques
- Prepared from high purity raw materials, acids and 18 Mohm DI water
- Manufactured in our ISO 9001, ISO Guide 34 facility, and certified in our ISO/IEC 17025 laboratory
- Assayed by NIST HP-ICP-AES method
- Purity confirmed by ICP-MS
- Accompanied by NIST-traceable COA

USP Class 1 Oral Impurities Standard
Matrix: 5% HNO_3

Volume (mL)	Product No.
100	VHG-USP1-100

Element	Conc. (mg/kg)	Element	Conc. (mg/kg)
As	1.5	Hg	15
Cd	25	Pb	5

USP Class 1 Parenteral Impurities Standard
Matrix: 5% HNO_3

Volume (mL)	Product No.
100	VHG-USP1-PI-100

Element	Conc. (mg/kg)	Element	Conc. (mg/kg)
As	1.5	Hg	1.5
Cd	2.5	Pb	5

USP Class 2 Oral & Parenteral Precious Metals Standard
Matrix: 20% HCl

Volume (mL)	Product No.
100	VHG-USP2-OPPM-100

Element	Conc. (mg/kg)	Element	Conc. (mg/kg)
Ir	100	Pt	100
Os	100	Rh	100
Pd	100	Ru	100

USP Class 2 Oral & Parenteral Impurities Standard
Matrix: 5% HNO_3

Volume (mL)	Product No.
100	VHG-USP2-OPI-100

Element	Conc. (mg/kg)	Element	Conc. (mg/kg)
Cr	10	Ni	50
Cu	100	V	10
Mo	10		

USP Class 1 Oral & Parenteral Mercury
Matrix: 5% HNO_3

Volume (mL)	Product No.
100	VHG-USP1-OPHG-100

Element	Conc (mg/kg)
Hg	10

Gold Stabilizer for Mercury Determination
Matrix: 5% HCl

Volume (mL)	Product No.
100	VHG-LSAU-100

Element	Conc (µg/mL)
Au	100

New USP elemental impurities standards will be available soon. Visit our website for the most current product information available.

More than 5,000 impurities from Atorvastatin to Zopiclone

LGC offers over 5,000 reference materials to identify and quantify impurities in **APIs, finished dosage** forms and excipients.

- Get all your impurities from a single source
- Over 5,000 impurities from all relevant suppliers
- Compliant with ICH guidelines Q3A and Q3B
- LGC manufactured impurities accompanied by the most detailed certificate of analysis
- Customised impurities available from LGC

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LGC Quality - ISO Guide 34 • GMP/GLP • ISO 9001 • ISO/IEC 17025 • ISO/IEC 17043

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VHG Labs Certificate of Analysis

Multi-Element Aqueous CRM

Internal Standard Multi-Element Mix 1

Matrix: 5% HNO_3

Product #: VHG-LIS1-100 Lot #: Sample

Element	Certified Concentration & Uncertainty	Element	Certified Concentration & Uncertainty	Element	Certified Concentration & Uncertainty
Bi	100.0 ± 0.5 µg/mL	Li^6	100.0 ± 0.5 µg/mL	Y	100.0 ± 0.5 µg/mL
Ga	100.0 ± 0.5 µg/mL	**Sc**	99.99 ± 0.50 µg/mL		
In	100.0 ± 0.5 µg/mL	Tb	100.0 ± 0.5 µg/mL		

Intended Use: This solution is intended for use as a certified reference material or an internal standard for inductively coupled plasma mass spectrometry (ICP-MS), or alternative techniques, such as inductively coupled plasma optical emission spectroscopy (ICP-OES), and flame or furnace atomic absorption spectroscopy (AA or GFAA).

Certification & Traceability: VHG CRMs are manufactured and certified under a quality management system that is accredited to ISO 9001, ISO Guide 34 and ISO/IEC 17025. This CRM was prepared to the certified concentrations shown above by gravimetric methods using single-element concentrates that were certified using the "High Performance ICP-OES" protocol developed by NIST and are directly traceable to the NIST SRMs listed below. This solution was stabilized using high purity nitric acid (HNO_3) and diluted with filtered (0.22µm), 18 M-ohm deionized water. The balances used in the preparation of VHG CRMs are calibrated regularly with traceability to NIST. All volumetric dilutions are performed in Class A calibrated glassware. The certified concentrations were determined by VHG Labs based upon gravimetric procedures. Secondary verification of the certified concentrations was performed by VHG Labs using ICP-OES that was calibrated and/or referenced against NIST SRMs: 3106, 3119a, 3124a, 3129a, 3148a, 3157a and 3167a. The uncertainty associated with each certified concentration represents the expanded uncertainty at the 95% confidence level using a coverage factor of k=2.

Uncertified Values: ICP-MS was used to determine trace metal concentrations for this product (nd = not determined).

Trace Concentrations (µg/L)

Ag	<0.5	Ce	<0.2	Gd	<0.2	Lu	<0.2	Pb	<1	Se	<2	Tl	<0.5
Al	<2	Co	<1	Ge	<0.5	Mg	<5	Pd	<0.5	Si	<100	Tm	<0.2
As	<2	Cs	<0.5	Hf	<0.2	Mn	<1	Pr	<0.2	Sm	<0.2	U	<0.5
Au	<0.5	Cr	<0.5	Hg	<0.5	Mo	<0.5	Pt	<0.5	Sn	<0.5	V	<1
B	<5	Cu	<1	Ho	<0.2	Na	<25	Rb	<0.5	Sr	<1	W	<0.5
Ba	<1	Dy	<0.2	In	MAJOR	Nb	<0.5	Re	<0.2	Ta	<0.5	Y	MAJOR
Be	<0.5	Er	<0.2	Ir	<0.2	Nd	<0.2	Rh	<0.5	Tb	MAJOR	Yb	<0.2
Bi	MAJOR	Eu	<0.2	K	<25	Ni	<2	Ru	<0.5	Te	<1	Zn	<2
Ca	<25	Fe	<10	La	<0.5	Os	<0.5	Sb	<0.5	Th	<0.5	Zr	<0.5
Cd	<0.5	Ga	MAJOR	Li	MAJOR	P	<100	Sc	MAJOR	Ti	<2		

Instructions for Use: We recommend that the solution be thoroughly mixed by repeated shaking or swirling of the bottle immediately prior to use. To achieve the highest accuracy the analyst should: (1) use only pre-cleaned containers and transferware, (2) not pipette directly from the CRM's original container, (3) use a minimum sub-sample size of 500µL, (4) make dilutions using calibrated balances or certified volumetric class A flasks and pipettes, (5) dilute with the same matrix as the original CRM, and (6) never pour used product back into the original container. The solution should be kept tightly capped and stored under normal laboratory conditions. Do not freeze, heat, or expose to direct sunlight. Minimize exposure to moisture or high humidity.

Period of Validity: VHG ensures the accuracy of this solution for **12 Months** from the Certification date shown below, provided the instructions for use are followed. During the period of validity, the purchaser will be notified if this product is recalled due to any significant changes in the stability of the solution.

VHG Labs, Inc.

Susan Evans Norris, Certifying Officer

Certification Date

ACCREDITED

REFERENCE MATERIALS
PRODUCER CERT #2848.02
CHEMICAL TESTING
CERT #2848.01

ISO 9001
ISO Guide 34
ISO/IEC 17025
ISO/IEC 17043

276 Abby Road, Manchester, NH 03103 USA
(603) 622-7660 Fax: (603) 622-5180 www.vhglabs.com

Solid Standards

www.lgcstandards.com

RoHS Calibration Standards (PE Powder)

For ICP or XRF

QC Check Samples for PE (Polyethylene) Analysis

RoHS compliant polymer samples in powder form for the determination of hazardous materials in PE. Available in 3 standard set.

Standard No.	Br (wt %)	Cd (wt %)	Cr (wt %)	Hg (wt %)	Pb (wt %)
Standard 1	0.0000	0.0000	0.0000	0.0000	0.0000
Standard 2	0.0250	0.0050	0.0500	0.0500	0.0500
Standard 3	0.0500	0.0100	0.1000	0.1000	0.1000

Standard Sets	Product No.
Set of 3 QC Check Samples in PE Powder (25 grams each)	VHG-ROHS-PE-SET1P

XRF Standard for PE (Polyethylene) Analysis

RoHS compliant polymer standards in powder form for the determination of hazardous materials in PE. Available in 9 standard set plus 1 QC Check Sample.

Standard No.	Br (wt %)	Cd (wt %)	Cr (wt %)	Hg (wt %)	Pb (wt %)
Standard 1	0.0000	0.0000	0.0000	0.0000	0.0000
Standard 2	0.0025	0.0025	0.0050	0.0100	0.1000
Standard 3	0.0400	0.0100	0.0750	0.0075	0.0250
Standard 4	0.0100	0.0125	0.1250	0.0500	0.0050
Standard 5	0.0250	0.0075	0.1000	0.0250	0.1250
Standard 6	0.0500	0.0010	0.0650	0.0800	0.0750
Standard 7	0.0200	0.0005	0.0250	0.1000	0.0100
Standard 8	0.0300	0.0050	0.0500	0.0030	0.0500
Standard 9	0.0050	0.0150	0.0100	0.1200	0.0350
QC Sample	0.0250	0.0050	0.0500	0.0500	0.0500

Standard Sets	Product No.
Set of 9 Standards plus one QC Check Sample in PE powder (25 grams each)	VHG-ROHS-PE-SET2P

RoHS Calibration Standards (PVC Discs or Powder)

For ICP or XRF

QC Check Samples for PVC (Polyvinylchloride) Analysis

RoHS compliant polymer samples in powder or disc form for the determination of hazardous materials in PVC. PVC samples also include some Ca and Cl in each sample. Available in 3 standard set only.

Standard No.	Br (wt %)	Cd (wt %)	Cr (wt %)	Hg (wt %)	Pb (wt %)
Standard 1	0.0000	0.0000	0.0000	0.0000	0.0000
Standard 2	0.0250	0.0500	0.0500	0.0500	0.0500
Standard 3	0.0500	0.1000	0.1000	0.1000	0.1000

Standard Sets	Product No.
Set of 3 QC Check Samples in PVC powder (25 grams each)	VHG-ROHS-PVC-SET3P
Set of 3 QC Check Samples, PVC discs (40mm each)	VHG-ROHS-PVC-SET3D

For 31mm discs, please inquire.

XRF Standard Sets for PVC (Polyvinylchloride) Analysis

RoHS compliant polymer samples in powder or disc form for the determination of hazardous materials in PVC. PVC samples also include some Ca and Cl in each sample. Available in 9 standard set plus 1 QC Check Sample.

Standard No.	Br (wt %)	Cd (wt %)	Cr (wt %)	Hg (wt %)	Pb (wt %)
Standard 1	0.0000	0.0000	0.0000	0.0000	0.0000
Standard 2	0.0025	0.0025	0.0050	0.0100	0.1000
Standard 3	0.0400	0.0100	0.0750	0.0075	0.0250
Standard 4	0.0100	0.0125	0.1250	0.0500	0.0050
Standard 5	0.0250	0.0075	0.1000	0.0250	0.1250
Standard 6	0.0500	0.0010	0.0650	0.0800	0.0750
Standard 7	0.0200	0.0005	0.0250	0.1000	0.0100
Standard 8	0.0300	0.0050	0.0500	0.0030	0.0500
Standard 9	0.0050	0.0150	0.0100	0.1200	0.0350
QC Sample	0.0250	0.0050	0.0500	0.0500	0.0500

Standard Sets	Product No.
Set of 9 Standards plus 1 QC Check Sample in PVC powder (25 grams each)	VHG-ROHS-PVC-SET4P
Set of 9 Standards plus 1 QC Check Sample PVC discs (40mm each)	VHG-ROHS-PVC-SET4D

For 31mm discs, please inquire.

Sulfur QC Check Monitors

Monitor Samples for XRF-Silicate Glasses. Optically polished on the analytical surface; sizes 30-40mm in diameter and 5mm in height.

Sulfur Standards	
Description	**Product No.**
High level of Sulfur approx. 0.70wt%	VHG-SGL-HI
Low level of Sulfur approx. 0.005wt%	VHG-SGL-LO
Mid level of Sulfur approx. 0.050wt%	VHG-SGL-MD

For other QC check monitors, please inquire.

XRF Standards for RoHS
- ▶ Standards for PE Analysis
- ▶ Standards for PVC Analysis

XRF Solid Standards
- ▶ Sulfur QC Check Monitors
- Nitrogen in Solid Polymer

Binder and Briquetting Materials, Grinding Additives

Borate Fusion Fluxes

Soil CRMs

Nitrogen in Solid Polymer

For XRF

Nitrogen in Solid Polymer

Finely divided synthetic polymer standard that contains a certified amount of nitrogen. Used for calibrating instruments for the analysis of nitrogen in all types of polymers and other solids that are completely combustible.

Description	Product No.
Concentration Range: 1ppm - 3.0 wt% Nitrogen (10 grams)	VHG-NP-XX-10G

Please specify concentration. Please inquire for other sizes.

Binder and Briquetting Materials, Grinding Additives

Direct analysis of solids by XRF and other techniques such as Laser Ablation ICP-MS often utilize dry sample preparation materials. VHG Labs provides a range of special high quality products for these purposes.

Boric Acid

Powder used as binding agent and tablets as grinding aid that withstands elevated temperature. Moderately self-binding.

Form	Package	Product No.
Powder	500g bottle	VHG-BAX1-500G
0.5g Tablets	1500/bottle	VHG-BAX50-1500T

Cellulose Binder

Good binder choice for samples with moderately soft characteristics, e.g. cement, limestone, etc. Available in powder form.

Form	Package	Product No.
Ashless Powder	500g bottle	VHG-CBXA-500G
Microcrystalline Powder	500g bottle	VHG-CBXM-500G

Paraffin Binder

Binding aid, excellent for use with geological, ore, slag, and other hard or abrasive samples. Low moisture, <20µm powder that can be blended with sample at 10-20% by weight for pressing.

Form	Package	Product No.
Powder	450g bottle	VHG-PBX1-450G

Pellet Mix

Wax-based blend, self-binding. For use with cement, alumina, ceramics, limestone, and miscellaneous refractories. Powder (approx. 30µm) that can be blended with sample at 10% by weight.

Form	Package	Product No.
Powder	500g bottle	VHG-PMX1-500G
0.25g Tablets	500/bottle	VHG-PMX25-500T
0.5g Tablets	500/bottle	VHG-PMX50-500T

PTFE (Teflon®)

Often the binder of choice for laser ablation where low blanks are needed. 6-10µm particle size. Use at up to 1:1 sample to binder.

Form	Package	Product No.
Powder	100g bottle	VHG-PTFE12-100

V-Flux™ High Purity Borate Fusion Fluxes

- High Purity - 99.99+% (Trace Impurities Certified on COA)
- Homogeneous, Free-Flowing, Dust-Free - Easy to Handle
- Controlled High Density Particle Size – No Crucible Overflows
- Anhydrous, Non-Hygroscopic – Faster Weighing Times
- Low Loss on Fusion – Avoids Correction, Pre-Firings
- Pre-Fused Fluxes Feature Uniform Individual Particle Composition

Borate fusion is an effective method of preparing samples, like cement, ceramics, glass, ores, oxides, refractories and rocks that either 1) due to inhomogeneity of particle size, density or composition, are difficult to press as a homogeneous pellet for analysis by XRF or OES or 2) are difficult to dissolve in acid, for analysis by AA or ICP.

Virtually all fusions are performed with borate compounds. Samples are mixed with a flux, typically lithium tetraborate ($Li_2B_4O_7$, m.p. 920ºC), lithium metaborate ($LiBO_2$, m.p. 845ºC) or mixtures of the two. The sample/flux mixture is heated until the flux disintegrates or solubilizes the sample, yielding a melt that is homogeneous at the atomic level and can be cast as a glass disc for analysis by XRF or OES or dissolved in HNO_3 or HCl for AA or ICP analysis.

Lithium tetraborate is better suited for dissolution of basic oxides while lithium metaborate is more suitable for acidic oxides. Between the two, you can dissolve almost anything with bonded oxygen. The addition of a high absorption diluent like lanthanum oxide has particular applications to geological and other similar types of samples exhibiting absorption-enhancement effects. The addition of non-wetting agents like fluorides can be added in small quantities so the molten flux will not stick to the crucible.

Lithium Metaborate Fluxes

Lithium Metaborate Fluxes (m.p. 845ºC)

A basic flux recommended for acidic samples; soluble in water. Often used in testing of ceramics and steel. Will not dissolve highly basic refractories. Samples must be fully oxidized. For use with AA and ICP instrumentation.

Description	Product No.
100% Lithium metaborate	VHG-VFLUX-210-1KG

Lithium Metaborate:Lithium Tetraborate Blends (m.p. 840ºC)

Intermediate acidity. Will dissolve entire aluminosilicate range. Often used in testing of ceramics and glass. Samples must be fully oxidized.

Description	Product No.
80% Lithium metaborate 20% Lithium tetraborate	VHG-VFLUX-211-1KG
80% Lithium metaborate 20% Lithium tetraborate, pre-fused	VHG-VFLUX-211PF-1KG
64.7% Lithium metaborate 35.3% Lithium tetraborate	VHG-VFLUX-212-1KG
64.7% Lithium metaborate 35.3% Lithium tetraborate, pre-fused	VHG-VFLUX-212PF-KG
61.5% Lithium metaborate 33% Lithium tetraborateVHG- 5.5% Sodium nitrate	VHG-VFLUX-213-1KG

XRF Standards for RoHS
XRF Solid Standards
Sulfur QC Check Monitors
▶ Nitrogen in Solid Polymer
Binder and Briquetting Materials, Grinding Additives
▶ Boric Acid
▶ Cellulose Binder
▶ Paraffin Blend
▶ Pellet Mix
▶ PTFE (Teflon®)
Borate Fusion Fluxes
Soil CRMs
▶ Soil Reference Materials
▶ Lead Paint Reference Materials

V-Flux™ High Purity Borate Fusion Fluxes

Lithium Tetraborate Fluxes

Lithium Tetraborate Fluxes (m.p. 920ºC)

General purpose acidic fluxes for fusing aluminosilicates, basic oxides, carbonates, ceramics, cement, glass, rare earth oxides, refractories, soils, and steel. Not suitable for highly acidic samples. Samples must be fully oxidized. VFLUX-312PF is typically used for cements. VFLUX-313 is typically used for ceramics.

Description	Product No.
100% Lithium tetraborate	VHG-VFLUX-310-1KG
100% Lithium tetraborate (100-500 micron), pre-fused	VHG-VFLUX-311PF-1KG
100% Lithium tetraborate (<800 micron), pre-fused	VHG-VFLUX-312PF-1KG
100% Lithium tetraborate (phosphorus <20ppm)	VHG-VFLUX-313-1KG

Lithium Tetraborate:Lithium Metaborate Fluxes (m.p. 875ºC)

Intermediate activity flux. Suitable for aluminosilicates and calcareous refractories. Often used in testing of cement and steel. Samples must be fully oxidized. VFLUX-315 is suitable for glass samples and chrome ore bearing samples up to 50% by weight.

Description	Product No.
66.5% Lithium tetraborate 33.5% Lithium metaborate	VHG-VFLUX-314-1KG
66.5% Lithium tetraborate 33.5% Lithium metaborate, pre-fused	VHG-VFLUX-314PF-1KG
50% Lithium tetraborate 50% Lithium metaborate	VHG-VFLUX-315-1KG
50% Lithium tetraborate 50% Lithium metaborate, pre-fused	VHG-VFLUX-315PF-1KG

Lithium Tetraborate:Lanthanum Oxide Fluxes (m.p. 900ºC)

Non-oxidizing, intermediate activity flux with La as a heavy absorber. Often used in testing of steel and cement. Samples must be fully oxidized.

Description	Product No.
85% Lithium tetraborate 15% Lanthanum oxide	VHG-VFLUX-316-1KG
81.8% Lithium tetraborate 18.2% Lanthanum oxide	VHG-VFLUX-317-1KG

Lithium Tetraborate:Lithium Fluoride Fluxes (m.p. 780ºC)

A low viscosity, low melting, acidic flux. Suitable for fusion on gas burners. Often used in testing of petroleum samples. Samples must be fully oxidized.

Description	Product No.
90% Lithium tetraborate 10% Lithium fluoride	VHG-VFLUX-318-1KG
80% Lithium tetraborate 20% Lithium fluoride	VHG-VFLUX-319-1KG

Lithium Tetraborate:Lithium Carbonate:Lanthanum Oxide (m.p. 700ºC)

A basic oxidizing flux. Suitable for sulfate, phosphate, and other acidic minerals. Will oxidize traces of reduced species. Note: contains La as a heavy absorber.

Description	Product No.
47% Lithium tetraborate 37% Lanthanum oxide 16% Lanthanum carbonate	VHG-VFLUX-320-1KG

Soil Certified Reference Materials

- Interlaboratory certified
- Full certificate of analysis supplied
- Analysis statistics supplied
- Instrumentally determined concentrations
- Suitable for use with US EPA Methods and other related procedures

Metals in Soil Certified Reference Materials

Description	Metals in Sandy Loam Soil	Metals in Sewage Amended Soil
Product No.	VHG-DS1-100G	VHG-SSD1-50G
Size	100g	50g
Element	**Nominal Conc. (mg/kg)**	**Nominal conc. (mg/kg)**
Aluminum Al	2730	15,300
Antimony Sb	4950	n/a
Arsenic As	24.8	6.9
Barium Ba	586	853
Beryllium Be	n/a	0.6
Cadmium Cd	1.2	13.7
Calcium Ca	5430	119,000
Chromium Cr, total	10.7	41.3
Cobalt Co	(2.7)	6.2
Copper Cu	4790	465
Iron Fe	6480	12,700
Lead Pb	(144,742)	89
Magnesium Mg	(2367)	6710
Manganese Mn	174	172
Mercury Hg	4.7	3.2
Molybdenum Mo	n/a	14.2
Nickel Ni	12.6	26
Phosphorus P, total	n/a	(10,071)
Potassium K	1010	6230
Selenium Se	n/a	19.9
Silver Ag	6.5	36.3
Sodium Na	380	2490
Tin Sn	(304.1)	n/a
Vanadium V	8.7	109
Zinc Zn	546	625

Values in parentheses are not certified and are given for information only.

XRF Standards for RoHS
XRF Solid Standards
Binder and Briquetting Materials, Grinding Additives
Borate Fusion Fluxes
Soil CRMs
▶ Soil Reference Materials
Lead Paint Reference Materials

Soil Certified Reference Materials

- Interlaboratory certified
- Full certificate of analysis supplied
- Analysis statistics supplied
- Instrumentally determined concentrations
- Suitable for use with US EPA Methods and other related procedures

Metals in Sewage Sludge Certified Reference Materials		
Description	Metals in Sewage Sludge (Amended)	Metals in Sewage Sludge (Amended)
Product No.	VHG-SL1-50G	VHG-SL2-40G
Size	50g	40g
Element	**Nominal Conc. (mg/kg)**	**Nominal conc. (mg/kg)**
Aluminum Al	12,300	18,957
Antimony Sb	3.1	195.6
Arsenic As	32.9	170.6
Barium Ba	1020	1288
Beryllium Be	4.4	70.2
Boron B	156	91
Cadmium Cd	497	76
Calcium Ca	48,000	44,759
Chromium Cr, total	346	192
Cobalt Co	5.7	83.4
Copper Cu	1130	670
Iron Fe	19,700	23,572
Lead Pb	303	284
Magnesium Mg	8470	7563
Manganese Mn	379	408
Mercury Hg	6.9	9.1
Molybdenum Mo	18	69
Nickel Ni	159	279
Phosphorus P, total	2.2 wt %	2.01 wt%
Potassium K	3170	4492
Selenium Se	27.3	307.6
Silicon Si	590	n/a
Silver Ag	44	72
Sodium Na	1630	1717
Strontium Sr	658	677
Thallium Tl	n/a	111
Tin Sn	n/a	218
Vanadium V	40.5	297
Zinc Zn	1390	1304

Soil Reference Materials

Metals in Clean Soil Reference Materials		
Description	Blank (Clean) Clay Loam Soil	Blank (Clean) Sandy Loam Soil
Product No.	VHG-BLKSOIL1-100G	VHG-BLKSOIL2-100G
Size	100g	100g
Element	**Nominal Conc. (mg/kg except *)**	**Nominal Conc. (mg/kg except *)**
Aluminum Al	3540	11,033
Antimony Sb	<1	<1
Arsenic As	2	2
Barium Ba	50	204
Beryllium Be	<0.2	0.7
Cadmium Cd	<0.3	0.5
Calcium Ca, soluble	20* (meq/L)	11*(meq/L)
Chromium Cr	<1	9
Cobalt Co	<1	9
Copper Cu	<1	10
Iron Fe	3163	27,000
Lead Pb	<2	17
Magnesium Mg	228* (meq/L)	3* (meq/L)
Manganese Mn	97	577
Mercury Hg	0.03	0.3
Nickel Ni	<1	8
Phosphorus P, total	0.02* (%)	0.09* (%)
Potassium K, soluble	5.7* (meq/L)	0.9* (meq/L)
Selenium Se	0.4	0.3
Silver Ag	<0.5	<0.5
Sodium Na, soluble	39* (meq/L)	0.5* (meq/L)
Thallium Tl	<1	<1
Vanadium V	16	17
Zinc Zn	21	112

Lead Paint Reference Materials

Environmental Lead			
Description	**Nominal Conc. Pb**	**Size**	**Product No.**
Lead-Free Paint (Powdered)	<0.01µg/g	20 grams	VHG-PBFP-20G
Lead-Free Soil	<4µg/g	50 grams	VHG-PBFS-50G
Lead in Paint Chips	643µg/g	50 grams	VHG-PBPC-50G
Lead Paint in Soil	484µg/g	50 grams	VHG-PBPS-50G

XRF Standards for RoHS
XRF Solid Standards
Binder and Briquetting Materials, Grinding Additives
Borate Fusion Fluxes
Soil CRMs
Metals in Soil
▶ Metals in Sewage Sludge
▶ Metals in Clean Soil
▶ Lead in Paint

Metal alloy CRMs and elemental reference materials

Exclusive distributor of Rio Tinto Alcan reference materials

We provide a wide range of metal alloy CRMs for many applications, including:

- IARM CRMs for OES, XRF, LIBS and more
- IARM pre-selected CRM alloy sets
- Unique metal alloy proficiency testing program
- Alloy and non-metallic reference materials from around the world

For further information contact us at askus@lgcgroup.com

www.lgcstandards.com

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LGC Quality - ISO 9001 • ISO/IEC 17025 • ISO Guide 34 • GMP/GLP • ISO 13485 • ISO/IEC 17043

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4673/GJ/0216

Instrument Consumables

www.lgcstandards.com

VHG Tips

You can cover sample tubes for trace metals with common poly-olefin (kitchen) wrap instead of waxy stretch film that is sold as laboratory wrap.

Common plastic wrap is generally much cleaner. Also, laboratory tissues may introduce contamination when used for wiping ICP-MS sipper probes.

Autosampler Cups & Tubes

For AA, GFAA, ICP, ICP-MS, Viscometers

VHG Labs autosampler tubes and vials are stadard sizes and fit many manufacturers' autosamplers, including Cetac and Gilson as well as systems by PerkinElmer, Varian, Unicam, TJA/Thermo Fisher Scientific and others.

Small Volume Sample Cups for AA, ICP and ICP-MS Autosamplers

Size	Material	Bottom	Product No.
9.1 x 23.6 mm (1.2mL)	Clarified Polypropylene	Cylindrical	VHG-FAASC4-MP
13 x 25mm (1.5 - 2.0mL)	Clarified Polypropylene	Conical	VHG-FAASC3-MP

Sample Tubes for ICP, ICP-MS Autosamplers

Size	Material	Bottom	Product No.
13 x 100mm (~8mL)	Polypropylene	Round	VHG-FPSC4-MP
17 x 100mm (~15mL)	Polypropylene	Round	VHG-FPSC1-MP
Plug for FPSC1-MP	Polyethylene	Round	VHG-FPSC1-MP-PLUG
30 x 115mm (~50mL) w/cap	Polypropylene	Conical	VHG-FPSC2A
30 x 115mm (~50mL) w/cap	Polypropylene	Conical Freestanding	VHG-FPSC5

Sample Tubes for Viscometer Autosamplers

Size	Material	Bottom	Product No.
2.3 x 6cm (15mL)	Polypropylene	Cylindrical	VHG-FVISC-MPA

Digestion Vials with Cap

Size	Material	Bottom	Product No.
30 x 110 mm (50mL) w/cap	Polypropylene	Flat	VHG-FDIG1-MP

Tubing for Peristaltic Pumps

For ICP & ICP-MS

Peri-Pump Tubing materials

Flexible PVC - Clear and economical, used in most ICP & ICP-MS work. Has excellent chemical resistance, medical grade, FDA approved DMF 2458, meets U.S. Pharmacopoeia Class VI

Solvent Flex - Translucent yellow, used for most oil or organic solvent samples. Resistant to cracking, swelling, and hardening.

Silicone - Clear, peroxide-cured, suitable for high-purity applications. Contains no plasticizer, food grade, FDA approved, meets U.S. Pharmacopoeia Class VI

Viton™ - Black synthetic rubber, resistant to strong acids, bases and solvents.

Santoprene™ - Opaque beige to protect light-sensitive fluids. Very robust, long-lasting tubing, high chemical resistance, medical grade, FDA approved, meets U.S. Pharmacopoeia Class VI

Flaring Tool for Peri-Pump Tubing

The ends of peristaltic pump tubing almost always need to be stretched to get a secure connection. Our flaring tool will work for all sizes, is rugged and won't contaminate or corrode.

Product No.: VHG-D180AWLP

For flared tubing, please inquire

Tubing for Peristaltic Pumps

For ICP & ICP-MS

"2 Bridge" Peri-Pump Tubing					
	Flexible PVC	**Solvent Flex**	**Silicone**	**Viton™**	**Santoprene™**
Quantity Per Pack	12	12	6	6	6
Length (in.)	17.9	17.9	17.9	6.9	15.7
No. of Bridges	2	2	2	2	2
Bridge Interval (in.)	5.9	5.5	5.5	5	5.9
I.D. mm (in.) /Color	**Product No.**	**Product No.**	**Product No.**	**Product No.**	**Product No.**
0.19 (.007")-oran/red	VHG-D180241				
0.25 (.010")-oran/blue	VHG-D180253		VHG-D180247		
0.38 (.015")-oran/grn	VHG-D180261				
0.51 (.02")-oran/yell	VHG-D180213	VHG-D180228		VHG-D180235	VHG-D180256
0.64 (.025")-oran/white	VHG-D180222	VHG-D180230	VHG-D180263	VHG-D180239	
0.76 (.03")-blk/blk	VHG-D180203	VHG-D180209	VHG-D180238	VHG-D180212	VHG-D180268
0.89 (.035")-oran/oran	VHG-D180202	VHG-D180208	VHG-D180255	VHG-D180211	
1.02 (.04")-white/white	VHG-D180219	VHG-D180232	VHG-D180267	VHG-D180236	
1.14 (.045")-red/red	VHG-D180201	VHG-D180207	VHG-D180250	VHG-D180210	VHG-D180259
1.30 (.051")-gray/gray	VHG-D180216	VHG-D180240	VHG-D180265	VHG-D180237	
1.52 (.06")-yell/blue	VHG-D180258		VHG-D180248		
1.65 (.065")-blue/blue	VHG-D180245				
3.18 (.125")-blk/white	VHG-D180276				

"3 Bridge" Peri-Pump Tubing					
	Flexible PVC	**Solvent Flex**	**Silicone**	**Viton™**	**Santoprene™**
Quantity Per Pack	12	12	6	6	6
Length (in.)	17.9	17	15.7	15.7	15.7
No. of Bridges	3	3	3	3	3
Bridge Interval (in.)	2.8	3.2	2.6	3.2	2.8
I.D. mm (in.) /Color	**Product No.**	**Product No.**	**Product No.**	**Product No.**	**Product No.**
0.19 (0.007")-oran/red	VHG-D180215				
0.38 (0.015")-oran/grn	VHG-D180244				
0.64 (0.025")-oran/white	VHG-D180254		VHG-D180264	VHG-D180266	
0.76 (0.03")-blk/blk	VHG-D180218	VHG-D180279			VHG-D180270
0.89 (0.035")-oran/oran	VHG-D180206	VHG-D180280	VHG-D180225	VHG-D180234	VHG-D180249
1.02 (0.04")-white/white	VHG-D180214		VHG-D180257		VHG-D180271
1.14 (0.045")-red/red	VHG-D180204	VHG-D180278	VHG-D180227	VHG-D180223	VHG-D180269
1.52 (0.06")-yell/blue	VHG-D180221				VHG-D180242
3.18 (0.125")-blk/white	VHG-D180277				

VHG Tips

We agree with many instrument manufacturers in recommending Santoprene tubing for drain lines or for cases where highest purity is critical. Santoprene has a much greater lifetime in most applications. While irrelevant for drain lines, it may add modest contamination for Zn and Sn if used for sample uptake.

Tubing for Peristaltic Pumps

For ICP & ICP-MS

"1 Bridge" Pump Tubing for Leeman Labs® ICP Spectrometers				
Description	**Material**	**ID mm (in)**	**Leeman Product No.**	**Product No.**
Sample Uptake	PVC	0.51mm (0.020")	309-3551	VHG-D180217
Sample Uptake	Solvent Flex	0.51mm (0.020")	309-3550	VHG-D180229
Sample Drain	PVC	1.14mm (0.045")	309-3538	VHG-D180220
Sample Drain	Solvent Flex	1.14mm (0.045")	309-3536	VHG-D180231

Mixing Tees for Sample Introduction

For ICP & ICP-MS

The use of a mixing tee to automatically combine two liquid streams, such as the sample and the internal standard, is gaining widespread popularity. VHG carries two types of tees: a simple plastic barbed tee and a 100% PTFE system. Both feature inert materials and low dead volume. If you have been considering an expensive auto-dilutor for your ICP or ICP-MS, try a simple mixing tee first - you may find that you don't need the expense or hassle.

Plastic Barbed Mixing Tee (TJA Type)

The plastic barbed mixing tee is ideal for many ICP and ICP-MS applications. Flexible PVC uptake tubing is used for each leg. A zero dead-space connector combines the liquid streams and a PTFE tube mixes and then delivers the combined solutions to the nebulizer.

TJA Type	Color Code	PTFE Exit
"Leg" 1	orange/orange	0.56mm
"Leg" 2	orange/green	0.38mm

Product No. VHG-D180243

PTFE Mixing Tee System

Suggested Use #1: Adding an internal standard

When an internal standard is teed into the sample stream, the analyst is spared the labor of having to add it to each sample. In addition, dilution takes place (see table below). This is an advantage since many samples require a set, consistent dilution.

Suggested Use #2: Online dilution

If you use a standard nebulizer with an approximate 1 mL/min liquid flow, you can create a 1:1 dilution by using two orange/orange legs. Greater or lesser dilutions can be achieved as desired (see chart below). VHG's new 100% PTFE mixing tee system is made from the best components, is completely configurable, has color-coded ends, and will likely last for years. Call us to configure your set.

Examples (call for others)	Sample diln. achieved	Nebulizer liquid flow	Peri tubing leg #1	Peri tubing leg #2	PTFE tube leg #3
1	Large dilution (1:20)	0.7 - 1.0	orange/red diluted about 1:20 (95%)	orange/orange diluted about 5%	(0.7mm ID) combined solutions
2	1:5	0.7 - 1.0	orange/orange diluted about 20%	orange/green diluted about 80%	(0.7mm ID) combined solutions
3	1:1	0.7 - 1.0	black/black diluted about 50%	black/black diluted about 50%	(0.7mm ID) combined solutions

Product No. (PTFE Tee Only)* VHG-D180TEE

*Pump tubing must be ordered separately.

Nebulizers

For ICP & ICP-MS

- Extensive Line of High Quality Nebulizers
- Designed to Meet or Exceed Original Specifications
- Direct Replacement Items and Upgrade Potential!

Replacement Nebulizers

Concentric Type Glass Nebulizers

Description	Liquid flow (mL/min)	Argon back pressure (psi)	Product No.
A-Type, 1.0 Lpm Ar	1.0	30	VHG-GNB-75
A-Type, 1.0 Lpm Ar	2.0	30	VHG-GNB-76
A-Type, 1.0 Lpm Ar	3.0	30	VHG-GNB-77
C-Type, 1.0 Lpm Ar	1.0	30	VHG-GNB-70
C-Type, 1.0 Lpm Ar	2.0	30	VHG-GNB-71
C-Type, 1.0 Lpm Ar	3.0	30	VHG-GNB-72
K-Type, 0.7 Lpm Ar	3.0	30	VHG-GNB-80
K-Type, 0.7 Lpm Ar Quick Disconnect	3.0	30	VHG-GNB-80QD
K-Type, 0.7 Lpm Ar	2.0	30	VHG-GNB-82
Aerosalt - High Solids, 0.7 Lpm Ar Quick Disconnect, Argon Connect	2.0	30	VHG-GNB-65QDAC

All nebulizers are available with sample and argon quick connection--please inquire. Quartz replacement nebulizers are available upon request.

Cross-Flow (CF) or V-Groove Nebulizers

	Specifications	Product No.
Fixed CF	High Flow (Agilent/HP)	VHG-GNB-94
Fixed CF	Fits 34mm Spray Chamber	VHG-GNB-92S
Fixed CF	Fits 35mm Spray Chamber	VHG-GNB-92
Fixed CF	High Solids (Agilent/HP)	VHG-GNB-93
V-Groove	Noordermeer MDSN, Quick Disconnect, Argon Connect	VHG-GNB-10QDAC
Modified Lichte	MDSN Nebulizer, 1 Lpm Ar	VHG-GNB-20S

MEINHARD®

Concentric Type Nebulizers

Description	Liquid flow (mL/min)	Argon back pressure (psi)	Product No.
A-Type-Quartz	0.5	30	VHG-TQ-30-A0.5
A-Type-Quartz	0.5	50	VHG-TQ-50-A0.5
A-Type-Quartz	3.0	30	VHG-TQ-30-A3
A-Type-Glass	2.0	30	VHG-TR-30-A2
A-Type-Glass	3.0	30	VHG-TR-30-A3
C-Type-Glass	2.0	30	VHG-TR-30-C2
C-Type-Glass	3.0	30	VHG-TR-30-C3
C-Type-Glass	0.5	50	VHG-TR-50-C0.5
C-Type-Glass	1.0	50	VHG-TR-50-C1
K-Type-Glass	2.0	30	VHG-TR-30-K2
K-Type-Glass	3.0	30	VHG-TR-30-K3

We Do Not Recommend Ultrasonic Cleaning Of Nebulizers.

VHG Tips

Concentric Nebulizer types:

"A" types have the nozzle and inner capillary flush with each other and the end tip is flat.

"C" and "K" types have a recessed capillary that handles high dissolved salts.

Quartz is pure SiO_2 and will offer lower backgrounds (ICP-MS) for some elements, such as B, Na & K. The benefit will only be apparent if the other sample introduction components of the instrument correspond.

Nebulizers

For ICP & ICP-MS

VHG Labs is an Authorized Distributor of Glass Expansion Products.

For information on Glass Expansion nebulizers or other sample introduction components, please inquire.

GE GLASS EXPANSION
Quality By Design

Burgener Enhanced Parallel Path Nebulizers

All Burgener Nebulizers have excellent stability and sensitivity, and fit standard spray chambers as direct replacements of glass concentrics. Burgener Nebulizers have no natural aspiration and must have the sample pumped to the nebulizer.

BR Burgener Research

Name	Mfg. No.	Nebulizer Description	VHG Part No.
T2100	T2100	High solids, inert wide bore (750um) Teflon® nebulizer. Designed to replace T2002 and BTN. Ideal for samples with large undissolved particulates - virtually unpluggable. Liquid flow 0.5mL/min to 3.0mL/min. Operates on standard pressures of 30-45psi.	VHG-T2100
PEEK™ Mira Mist	PMM4000	Standard flow, inert *PEEK™ nebulizer. Teflon® sample and gas capillaries, *PEEK™ body. Suitable for most samples, excluding concentrated acids, strong bases or some organic solvents. Tolerates high salts and undissolved particulates. Liquid flow 0.2mL/min to 2.5mL/min. Operates on standard gas pressure of 45psi.	VHG-PMM4000
Teflon® Mira Mist	TMM3500	Standard flow, inert Teflon® nebulizer. Teflon® capillaries and body. Best choice for aggressive samples such as concentrated acids. Tolerates high salts and undissolved particulates. Liquid flow 0.2mL/min to 2.5mL/min. Operates on standard gas pressures of 35-45psi.	VHG-TMM3500
Ari Mist	AM5000	Low flow, inert *Peek® nebulizer. Teflon® sample and gas capillaries. Designed for particulate-free samples. Black *PEEK™ body. Liquid flow 0.050mL/min to 1.0mL/min. Operates at standard gas pressures of 40-50psi.	VHG-AM5000
Ari Mist HP	AMHP5500	Ultra low flow, inert *Peek® nebulizer. Teflon® sample and gas capillaries. Brown *PEEK™ body designed for particulate-free samples. Liquid flow 0.005mL/min to 1.0mL/min. Operates at higher gas pressure (80psi). Excellent for LC/ICP/ICP-MS.	VHG-AMHP5500

** Peek™ Polymer: Polyether Ether Ketone*

Please supply the name and model number of the instrument, so that the nebulizer will be supplied with correct fittings for the instrument's gas line.

Torches, Accessories & Spray-Chambers

For ICP & ICP-MS

Autosampler Cups & Tubes
ICP & ICP-MS Consumables
Peristaltic Pump Tubing
Mixing Tees
▶ Nebulizers
▶ Torches & Spray-Chambers
Cones
AA & GFAA Consumables
XRF Consumables
Graphite Crucibles

Agilent (Hewlett Packard) ICP-MS Supplies For 4500, 7500 & 7700

ICP-MS Torch and Torch Accessories	Mfg. No.	Product No.
Standard Torch, 2.5mm Injector (Agilent 7500), 2 Projections, HMI Compatible	G3270-80043	VHG-GHP-01
Quartz Bonnet (Agilent 7500)	G1833-65421	VHG-GHP-25
One Piece Torch, 2.5mm Injector (Agilent 7700)	G3280-80001	VHG-GHP-51
One Piece Torch, 1.5mm Injector (Agilent 7700)	G3280-80004	VHG-GHP-54
One Piece Torch, 1.0mm Injector (Agilent 7700)	G3280-80005	VHG-GHP-55
Spray Chambers and Nebulizers		
Scott Chamber, Inner/Outer Tube Flush, Drain & Exit 90º, Quartz (HP 4500, Agilent 7500)	G1820-65337	VHG-GHP-13
C-Type Concentric Nebulizer, 1 Lpm Ar, 30psi, 1mL/min		VHG-GNB-70
Meinhard A-Type Concentric Quartz Nebulizer, 30psi, 2mL/min	G1820-65138	VHG-TQ-30-A2
Glass Expansion MicroMist Nebulizer, 1 Lpm Ar 35psi, 0.4mL/min		VHG-AR35-1-FM04EX
Platinum Torch Shields		
Long Life Platinum Shield (4500)	G1820-65357	VHG-CHP5003
Long Life Platinum Shield (7500)	G1833-65419	VHG-CHP5004

HORIBA Jobin Yvon ICP-AES Supplies

ICP Torch and Torch Accessories	Mfg. No.	Product No.
Demountable Torch Assembly, Complete	21.356.110	VHG-GISA-40
Outer Quartz Tube, 71mm, Radial	31.023.722	VHG-GISA-50
Outer Quartz Tube, Axial	31.031.099	VHG-GISA-70
Inner Quartz Tube	31.023.723	VHG-GISA-52
PTFE Centering Ring	31.023.724	VHG-GISA-53
PTFE Insert	31.021.730	VHG-GISA-55
Alumina Injector	31.021.589	VHG-GISA-58
Alumina Injector and Teflon Insert	21.356.130	VHG-GISA-61
Spray Chambers and Nebulizers		
Cyclonic Spray Chamber, 4mm Drain	31.031.279	VHG-GISA-15
C-Type Concentric Nebulizer, 1 Lpm Ar, 50psi, 1mL/min	47.929.001	VHG-GNB-70P
Meinhard C-Type Concentric Glass Nebulizer, 50psi, 1mL/min	47.929.001	VHG-TR-50-C1
Meinhard K-Type Concentric Glass Nebulizer, 30psi, 3mL/min	47.929.005	VHG-TR-30-K3

Leeman Labs ICP-AES Supplies

ICP Torch and Torch Accessories	Mfg. No.	Product No.
1 Piece Torch with Ball Joint, Aqueous	120-3748	VHG-GLMN-20
1 Piece Torch with Ball Joint, Organics	120-3749	VHG-GLMN-22
Demountable Torch	318-0001	VHG-GLMN-43
Spray Chambers and Nebulizers		
Spray Chamber, Scott, Radial	120-3751	VHG-GLMN-25
C-Type Concentric Nebulizer, 1 Lpm Ar, 30psi, 3mL/min		VHG-GNB-72
Glass Expansion Conikal Nebulizer with EzyFit & EzyLok 30psi, 2mL/min	318-00078	VHG-AR30-1-FC2E

Torches, Accessories & Spray-Chambers

For ICP & ICP-MS

VHG Tips

To avoid downtime, it is good to keep spare items of all instrument glassware.

Even though intact, torches with white, metallic-looking or brownish surface discolorations may ignite with greater difficulty.

The injector tip of the ICP-MS torch can be a source of "background," especially for Na, K, Li, and B. In some cases, operating with higher nebulizer and/or auxiliary argon flow can reduce this.

PerkinElmer ICP-AES Supplies

Optima 3000 Series Radial

ICP Torch and Torch Accessories	Mfg. No.	Product No.
Torch Body, Optima, Radial	N069-0568	VHG-GPE1-04
Torch Bonnet, Flat Edge (Optima post 9/94)	N069-5456	VHG-GPE1-13
Quartz Injector, 1.2mm	N068-1631	VHG-GPE2-33
Spray Chambers		
Cyclonic Spray Chamber, Optima		VHG-GPE0-19

Optima 3000XL & SC(X)

ICP Torch and Torch Accessories	Mfg. No.	Product No.
Torch Body, Optima XL	N069-5379	VHG-GPE1-11
Quartz Injector, 2.0mm	N069-5442	VHG-GPE2-41
Alumina Injector, 2.0mm	N069-5362	VHG-GPE2-50
Torch Bonnet	N069-1664	VHG-GPE1-15

Optima 3000 Series DV

ICP Torch and Torch Accessories	Mfg. No.	Product No.
Torch Body, Optima DV, 1 Slot	N069-1662	VHG-GPE1-14
Torch Bonnet	N069-1664	VHG-GPE1-15
Purge Tube Window, Radial, Short	N069-0672	VHG-GPE2-73
Quartz Injector, 2.0mm	N069-5442	VHG-GPE2-41
Alumina Injector, 2.0mm	N069-5362	VHG-GPE2-50
Spray Chambers and Nebulizers		
Cyclonic Spray Chamber	N812-2188	VHG-GPE0-18DV
C-Type Concentric Nebulizer, 1 Lpm Ar, 50psi, 1mL/min	0047-2022	VHG-GNB-70P
K-Type Concentric Nebulizer, 0.7Lpm Ar, 30psi, 3mL/min	N068-1574	VHG-GNB-80

Optima 2000/4000/5000/7000DV & 4000/5000V

ICP Torch and Torch Accessories	Mfg. No.	Product No.
Torch Body, Optima 2000/4000/5000/7000DV, 1 Slot	N077-0338	VHG-GPE1-16
Torch Body, Optima 4300V/5300V	N077-1500	VHG-GPE1-17A
Torch Body, Optima 4300V/5300V/7300V, Wear Metals	N077-1561	VHG-GPE1-17W
Glass Expansion Demountable Ceramic Torch, Optima 4300V/5300V/7300V	N077-7052	VHG-31-808-2815
Torch Bonnet	N077-5289	VHG-GPE1-25
Alumina Injector, 2.0mm	N077-5177	VHG-GPE1-42
Alumina Injector, 1.2mm, Optima 4300V/5300V	N077-1531	VHG-GPE2-54
Quartz Injector, 1.2mm	N077-5226	VHG-GPE2-77
Axial Purge Window, Optima 2000DV	0999-2731	VHG-GPE2-65
Axial Purge Window, Optima 4000/5000/7000DV	N077-1116	VHG-GPE2-67
Radial Purge Window, Optima 4000/5000/7000DV	N077-0322	VHG-GPE2-80
Purge Tube Window, Radial, Short, Optima 2000DV	N069-0672	VHG-GPE2-73
Quartz Injector, 2.0mm	N077-5014	VHG-GPE2-74
Spray Chambers and Nebulizers		
Cyclonic Spray Chamber, no Baffle, with Neb Adapter	N077-6052	VHG-GPE0-29
Cyclonic Spray Chamber, Baffled, with Neb Adapter	N077-6053	VHG-GPE0-30
C-Type Concentric Nebulizer, 1 Lpm Ar, 50psi, 1mL/min	0047-2022	VHG-GNB-70P
K-Type Concentric Nebulizer, 0.7 Lpm Ar, 30psi, 3mL/min	N068-1574	VHG-GNB-80

Torches, Accessories & Spray-Chambers

For ICP & ICP-MS

Autosampler Cups & Tubes
ICP & ICP-MS Consumables
Peristaltic Pump Tubing
Mixing Tees
Nebulizers
▶ Torches & Spray-Chambers
Cones
AA & GFAA Consumables
XRF Consumables
Graphite Crucibles

PerkinElmer Sciex ICP-MS Supplies

Elan 5000/6X00/9000/DRC II

ICP-MS Torch and Torch Accessories	Mfg. No.	Product No.
Torch Body, Elan	N812-2006	VHG-GSC4-10
Quartz Injector, 2.0mm	N812-5029	VHG-GSC2-35
Quartz Injector, 2.0mm, 6100 DRC & DRC II	WE02-3948	VHG-GSC4-30
Spray Chambers and Nebulizers		
Cyclonic Spray Chamber	N812-0150	VHG-GSC3-19MS
Cyclonic Spray Chamber, 6100 DRC, Quartz	WE02-5221	VHG-GSC4-20
Meinhard A-Type Quartz Concentric Nebulizer, 30psi, 3mL/min	WE02-4371	VHG-TQ-30-A3

Spectro ICP-AES Supplies

Spectroflame and Ciros

ICP Torch and Torch Accessories	Mfg. No.	Product No.
EOP Flared End Torch, with 2.5mm injector	48105052	VHG-GSP-40
Demountable EOP Torch	48206007	VHG-GSP-42
Torch, Fixed, Spectroflame, 1.8mm, Standard		VHG-GSP-05
Torch, Fixed, Spectroflame, 1.8mm, Standard with Fittings	75060596	VHG-GSP-05F
Demountable Torch, Spectroflame	48206002	VHG-GSP-06
Spray Chambers and Nebulizers		
Cyclonic Spray Chamber for Modified Lichte	48105061	VHG-GSP-27
Modified Lichte MDSN Nebulizer, 1 Lpm Ar	48205036	VHG-GNB-20S
C-Type Concentric Nebulizer, 1 Lpm Ar, 30psi, 1mL/min	76060510	VHG-GNB-70
Meinhard C-Type Glass Concentric Nebulizer, 30psi, 1mL/min	76060510	VHG-TR-30-C1

Thermo Fisher Scientific (VG) ICP-MS Supplies

Axiom, PlasmaQuad 1,2,3 & PQ ExCell

ICP-MS Torch and Torch Accessories	Mfg. No.	Product No.
Torch, 1.5mm	3201192	VHG-GVG-05
Torch Bonnet		VHG-GVG-25
Torch Bonnet Cap	1200274	VHG-GVG-26
Torch Bonnet, 72mm	3204703	VHG-GVG-28
Spray Chambers and Nebulizers		
Conical Spray Chamber w/ Impact Bead, Quartz	3600170	VHG-GVG-13
Scott Spray Chamber, Water-Cooled, Quartz	3200841	VHG-GVG-16
C-Type Concentric Nebulizer, 1 Lpm Ar, 30psi, 1mL/min	1040894	VHG-GNB-70
Glass Expansion Conikal Nebulizer, 1 Lpm Ar, 35psi, 1mL/min	1201318	VHG-AR35-1-FC1ET
Glass Expansion MicroMist Nebulizer, 1 Lpm Ar, 35psi, 0.4mL/min	1201831	VHG-AR35-1-FM04E

VHG Tips

The tip of the torch injector (central tube) ought to be regularly inspected for build-up of sample residue.

Even small amounts of material can disrupt the even flow of sample aerosol.

To avoid downtime, it is good to keep spare items of all instrument glassware.

Even though intact, torches with white, metallic-looking or brownish surface discolorations may ignite with greater difficulty.

Torches, Accessories & Spray-Chambers

For ICP & ICP-MS

Thermo Fisher Scientific (TJA) ICP-AES Supplies

61E, Iris Advantage, Intrepid Radial, 61E Trace, Iris AP, Intrepid

ICP Torch and Torch Accessories	Mfg. No.	Product No.
Ceramic Base Torch, High Flow w/ 1.5mm Injector	126432-01	VHG-GTJA5-07
Ceramic Base Torch, Trace, with 1.5mm Injector	126432-03	VHG-GTJA5-10
Ceramic Base Torch, DV, with 1.5mm Injector		VHG-GTJA5-10DV
Duo Torch Sleeve and Seal Kit	138563-00	VHG-GTJA0-26
Quartz Injector, 1.5mm	125407-00	VHG-GTJA0-41
Spray Chambers and Nebulizers		
Cyclonic Spray Chamber, Axial, Pump	139662-00	VHG-GTJA5-13
Cyclonic Spray Chamber, Radial, Pump	139663-00	VHG-GTJA5-14
V-Groove Nebulizer, Noordermeer MDSN, Quick Disconnect, Argon Connect		VHG-GNB-10QDAC
K-Type Concentric Nebulizer, 0.7Lpm Ar, 30psi, 3mL/min, Quick Disconnect, Argon Connect		VHG-GNB-80QDAC
Meinhard K-Type Glass Concentric Nebulizer, 30psi, 2mL/min	139600-00	VHG-TR-30-K2
Glass Expansion Conikal Nebulizer, 0.7 Lpm Ar, 30psi, 2mL/min	139184-00	VHG-AR30-07-FC2E

Varian ICP-AES Supplies

700-ES Series, Liberty Radial, Vista Axial

ICP Torch and Torch Accessories	Mfg. No.	Product No.
Low Flow Torch, One Piece, Radial	20-100696-90	VHG-GVA-05
Torch Bonnet	20-100707-00	VHG-GVA-25
Low Flow Torch, One Piece, Axial, 90º Bend	20-100904-00	VHG-GVA-12
Spray Chambers and Nebulizers		
Cyclonic Spray Chamber, 8mm Top, 4mm Drain	20-100817-00	VHG-GVA-21
Noordermeer V-Groove MDSN Nebulizer		VHG-GNB-10
Aerosalt - High Solids Nebulizer, 0.7 Lpm Ar, 30psi, 2mL/min, Quick Disconnect, Argon Connect	20-100964-00	VHG-GNB-65QDAC
C-Type Concentric Nebulizer, 1 Lpm Ar, 30psi, 1mL/min	20-100765-00	VHG-GNB-70
K-Type Concentric Nebulizer, 0.7 Lpm Ar, 30psi, 3mL/min, Quick Disconnect, Argon Connect	20-101068-00	VHG-GNB-80QDAC
K-Type, High Flow Concentric Nebulizer	20-100816-00	VHG-GNB-85
Meinhard C-Type Glass Concentric Nebulizer, 30psi, 2mL/min	20-100765-00	VHG-TR-30-C2
Glass Expansion Conikal Nebulizer, 0.7 Lpm Ar, 30psi, 3mL/min		VHG-AR30-07-FC3E

Varian ICP-MS Supplies

800-MS Series

ICP-MS Torch and Torch Accessories	Mfg. No.	Product No.
Torch with Placement Posts	20-101007-00	VHG-GVA-34
Sheath Bypass	20-101008-00	VHG-GVA-31
Sheath Gas Port	20-101009-00	VHG-GVA-32
Spray Chambers and Nebulizers		
ICP-MS Spray Chamber	20-101010-00	VHG-GVA-33
C-Type Concentric Nebulizer, 1 Lpm Ar, 30psi, 1 mL/min	20-100765-00	VHG-GNB-70
Glass Expansion Conikal Nebulizer with EzyFit & EzyLock, 1 Lpm Ar, 30psi, 2mL/min		VHG-AR30-1-FC2E

ICP-MS Cones

Autosampler Cups & Tubes
ICP & ICP-MS Consumables
Peristaltic Pump Tubing
Mixing Tees
Nebulizers
▶ Torches & Spray-Chambers
▶ Cones
AA & GFAA Consumables
XRF Consumables
Graphite Crucibles

SPECTRON cones are the world's best quality, most precisely engineered ICP-MS cones and we are proud to be a supplier. These cones are either identical to OEM cones, or else meet and exceed OEM specifications.

SPECTRON INC
The leading ICP-MS cone supplier worldwide

Agilent (HP) ICP-MS Cones & Accessories
For 4500, 7500, 7700 Series Instruments

Cone	Mfg. No.	Product No.
Nickel Sampler (25mm Ni insert)	G1820-65238	VHG-CHP1001-NI
Nickel Sampler (7700)	G3280-67040	VHG-CHP2001-NI
Platinum (10mm Pt insert) Sampler (4500, 7500)	G1820-65239	VHG-CHP1006-PT
Platinum (10mm Pt insert) Sampler (7700)	G3280-67036	VHG-CHP2006-PT
Nickel Skimmer (7500ce)	G3270-65024	VHG-CHP1002CE-NI
Nickel Skimmer (7700s)	G3280-67066	VHG-CHP2002S-NI
Nickel Skimmer (7700x)	G3280-67041	VHG-CHP2002X-NI
Platinum Skimmer (7500ce, 7500cs)	G1833-65132	VHG-CHP1008CS-PT
Platinum "X" Skimmer in Copper Base (7700)	G3280-67060	VHG-CHP2008X-PT/CU
Platinum "S" Skimmer in Copper Base (7700)	G3280-67064	VHG-CHP2008S-PT/CU
eSPEC Platinum Shield Plate (7500)	G1833-65419	VHG-CHP5004e

PerkinElmer Sciex ICP-MS Cones & Accessories
For 5000, 6000, 6100, 9000, DRC Series Instruments

Cone	Mfg. No.	Product No.
Nickel Sampler (6000, 6100, 9000)	WE02-1140	VHG-CSC2011-NI
Platinum Sampler (6000, 6100, 9000)	WE02-7802	VHG-CSC2013-PT
eSPEC Platinum Sampler (6000, 6100, 9000)	WE02-7802	VHG-CSC2013-PTe
Nickel Skimmer (6000, 6100, 9000)	WE02-1137	VHG-CSC2012-NI
Platinum Skimmer (6000, 6100, 9000)	WE02-7803	VHG-CSC2014-PT
eSPEC Platinum Skimmer (6000, 6100, 9000)	WE02-7803	VHG-CSC2014-PTe

Cone Refurbishment Program:

Platinum parts are refurbished at no charge for the life of the part. Non-Spectron cones may also be refurbished at a nominal charge (please call). This applies to cones where their condition is suitable for refurbishment and not those chemically or mechanically degraded to a point where the metal is compromised.

e•SPEC™ Cones Now Available.

Unprecedented value is offered with Spectron's new line of enhanced performance ICP-MS cones. Call us or visit our website for details. Platinum cones at 1990's prices!

VHG Tips

Nickel cones work well for many ICP-MS applications. Pt-tipped cones offer greater lifetime and usually require less day-to-day maintenance attention. Aggressive matrices (high in oxidizing conditions) may require Pt-tipped cones.

Platinum diameter is stated with respect to a platinum insert piece. It is the outer dimension of the insert.

ICP-MS Cones

Thermo Fisher Scientific (VG, Finnigan) ICP-MS Cones & Accessories
For VG X-Series, PlasmaQuad, Axiom, PQ ExCell, Genesis and Finnigan Element, Element 2, Neptune Series Instruments

Cone	Mfg. No.	Product No.
Nickel Sampler, 100% Ni (VG X-Series)	3600812	VHG-CVG1021-NI
Nickel Sampler, Cu Core (VG X-Series)	3600812	VHG-CVG1021-NI/CU
Nickel Sampler (all VG models except X-Series)	3004661	VHG-CVG1001-NI
Platinum (15.2mm Pt insert) Sampler (all VG models except X-Series)	3601289	VHG-CVG1006A-PT
Nickel Skimmer (VG X-Series)	3600811	VHG-CVG1022-NI
Nickel Micro-Skimmer (all VG models except X-Series)	3200860	VHG-CVG1004-NI
Platinum Skimmer (all VG models except X-Series)	N/A	VHG-CVG1028-PT
Nickel Sampler, Cu Core (Element, Element 2, Neptune)	1044520	VHG-CT1001-NI/CU
eSPEC Platinum (7.62mm Pt insert) Sampler (Element, Element 2, Neptune)	1067500	VHG-CT1006-PTe
Nickel Skimmer (Element, Element 2, Neptune)	1067600	VHG-CT1002A-NI
Platinum Skimmer, Ni base (Element, Element 2, Neptune)	1047510	VHG-CT1007-PT
Platinum Guard Electrode (Element, Element 2, Neptune)	1126640	VHG-CT5004

VHG Labs' ICP-MS Maintenance Kit

VHG Labs has assembled an ICP-MS Maintenance Kit designed to provide the ICP-MS analyst with the right tools for the job of cleaning and restoring cones to their "as-new" performance. Cone maintenance and cone restoration improve analytical performance, reduce the time needed to tune and optimize, reduce interference, and can save substantial money!

ICP-MS cones take the brunt of all sample by-products and also experience high temperature which leads to build-up of residue on the cone and reduced performance. Ion lenses also experience issues with build-up of residue. We are certain that the items in this kit will result in better and quicker cone cleaning. If you have never used proper polishing felt or cloth, the right swab, or diamond paste, then you will be in for a pleasant experience. Our Maintenance Kit is designed for any brand or type of ICP-MS cone.

Our ICP-MS Cone and Lens Maintance Kit Includes:

- Diamond abrasive paste compound
- Diamond abrasive lapping paper: coarse and fine
- Alumina abrasive powder: coarse and fine
- Lint-free, "clean-room" quality polyester cloths
- Polyester polishing felt (3/8")
- Wood-stick cotton swabs
- Pointed-tip plastic foam swabs
- Magnifier lens
- Instruction guide

Description	Product No.
ICP-MS Maintenance Kit	VHG-CVHG-MNTKIT1

GFAA Tubes & Parts

All tubes are pyrolytic graphite-coated unless otherwise stated

GBC	Description	Mfg. No.	Product No.
Graphite Tube	Pre-Inserted Omega Platform	N/A	VHG-FGBC25
Graphite Tube	Non-Platform	99-0059-00	VHG-FGBC59
Platform	Solid Pyro Graphite (for FGBC59)	99-0060-00	VHG-FGBC60
Graphite Shroud	GF 3000	45-0004-00	VHG-FGBC04

Hitachi	Description	Mfg No.	Product No.
Graphite Cuvette	Pre-Inserted Forked Platform	190(ANO)-0028	VHG-FHIT55
Contact Rings	Set of 2, AD 20mm	180-7401	VHG-FHIT01

PerkinElmer	Description	Mfg. No.	Product No.
Graphite Tube	Pre-Inserted Platform	B011-2660	VHG-FPE93
Graphite Tube	Pre-Inserted Forked Platform	B050-5057	VHG-FPE57
Graphite Tube	Std Tube for L'Vov Platform	B012-1092, B010-9322	VHG-FPE92
L'Vov Platform	Solid Pyro Graphite (for FPE92)	B012-1091, B010-9324	VHG-FPE91
Graphite Tube	Non-Platform	B013-5653, B009-1504	VHG-FPE53
Graphite Tube	Non-Platform, Uncoated	B007-0699	VHG-FPE99
Zeeman Contact Set	Set of 2	B011-6823	VHG-FPE61
HGA Contact Set	Set of 2, with Sensor Hole	B012-8490	VHG-FPE63

For other GFAA tubes and parts, please inquire.

Autosampler Cups & Tubes
ICP & ICP-MS Consumables
Peristaltic Pump Tubing
Mixing Tees
Nebulizers
Torches & Spray-Chambers
▶ Cones
AA & GFAA Consumables
▶ GFAA Tubes & Parts
Hydride Quartzware
Hollow Cathode Lamps
XRF Consumables
Graphite Crucibles

VHG Tips

We guarantee the quality of our graphite consumables!

We supply only top quality, pure, high-density graphite and pyrolytic graphite-coated parts.

Tubes are pyrolytic graphite-coated unless otherwise stated.

GFAA Tubes & Parts

All tubes are pyrolytic graphite-coated unless otherwise stated

Thermo Fisher Scientific Unicam/ATI	Description	Mfg. No.	Product No.
Graphite Cuvette	ELC Type	9423 393 95041	VHG-FATI41
Graphite Cuvette	Omega Platform	9423 490 20101	VHG-FATI20101
Graphite Cuvette	Ridged	9423 393 95071	VHG-FATI71
Graphite Cuvette	Ridged, Uncoated	9423 393 95031	VHG-FATI31
Graphite Cuvette	Standard, Unridged	9423 393 95091	VHG-FATI95091

Varian	Description	Mfg. No.	Product No.
Graphite Tube	Pre-Inserted Omega Platform	N/A	VHG-FVAR37
Graphite Tube	Partitioned Type	63-100012-00	VHG-FVAR12
Graphite Tube	Plateau Type	63-100011-00	VHG-FVAR11
Bone Platform	Solid Pyro Graphite (for FVAR11)	63-100013-00	VHG-FVAR13
Zeeman Electrodes	Set of 2	63-100017-00	VHG-FVAR17

For other GFAA tubes and parts, please inquire.

Hydride and Mercury Cold Vapor Quartzware

VHG provides quartz components for commercial hydride generators that are guaranteed to meet your application. These are direct match components.

PerkinElmer Quartz Components

Description	Material	Mfg. No.	VHG Product No.
Cell for MHS-10™ (no rings or sleeves incl.)	Pure Quartz	B009-4415	VHG-GPEQC55
Cell for MHS-20™ (with UV windows)	Pure Quartz	B009-7693	VHG-GPEQC65

Varian Quartz Components

Description	Material	Mfg. No.	VHG Product No.
Mercury Flow Through Cell (VGA-76/77™)	Pure Quartz	99-100407-00	VHG-GVARQC30
Hydride Absorption Cell (VGA-76/77™)	Pure Quartz	99-100400-00	VHG-GVARQC35
Gas/Liquid Separator (VGA-76™)	Pure Quartz	99-100402-00	VHG-GVARQC40
Gas/Liquid Separator (VGA-77™)	Pure Quartz	99-100711-00	VHG-GVARQC65
Atom Concentrator Tube (ACT-80™)	Pure Quartz	99-100544-00	VHG-GVARQC60

For pricing on other quartz cells, please inquire.

Hollow Cathode Lamps

For AA & GFAA

- Highest available quality line sources for Atomic Absorption
- Most advanced, pure cathode materials and inert fill gas
- Fast warm-up times
- High output, stable and with low noise
- Long operating life with a five-year shelf life

Single-Element Hollow Cathode Lamps

	1.5" Diam., 2-pin, Non-Coded for GBC, Hitachi, Shimadzu, Thermo, Varian	2.0" Diam., 9-pin, Non-Coded for Older PerkinElmer Instrumentation	2.0" Diam., 4-pin, Cableless for Perkin-Elmer AAnalyst* (timer excluded)
Element	**Product. No.**	**Product. No.**	**Product. No.**
Aluminum Al	VHG-LAL	VHG-LPEAL	VHG-LPE4AL
Antimony Sb	VHG-LSB	VHG-LPESB	VHG-PE4SB
Arsenic As	VHG-LAS	VHG-LPEAS	VHG-LPE4AS
Barium Ba	VHG-LBA	VHG-LPEBA	VHG-LPE4BA
Beryllium Be	VHG-LBE	VHG-LPEBE	VHG-LPE4BE
Bismuth Bi	VHG-LBI	VHG-LPEBI	VHG-LPE4BI
Boron B	VHG-LB	VHG-LPEB	VHG-LPE4B
Cadmium Cd	VHG-LCD	VHG-LPECD	VHG-LPE4CD
Calcium Ca	VHG-LCA	VHG-LPECA	VHG-LPE4CA
Chromium Cr	VHG-LCR	VHG-LPECR	VHG-LPE4CR
Cobalt Co	VHG-LCO	VHG-LPECO	VHG-LPE4CO
Copper Cu	VHG-LCU	VHG-LPECU	VHG-LPE4CU
Gold Au	VHG-LAU	VHG-LPEAU	VHG-LPE4AU
Iron Fe	VHG-LFE	VHG-LPEFE	VHG-LPE4FE
Lead Pb	VHG-LPB0	VHG-LPEPB	VHG-LPE4PB
Lithium Li	VHG-LLI	VHG-LPELI	VHG-LPE4LI
Magnesium Mg	VHG-LMG	VHG-LPEMG	VHG-LPE4MG
Manganese Mn	VHG-LMN	VHG-LPEMN	VHG-LPE4MN
Mercury Hg	VHG-LHG	VHG-LPEHG	VHG-LPE4HG
Molybdenum Mo	VHG-LMO	VHG-LPEMO	VHG-LPE4MO
Nickel Ni	VHG-LNI	VHG-LPENI	VHG-LPE4NI
Palladium Pd	VHG-LPD	VHG-LPEPD	VHG-LPE4PD
Platinum Pt	VHG-LPT	VHG-LPEPT	VHG-LPE4PT
Potassium K	VHG-LK	VHG-LPEK	VHG-LPE4K
Selenium Se	VHG-LSE	VHG-LPESE	VHG-LPE4SE
Silicon Si	VHG-LSI	VHG-LPESI	VHG-LPE4SI
Silver Ag	VHG-LAG	VHG-LPEAG	VHG-LPE4AG
Sodium Na	VHG-LNA	VHG-LPENA	VHG-LPE4NA
Strontium Sr	VHG-LSR	VHG-LPESR	VHG-LPE4SR
Thallium Tl	VHG-LTL	VHG-LPETL	VHG-LPE4TL
Tin Sn	VHG-LSN	VHG-LPESN	VHG-LPE4SN
Titanium Ti	VHG-LTI	VHG-LEPTI	VHG-LPE4TI
Vanadium V	VHG-LV	VHG-LPEV	VHG-LPE4V
Zinc Zn	VHG-LZN	VHG-LPEZN	VHG-LPE4ZN

** Timers are no longer supplied with Perkin Elmer 4-pin lamps. If you require timers, please order LTIMER with each lamp.* *See Page 75.*

Hollow Cathode Lamps

For AA & GFAA

VHG Tips

Coded lamps are recognized by the instrument hardware automatically. Performance is identical for coded and non-coded lamps.

Expand the range of your AA! Multi-Element hollow cathode lamps offer a convenient option to expand the range of your AA.

We guarantee our lamps. They are equal to or better than those supplied by the AA manufacturers' parts departments.

Lamps have a finite shelf life. Consider replacing your old lamps to enhance results.

Timer for 2.0" Diameter, 4-pin, Cableless Lamp for PerkinElmer AAnalyst		
Description	**Instrument**	**Product No.**
10,000 mA/hour Timer	LPE4xx Series Lamps	VHG-LTIMER

Multi-Element Hollow Cathode Lamps

Type of Lamp and the Instrument Fitted:	1.5" Diam., 2-pin, Non-Coded for GBC, Hitachi, Shimadzu, Thermo, Varian	1.5" Diam., 4-pin, Coded for GBC, Varian	2.0" Diam., 9-pin, Non-Coded for Older Perkin-Elmer Instrumentation	2.0" Diam., 12-pin, Coded for Perkin-Elmer
Elements*	**Product No.**	**Product No.**	**Product No.**	**Product No.**
Al/Ca/Mg	VHG-L506		VHG-L606	
Al/Si	VHG-L503		VHG-L603	
As/Pb	VHG-L539			
Ca/Cu/Mg/Zn	VHG-L507		VHG-L607	
Ca/Mg	VHG-L870	VHG-L870C	VHG-L970	VHG-L970C
Co/Cr/Cu/Fe/Mn/Ni	VHG-L873	VHG-L873C	VHG-L973	VHG-L973C
Cr/Fe/Ni	VHG-L516		VHG-L616	
Cu/Fe/Mn/Zn	VHG-L524		VHG-L624	
Cu/Mn/Zn	VHG-L526		VHG-L626	
Cu/Zn	VHG-L872		VHG-L972	
Fe/Mn	VHG-L530		VHG-L630	
K/Na	VHG-L871	VHG-L871C	VHG-L971	VHG-L971C
K/Na/Ni	VHG-L537		VHG-L637	

**For other multi-element lamp choices, please inquire.*

Deuterium Background Correction Lamps

Deuterium background correction lamps provide accurate and fast correction over the widest possible absorbance range and typically last in excess of 1100 hours.

Description	Instrument	Product No.
Deuterium Arc Lamp 10 Volt	GBC UV Cintra & UV-VIS 914/916, 918/920	VHG-P702
Deuterium Arc Lamp 10 Volt	Hitachi Instruments (most)	VHG-P703
Deuterium Arc Lamp 3 Volt	PerkinElmer AAS & AAnalyst 600, 700, 800	VHG-P735
Deuterium Arc Lamp 10 Volt	Varian 75 Series, AA, DMS 100, Spectra, UV Superscan	VHG-P706

**For other Deuterium lamp choices, please inquire.*

Thin Films for XRF Sample Cups

XRF sample cup films allow liquids, powders and slurries to be analyzed by X-Ray Fluorescence. VHG Labs provides a range of special films of highest quality. For selection of the ideal film, consider the material's transmission (especially important for "light elements"), purity, and physical strength.

Kapton® (Polyimide)	Thickness (microns)	Film Size & Shape	Product No.
Features high strength, high purity, chemical robustness, and withstands prolonged X-Ray irradiation.	7.6 Micron	3" x 50' Roll	VHG-FKP30-R15
	12.7 Micron	3" x 50' Roll	VHG-KP50-R15
		Also available in pre-cut circles or squares	

Mylar®	Thickness (microns)	Film Size & Shape	Product No.
Mylar (polyethylene-terephthalate) film is economical, strong and offers good chemical resistance. It is well suited for light elements analysis (Note: may contain Ca, Fe, P, Sb, Zn).	2.5 Micron	3" x 300' Roll	VHG-FMY10-R3
	3.6 Micron	3" x 300' Roll	VHG-FMY15-R3
	6 Micron	3" x 300' Roll	VHG-FMY25-R3
	6 Micron	3" x 3" Squares	VHG-FMY25-33
	6 Micron	2.5" Dia. Circles	VHG-FMY25-C64
		Also available in 1.5 & 12.7 micron thickness	

Optilene-XF™	Thickness (microns)	Film Size & Shape	Product No.
Highest grade, proprietary film featuring optimal transmission, purity, strength, chemical resistance, and thermal stability. Good for full range of XRF analytes, including light elements.	4 Micron	3" x 300' Roll	VHG-FOL04-R3
	4 Micron	3" x 3" Squares	VHG-FOL04-33
	4 Micron	2.5" Dia. Circles	VHG-FOL04-S64
	6 Micron	3" x 300' Roll	VHG-FOL06-R3
	6 Micron	3" x 3" Squares	VHG-FOL06-33
		Also available in 1.5, 3.6 & 12.7 micron thickness	

Polycarbonate	Thickness (microns)	Film Size & Shape	Product No.
Features excellent X-Ray transmission characteristics and good chemical resistance.	2 Micron	3" x 300' Roll	VHG-FPC02-R3
		Also available in pre-cut circles or squares	

Polypropylene	Thickness (microns)	Film Size & Shape	Product No.
General purpose film with good transmission and chemical resistance (Note: may contain Al, Ca, Cu, Fe, P, Ti, Zn, Zr).	4 Micron	3" x 300' Roll	VHG-FPP16-R3
	5 Micron	2.5" Dia. Circles	VHG-FPP20-C64
	6 Micron	3" x 300' Roll	VHG-FPP25-R3
		Also available in pre-cut squares	

Teflon® Microporous	Film Size & Shape	Product No.
Gas permeable Microporous Teflon® allows pressure or gas equalization between the sample cell and instrument.	2.5" x 200'	VHG-FPTFE-R64

VHG Tips

Our XRF Cups feature a unique Tri-Lock Taut-Film™ design that ensures a wrinkle-free, leak resistant and taut window film.

Only a limited sample available?

When sample is limited, smaller sample cups can be used with accurate centering over the aperature made possible with a VHG Cup Positioning Guide. See Page 79

Analyzing powders or nonvolatile liquids in vacuum?

Try the Double Open-end cup with Baffle Plus™ Cap. Superior, vented baffle system features efficient pressure equalization, vapor recirculation, particle entrapment, and greater sample stability.

Why buy VHG's pellet caps?

- Firm support of samples & less susceptible to damage
- Easy & convenient storage
- Accommodated by all XRF spectrometers

Our pellet caps are made of thin wall aluminum with either straight side-walls or tapered side-walls. They support and reinforce samples in cup presses and are useful for holding, transporting and storing powder samples. They have a painted exterior and eject simply from the mold assembly.

XRF Sample Cups

VHG's XRF Cups feature a unique Tri-Lock Taut Film™ design that ensures a wrinkle-free, leak-resistant and taut window film.

Double Open-End Cups

VHG's double open-end cups come with open or vented caps with a proprietary lift tab feature that enables more reliable sample handling of full sample cups. Samples are top loaded for maximum ease and are self-nesting. These cups support thin film and microporous sheets for sealing.

Double Open-End Cup with Open Cap (consists of 3 parts)

O.D. (mm)	I.D. (mm)	Height (mm)	Vol. (cc)	Product No.
25	17	24	4.6	VHG-CUP11-25S
31	25	24	8.4	VHG-CUP11-31S
40	31	24	14.0	VHG-CUP11-40S
40	31	34	22.0	VHG-CUP11-40T

Double Open-End Cup with Vented Cap (consists of 3 parts)

O.D. (mm)	I.D. (mm)	Height (mm)	Vol. (cc)	Product No.
25	17	24	4.6	VHG-CUP22-25S
31	25	24	8.4	VHG-CUP22-31S
40	31	24	14.0	VHG-CUP22-40S
45	39	34	36.7	VHG-CUP22-45T

Double Open-End Cup with Baffle Plus™ Cap (consists of 4 parts)

O.D. (mm)	I.D. (mm)	Height (mm)	Vol. (cc)	Product No.
31	25	29	6.8	VHG-CUP69-31S
40	31	29	11.3	VHG-CUP69-40S
45	39	39	31.0	VHG-CUP69-45T

Oxford Analyzers (consists of 2 parts)

Double Open-End Cup for Oxford

Standard replacement cup. Fits directly into aluminum sample sleeve (supplied with instrument) to form a taut-film sample support with respect to the integrated o-ring. Each cup supplied with vented cap.

O.D. (mm)	I.D. (mm)	Height (mm)	Vol. (cc)	Product No.
32	28	36	20	VHG-CUPOX-35

XRF Sample Cups

Autosampler Cups & Tubes
ICP & ICP-MS Consumables
AA & GFAA Consumables
XRF Consumables
Thin Films
▶ XRF Sample Cups
XRF Accessories
Graphite Crucibles

Closed End Cups

Bottom loaded to handle liquids, slurries, powders, and many volatiles or foaming liquids, where user wishes immediate back pressure of closed cell conditions. Cups are ventable for pressure equalization.

Standard Closed-End Cups (consists of 2 parts)

O.D. (mm)	I.D. (mm)	Height (mm)	Vol. (cc)	Product No.
25	17	24	4.6	VHG-CUP77-25S
31	25	24	8.1	VHG-CUP77-31S
40	31	24	14.7	VHG-CUP77-40S
45	39	34	29.0	VHG-CUP77-45T

HORIBA Analyzers (consists of 2 parts)

Closed-End Cups for HORIBA

Designed for special needs of Horiba Instruments and applications requiring low-profile cups. Feature Taut Film Ring™ and Lift Tab™ .

O.D. (mm)	I.D. (mm)	Height (mm)	Vol. (cc)	Product No.
43	47	18.4	17	VHG-CUPH-43

Pellet Caps For XRF Analysis of Powders

Pellet Caps - Straight Wall

Straight wall cap design is generally recommended for briquetting materials of uniform size distribution.

Briquette Size (mm)	Product No.
32	VHG-CAP30
40	VHG-CAP38

Pellet Caps -Tapered Wall

Tapered wall cap design helps overcome briquetting difficulties and spill over for materials that resist briquetting or are of non-uniform chemistry or size.

Briquette Size (mm)	Product No.
32	VHG-CAP32
40	VHG-CAP40

VHG Tip

VHG Labs' crucibles are made using a unique high temperature and vacuum purification process. This eliminates gas impurities and ensures optimal analytical results.

Accessories & Tools for XRF

Cup Press Plates (consists of 2 parts)

Easy to use, 3" diameter, tool made of polyethylene that simplifies the task of XRF Sample Cup assembly and makes simple work of setting Tri-Lock taut thin film sample support windows. Two parts – the assembly base and top plate.

Cup Size (mm)	Product No.
25	VHG-CPP25
31	VHG-CPP31
40	VHG-CPP40
43/45	VHG-CPP45

Cup Positioning Guides

Convenient and re-usable guides that achieve secured and centered positioning of smaller sample cups in larger sample holders.

Cup Size (mm)	Product No.
25	VHG-CPG25
31	VHG-CPG31
40	VHG-CPG40
45	VHG-CPG45

Sample Cup Trays

Chemical resistant polyethylene trays for holding, transporting or storing XRF sample cups/caps. Made to protect Thin–Film windows from damage or contamination in either single or stacked mode.

Cup Size (mm) to hold	No. Cups Per Tray	Product No.
25	15	VHG-CT25
31	15	VHG-CT31
40	15	VHG-CT40
43	8	VHG-CT43
45	8	VHG-CT45
50/52	6	VHG-CT50

Graphite Crucibles

For Gas Determination Analyzers

- Made from special, high-purity graphite with proper electrical characteristics
- Machined to exact dimensions to ensure good contact with electrode and proper thermal characteristics
- Ultrasonically cleaned to remove machining dust; then dried
- Undergo final purification and degassing; then cooled under vacuum or nitrogen to provide maximum purity

LECO Models EF-100, TC-136 to 436, TN-114 to 414, RO-116 to 416

Item/Specifications	Mfg. No.	VHG Product No.
Crucible: designed for typical nitrogen/oxygen analysis	776-247	VHG-F776247
Crucible: designed for high temp. alloys and refractories	782-719/720	VHG-F782720
Inner Crucible–uniform temp.; for use with F775433	775-431/892	VHG-F775431
Outer Crucible–uniform temp.; for use with F775431	775-433	VHG-F775433

LECO Models EF-10, RH-1, 1E&EN, RH2/3, RH-402&404EN, TN-14/15, RO-16/17, TC30/36

Item/Specifications	Mfg. No.	VHG Product No.
Short Crucible, degassed (for LECO RH-2, RH-402)	769-520	VHG-F769520
Tall Crucible, degassed (for LECO RH-3, RH-402)	769-761	VHG-F769761
Crucible (for LECO TN-15, TC-36, RO-17, RO-18, EF-10)	767-277	VHG-F767277

Autosampler Cups & Tubes
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Conversion Tables For Reference

Use these tables to find the information you need

Tubing I.D. & Volumes

I.D. (in.)	I.D. (mm.)	Vol. (µL/in)	Vol. (µL/cm)
0.001	0.0254	0.0129	0.005
0.01	0.254	1.287	0.507
0.02	0.508	5.148	2.027
0.04	1.016	20.59	8.107
0.06	1.524	46.33	18.24
0.08	2.032	82.37	32.43
0.1	2.540	128.7	50.67

Viscosity Conversion

Centipoise (cp)*	Centistokes (cSt)	Examples
1	1	water
16.5	20.635	lotion
40	43.2	veg. oil
88	110	latex paint
176	220	maple syrup
352	440	SAE 30 oil

*cp = cSt x (density in g/mL)

Volume Conversion

CC (cm^3)	mL	Liter	Fl. Oz.	Gallon
1.0	1.0	0.001	0.0338	2.64E-04
10	10	0.01	0.338	0.00264
29.57	29.57	0.0296	1.0	0.00781
3785	3785	3.785	128	1.0

Weight Conversion

Pound (lb)	Ounce (oz)	Gram (g)	Kilogram (kg)
0.00220	0.0352	1.0	0.001
0.0625	1.0	28.38	0.0284
1.0	16	454	0.454
2.203	35.24	1000	1.0

Flow Rate Conversion

L/min.	L/sec.	Gal./min. (gpm)	Gal./sec (gps)
3.785	0.0631	1.0	0.0167
227.1	3.785	60	1.0
1.0	0.0167	0.264	0.00440
60	1.0	15.85	0.264

1000 ppm standard Dilution Table

Desired Content:	Volumetric Size (mL) 10	25	50	100	250
100ppm	1.0mL	2.5mL	5.0mL	10.0mL	25.0mL
10ppm	100µL	250µL	500µL	1mL	2.5mL
1ppm	(10µL)	25µL	50µL	100µL	250µL
100ppb	*	(2.5µL)	(5µL)	(10µL)	25µL
10ppb	*	*	*	*	(2.5µL)
1ppb	*	*	*	*	*

Aliquot Volume

Those shown with * or ( ) not recommended due to overly ambitious dilution factor and small aliquot.

Pressure Conversion

psi	bar	Pa (N/m^2)	Torr	atm
1.45E-04	1.00E-05	1.0	0.00750	9.87E-06
0.0145	0.001	100	0.750	9.87E-04
0.0193	0.00133	133	1.0	0.00132
1.0	0.0689	6894	51.72	0.0680
10.0	0.689	68940	517	0.680
14.7	1.013	101,325	760	1.0
25.0	1.724	172,350	1293	1.701
50.0	3.447	344,700	2586	3.402
100	6.894	689,400	5172	6.805

Dimension Conversion

U.S.A. Fractional Inches	Metric	U.S.A Decimal Inches
1/32	0.794mm	0.0313
n/a	1.00mm	0.0394
1/16	1.59mm	0.0625
1/8	3.18mm	0.125
1/4	6.35mm	0.250
5/16	7.94mm	0.313
3/8	9.53mm	0.375
n/a	10mm(1cm)	0.394
7/16	1.11cm	0.438
1/2	1.27cm	0.500
9/16	1.43cm	0.563
5/8	1.59cm	0.625
11/16	1.75cm	0.688
3/4	1.91cm	0.750
13/16	2.06cm	0.813
7/8	2.22cm	0.875
15/16	2.38cm	0.938
1	2.54cm	1.00
2	5.08cm	2.00
n/a	10.0cm	3.94
5	12.7cm	5.00
n/a	50.0cm	19.7
n/a	100cm(1m)	39.4

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