SPEX

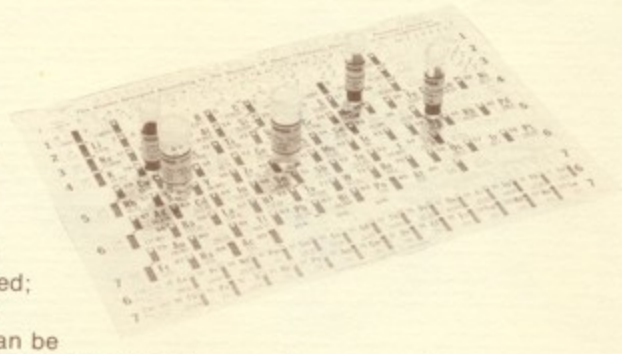
Catalog for Spectrochemistry

John Dalton (1766-1844)
Prepared first table of atomic weights.

93

SPEX

Qualitative and Semiquantitative Standards



Standards are the limiting factor of any spectrochemical method, whether for characterizing a pure material or producing a near-quantative elemental analysis of a mixture. Presenting the greatest challenges to emission spectrochemists in search of standards are unknowns of two types. One is a pure material, the elemental contaminants of which are to be identified and quantified; the other is a complete unknown—organic residues, atmospheric particulates, corrosion scales, minerals, water deposits—the list can be extended indefinitely. These are materials for which the levels of principal elements as well as contaminants are sought. The problems are universal and unpredictable, subject to the whimsy of the all-too-familiar "matrix effect."

Spex offers a variety of standards with which you can attain dependable analyses ranging from qualitative to truly quantitative.

SPECIAL STANDARDS

We continue our policy of welcoming orders to prepare special standards containing specific elements at specific concentrations in specific matrices; we invite your inquiry to meet your individual requirements.

QUALITATIVE STANDARDS

Three proprietary Qual Mix standards contain, respectively, 49 common elements, 16 rare earths, or 10 noble metals. When one of these qualitative standards is arced in a #9027 Enclosed Stallwood Jet on a modern spectrograph, in accordance with directions, only the strongest spectral lines (raies ultimes) of these elements appear in its spectrum. For a qualitative survey high-purity graphite is mixed with a sample in a #5100 Mixer/Mill; the container and pestle are a #3111 plastic vial and #3112 ball. Our #1103 Master Plates facilitate quick major, minor, or trace constituent estimates.

SEMIQUANTITATIVE STANDARDS

Containing elements identical to those in the three Qual Mixes are several series of semiquantitative standards. Where the composition of a Qual Mix series is balanced to achieve appropriate spectral line intensities, a semiquant series contains identical concentrations of each element. The Spex Mixes (common element, rare earth, or noble metal) are recommended for "spiking" pure materials to bracket the concentrations of several contaminating elements and, equally important, determine "less than" concentrations for those not found. If only a single element is sought, just one of the Spex HiPure salts can be chosen for the "spikant." A ready assortment of these salts is available in the three Spex Element Kits.

A complete unknown, the proverbial "gook," is analyzed by comparison with one of the G (graphite), L (lithium carbonate), Z (zinc oxide), or Time Saver Standards. The procedure is a simple one involving just a few dilution steps and visual or densitometric interpolations. While experience will dictate which set is ideal for a specific sample, G standards are widely applicable and are most popular by our records. For organic ashes, however, carbon has a tendency to reduce some of the compounds to metals during ashing, so Z Standards are suggested. For industrial laboratories doing routine quality control a wide assortment of Time Saver Standards, made from high-purity base compounds, provides a unique solution for repetitive analyses of particular substances.

APPROACHING QUANTITATIVE RESULTS

Between the mid-1950s and the mid-1970s both our standards and your techniques have improved. We have weeded out volatile and hygroscopic compounds to refine formulas, improved interpolation precision by offering 5- and 7-part standard sets in addition to the original 3- and 4-part sets, and devised Time Saver Standards. These are electrode-ready sets available in many high-purity base materials.

Likewise, in many laboratories eyeballometric comparisons have been replaced by high-speed densitometric and photoelectric measurements. High-intensity arcs and the Spex Enclosed Stallwood Jet provide stable sources while modern gratings improve resolution unhampered by ghosts and scattered light.

By 1971 a comprehensive article ["A Universal Spectrochemical Method," T.S. Long, Appl. Spectrosc., **25**, 37] cited data showing routinely attained accuracy of 15% for 500 determinations of random materials over a two-year period. And where more knowledge or control over unknowns exists even higher accuracies have been reported.

Spex Mixes

Otherwise called spiking standards, Spex Mixes are added to samples so that trace elements may be determined semiquantitatively by the method of known additions.

1000 SPEX MIX comprises 1.27% each of 49 common elements: Ag, Al, As, B, Ba, Be, Bi, Br, Ca, Cd, Ce, Cl, Co, Cr, Cs, Cu, F, Fe, Ga, Ge, Hg, I, In, K, Li, Mg, Mn, Mo, Na, Nb, Ni, P, Pb, Rb, Sb, Se, Si, Sn, Sr, Ta, Te, Th, Ti, Tl, U, V, W, Zn, Zr

1031 RARE EARTH SPEX MIX comprises 5.28% each of 16 elements: Ce, Dy, Er, Eu, Gd, Ho, La, Lu, Nd, Pr, Sc, Sm, Tb, Tm, Y, Yb

1041 NOBLE METAL SPEX MIX comprises 9.32% each of 10 elements: Au, Ga, Hf, In, Ir, Pd, Pt, Re, Rh, Ru

Qualitative Standards

Proprietary preparations for qualitative spectrochemical analysis. Indicated elements are blended in a readily arced base so that several lines of each metal will appear on a spectrographic plate in the region 2000 to 4700 Å.

1020 QUAL MIX contains the same 49 elements as #1000 above

1033 RARE EARTH QUAL MIX contains the same 16 elements as #1031 above

1043 NOBLE METAL QUAL MIX contains the same 10 elements as #1041 above

Basic Element Kits

Separate containers of compounds of the indicated elements. For quantitative, semiquantitative, and qualitative spectrochemical analyses.

1010 ELEMENT KIT is ≤2 g each of compounds of the 49 elements in #1000 above

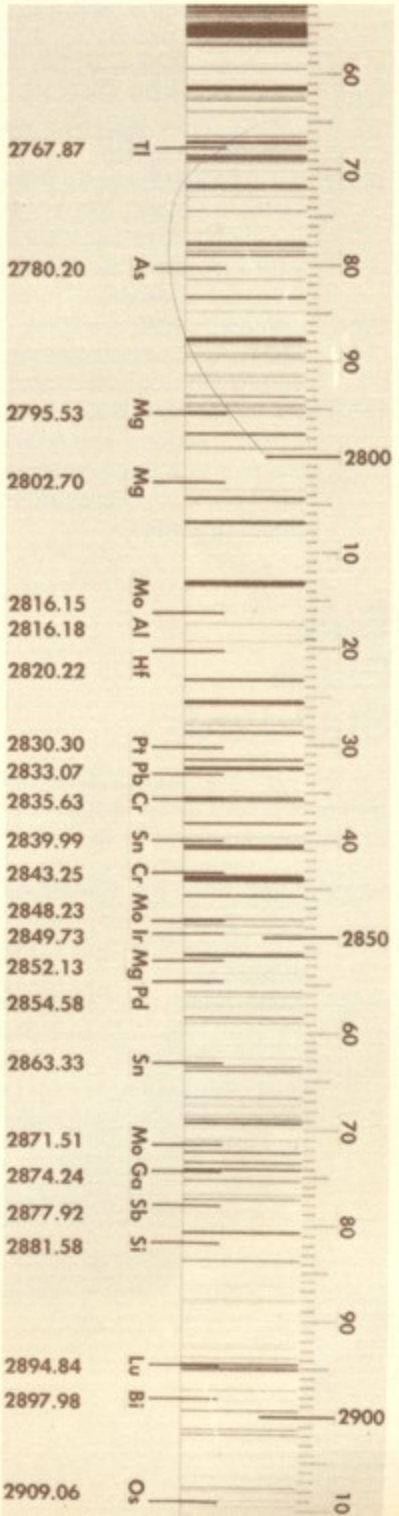
1030 RARE EARTH ELEMENT KIT is ≤2 g each of compounds of the 16 elements in #1031 above

1040 NOBLE METAL ELEMENT KIT is ≤2 g or 5 ml each of compounds of the 10 elements in #1041 above

1011 REPLACEMENT CHEMICALS for Element Kits; same quantity as in kit; specify element

Master Plates

Covering any wavelength interval from 1950 to 4700 Å and individually matched to any linear dispersion spectrograph, the Master Plate shows the persistent lines of about 70 elements, color-coded for easy identification—arc lines are green, spark lines red. To order, please send an iron arc spectrum covering the region of interest made under usual conditions, and specify 2" x 10" or 4" x 10" plate size for mounting. (For shipping the glass plate we recommend taping it between ¼" plywood or Masonite and wrapping the sandwich in corrugated cardboard or a similar buffer.)



1103 MASTER PLATE
10 inches of spectrum

40 inches of spectrum

Common Element Standards

For the semiquantitative determination of 49 elements (see list under #1000) by the dilution technique. A set consists of 2 g of each standard included; a standard contains the given percentage of each of the 49 elements in the matrix specified.

1001 **Z STANDARDS** are 0.1%, 0.01%, and 0.001% of each element in zinc oxide

10015 **Z-5 STANDARDS** are 0.1%, 0.033%, 0.01%, 0.0033%, and 0.001% of each element in zinc oxide, 0.1% indium internal standard added

1002 **G STANDARDS** are 0.1%, 0.01%, 0.001% and 0.0001% of each element in #4061 graphite

10027 **G-7 STANDARDS** are 0.1%, 0.033%, 0.01%, 0.0033%, 0.001%, 0.00033%, and 0.0001% of each element in #4061 graphite, 0.1% indium internal standard added

1004 **L STANDARDS** are 0.1%, 0.01%, and 0.001% of each element in 5-9s HiPure lithium carbonate

10045 **L-5 STANDARDS** are 0.1%, 0.033%, 0.01%, 0.0033%, and 0.001% of each element in 5-9s HiPure lithium carbonate, 0.1% indium internal standard added

Rare Earth Standards

For the semiquantitative determination of 16 rare earth elements (listed under #1031) by the dilution technique; 2 g of each standard in the set.

1032 **RARE EARTH L STANDARDS** are 0.5%, 0.05%, 0.005%, and 0.0005% of each element in 5-9s HiPure lithium carbonate

10327 **RARE EARTH L-7 STANDARDS** are 0.5%, 0.167%, 0.05%, 0.0167%, 0.005%, 0.00167%, and 0.0005% of each element in 5-9s HiPure lithium carbonate, 0.5% indium internal standard added

Noble Metal Standards

For the semiquantitative determination of 10 noble metal elements (listed under #1041) by the dilution technique; 2 g of each standard in the set.

1042 **NOBLE METAL G STANDARDS** are 0.5%, 0.05%, 0.005%, and 0.0005% of each element in #4061 graphite

10427 **NOBLE METAL G-7 STANDARDS** are 0.5%, 0.167%, 0.05%, 0.0167%, 0.005%, 0.00167%, and 0.0005% of each element in #4061 graphite, 0.5% indium internal standard added

Pellementary Standards

Reference standards for direct-reading emission spectrometers and x-ray emission spectrometers. Each Pellement contains 1% of a metal in graphite. A pellet of the mixture is pressed in a #3619 Spec-Cap for protection and identification.

1015 **PELLEMENT**, 1¼" diam x 3/16" (32 x 5 mm), in #4062 graphite (National #SP-1); specify one element: Ag, Al, As, Au, B, Ba, Be, Bi, Br, Ca, Cd, Ce, Cl, Co, Cr, Cs, Cu, Dy, Er, Eu, F, Fe, Ga, Gd, Ge, Hf, Hg, Ho, I, In, Ir, K, La, Li, Lu, Mg, Mn, Mo, Na, Nb, Nd, Ni, P, Pb, Pd, Pr, Pt, Rb, Re, Rh, Ru, Sb, Sc, Se, Si, Sm, Sn, Sr, Ta, Tb, Te, Th, Ti, Tl, Tm, U, V, W, Y, Yb, Zn, Zr

Multielement ICP Solution Standards

Like all OES methods, analyses with an Inductively Coupled Plasma Jet source rely on standards for calibration. And because higher precision and accuracy are attained than with dc arcs the ultimate detection limits and reproducibility may well depend on the purity of the standards' components.

Spex 5-9s HiPure inorganics are ideal starting materials to insure <1 ppb impurity level per element. Only pure metals or assayed metal compounds are chosen. Then every precaution is taken during preparation to maintain the highest quality for the ICP Solution Standards. Finally they are packaged in precleaned, tamper-proof, sealed, polypropylene bottles.

Stability is assured by our custom-chosen matrices which minimize contaminants, avoid formation of precipitates, and prevent hydrolysis in the multielement mixtures.

Please specify the mixture of elements you prefer. Our base price is for 100 ppm of one element.

Time Saver Standards

To speed the semiquantitative analysis of relatively pure materials. A set of Time-Saver Standards consists of 2 g of one of our HiPure materials (for a blank) and five 2-g standards spiked with a Spex Mix at levels of 0.1%, 0.033%, 0.01%, 0.0033%, and 0.001% of each element in the Mix. To order, specify the TS number, the pure base (from the list below), and the Spex Mix for spiking: #1000 (common elements), #1031 (rare earths), or #1041 (noble metals).

TS-6 TIME-SAVER STANDARDS prepared from 6-9s HiPure materials; specify base:

- Aluminum Oxide
- Bismuth Trioxide
- Cadmium Oxide
- Copper(II) Oxide
- Gallium Sesquioxide
- Indium Oxide
- Silicon Dioxide
- Tin(IV) Dioxide
- Yttrium Oxide

TS-5 TIME-SAVER STANDARDS prepared from 5-9s HiPure materials; specify base:

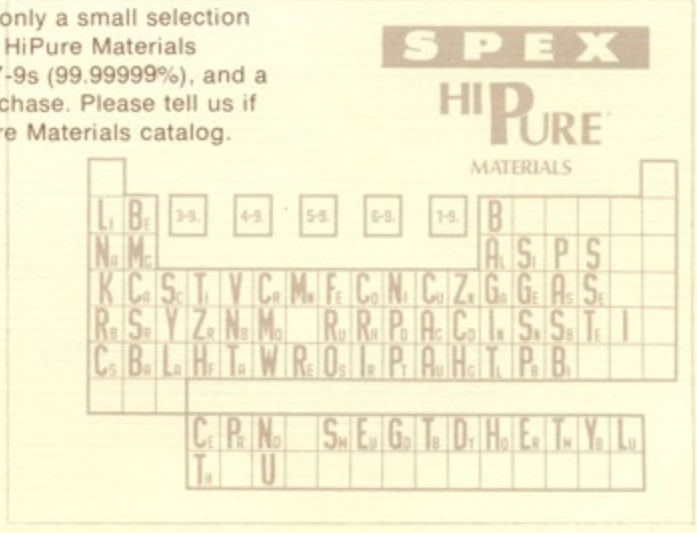
- Antimony Trioxide
- Arsenic Trioxide
- Barium Carbonate
- Boron Oxide
- Calcium Carbonate
- Cerium (IV) Oxide
- Chromium(III) Sesquioxide
- Cobalt(III) Oxide
- Germanium Dioxide
- Iron(III) Oxide
- Lanthanum Oxide
- Lead Monoxide
- Magnesium Oxide
- Manganese Dioxide
- Mercury(II) Oxide
- Molybdenum Trioxide
- Nickel Monoxide
- Potassium Carbonate
- Selenium Dioxide
- Silicon
- Sodium Carbonate
- Strontium Carbonate
- Tellurium Dioxide
- Thallium(III) Oxide
- Titanium Dioxide
- Tungsten Trioxide
- Vanadium Pentoxide

TS-4 TIME-SAVER STANDARDS prepared from 4-9s HiPure materials; specify base:

- Niobium Pentoxide
- Tantalum Pentoxide
- Triuranium Octoxide
- Zirconium Oxide

HiPure Materials

The bases for the Time-Saver Standards are only a small selection of the 500 compounds of 71 elements in our HiPure Materials catalog. Purities range from 3-9s (99.9%) to 7-9s (99.99999%), and a certificate of analysis accompanies each purchase. Please tell us if you would like to receive a copy of the HiPure Materials catalog.



Aqueous Standard Solutions FOR ATOMIC ABSORPTION AND FLAME EMISSION SPECTROSCOPY

For atomic absorption, flame spectroscopy, x-ray fluorescence, and optical emission spectroscopy. Prepared from HiPure materials, each batch of solution is assayed and the metal concentration certified. Each standard contains 1000 μg/ml of the specified element. So that the matrices of our standard and your sample are similar, most of the metals are available in alternate matrices. To order, please specify element, matrix, and quantity (100, 500, or 1000 ml).

ELEMENT	MATRIX	ALTERNATE MATRICES (see key below)
Aluminum	2% HCl	2, 6, 7
Antimony	20% HCl	7
Arsenic	2% KOH	1, 2
Barium	2% HCl	2
Beryllium	2% HCl	2
Bismuth	10% HNO_3	3
Boron	H_2O	6, 7
Cadmium	2% HNO_3	1
Calcium	2% HCl	2
Cerium	10% HNO_3	
Cesium	2% HNO_3	1
Chromium	2% HCl	2
Cobalt	2% HNO_3	1
Copper	2% HNO_3	1
Dysprosium	2% HNO_3	1
Erbium	2% HNO_3	1
Gadolinium	2% HNO_3	1
Germanium	2% KOH	3, 6
Holmium	2% HNO_3	1
Indium	2% HNO_3	1
Iron	2% HNO_3	1
Lanthanum	2% HNO_3	1
Lead	2% HNO_3	5
Lithium	2% HCl	2
Magnesium	2% HNO_3	1
Manganese	2% HNO_3	1
Mercury	2% HNO_3	1
Molybdenum	H_2O	6
Neodymium	2% HNO_3	1
Nickel	2% HNO_3	1
Niobium	5% HF	5
Phosphorus	H_2O	
Potassium	2% HNO_3	1
Praseodymium	2% HNO_3	1
Rubidium	2% HCl	2
Samarium	2% HNO_3	1
Selenium	10% HCl	7
Silicon	2% KOH	6
Silver	2% HNO_3	8
Sodium	2% HCl	2
Strontium	2% HCl	2
Tantalum	5% HF	5
Tellurium	2% KOH	3
Terbium	2% HCl	2
Thallium	2% HNO_3	
Thorium	10% HNO_3	6
Tin	10% HCl	7
Titanium	5% HF	3
Tungsten	5% HF	7
Uranium	2% HNO_3	1
Vanadium	2% HNO_3	1, 7
Ytterbium	2% HNO_3	1
Yttrium	2% HNO_3	1
Zinc	2% HCl	2, 8
Zirconium	5% HF	5
Europium	2% HNO_3	1
Gallium	2% HNO_3	1
Hafnium	5% HF	5
Palladium	10% HCl	
Rhenium	H_2O	
Ruthenium	10% HCl	
Scandium	2% HNO_3	1
Thulium	2% HNO_3	1
Gold	2% HCl	2, 8
Lutetium	2% HNO_3	1
Platinum	10% HCl	
Rhodium	10% HCl	
Iridium	10% HCl	

1% Solutions of $LaCl_3$ or $La(NO_3)_3$ or KCl releasing agents or ionization buffers.

Alternate Matrix Key

1) 2% HCl
2) 2% HNO_3
3) 10% HCl
4) 10% HNO_3
5) 20% HCl
6) 5% HF
7) 2% KOH
8) 2% KCN
9) H_2O

NOTE: Solutions in Alternate Matrices may be purchased in 1-liter size only.

CUSTOM & MULTIELEMENT STANDARDS

are prepared on special order. Please inquire about standards in other matrices, at other concentrations, or containing several elements.

Organic Solvent Soluble Metal Salts FOR NON-AQUEOUS ATOMIC ABSORPTION STANDARDS

In addition to aqueous atomic absorption standards, Spex is now offering a number of metal compounds soluble in organic solvents. These materials are suitable for the determination of trace metals in oils, as internal standards for non-aqueous x-ray fluorescence analysis, or for many other applications requiring a metal compound soluble in non-aqueous media. In applications such as analyses of metals in oils, dissolving these salts in the same oil (or solvent) as the samples eliminates errors due to matrix effects.

Each compound is prepared from a high-purity starting material in order to minimize the amount of metallic impurities present. As for all of our standards, the exact percentage of the metal in each lot is certified on the label.

We invite your inquiries for any other metal compounds, including coordination compounds or organometallics, which are soluble in other organic solvents.

Metal	Salt
Aluminum	Aluminum 2-ethylhexanoate
Barium	Barium 4-cyclohexanebutyrate
Cadmium	Cadmium 4-cyclohexanebutyrate
Calcium	Calcium 2-ethylhexanoate
Cobalt	Cobalt(II) 4-cyclohexanebutyrate
Copper	Copper(II) 4-cyclohexanebutyrate
Iron	Iron(III) 4-cyclohexanebutyrate
Lead	Lead 4-cyclohexanebutyrate
Lithium	Lithium 4-cyclohexanebutyrate
Magnesium	Magnesium 4-cyclohexanebutyrate
Manganese	Manganese 4-cyclohexanebutyrate
Mercury	Mercury(II) 4-cyclohexanebutyrate
Nickel	Nickel 4-cyclohexanebutyrate
Potassium	Potassium 4-cyclohexanebutyrate
Silver	Silver 2-ethylhexanoate
Sodium	Sodium 4-cyclohexanebutyrate
Strontium	Strontium 4-cyclohexanebutyrate
Zinc	Zinc 4-cyclohexanebutyrate

Gas Standards

Primary standard gases at known concentrations. The standards are supplied as solid stoichiometric gas adducts (usually a complex of a transition metal compound and the gas) in sealed glass containers of known volume. Gentle heating of the accurately weighed solid releases the gas quantitatively and irreversibly (with a color change to indicate complete dissociation); dozens of aliquots can then be withdrawn with a gas-tight syringe. To order, specify gas and concentration. (Mixtures and other custom standards are available on special order.)

1080 PRIMARY GAS STANDARDS, 1, 10, or 100 μg/ml in dry nitrogen; sealed in 100-ml borosilicate bottle with silicone rubber septum and aluminum crimp seal; specify one gas:
NH_3, PH_3, H_2S, SO_2, CO, CO_2, Cl_2, Br_2, HBr, HCl, HCN, NO_2

Pre-Weighed Chemicals

Ready for blending or fluxing as soon as the sample is added, these powders are supplied in vials (mixing ball included) that fit a #5100 Mixer/Mill or a Wig-L-Bug. To order, specify the chemical, the amount required per container, and the number of containers; for graphite also specify #4061 (≤100 mesh for buffering), #4064 (≤200 mesh for buffering), or #4062 (≤200 mesh for briquetting; National #SP-1).

GRAPHITE POWDER, highest purity, in #3111 vial with #3112 ball

30-100* mg 101-150 mg 151-200 mg	±2 mg

* <100 mg in #4061 (#SP-2x) graphite only

GRAPHITE POWDER, highest purity; ≤400 mg in #3116 vial with #3112 ball; >400 mg in #6133 vial with #3112 ball

≤400 mg 401-900 mg	±2 mg

LITHIUM CARBONATE, 5-9s HiPure; in #3111 vial with #3112 ball

30-100 mg 101-150 mg 151-200 mg	±2 mg

LITHIUM CARBONATE-GRAPHITE, 5-9s HiPure lithium carbonate and #4061 ≤100 mesh graphite, 1:1 by weight, in #3111 vial with #3112 ball

30-100 mg 101-150 mg 151-200 mg	±2 mg

POTASSIUM BROMIDE, infrared grade, in glass vial (19 diam x 25mm) with stainless steel ball (3.2-mm diam); vial is sealed in container with silica gel to keep KBr dry; vial fits #5100 Mixer/Mill directly, requires #3113K adapter (p. 14) for Wig-L-Bug; 13-mm diam pellet may be stored in vial

≤200 mg 201-300 mg 301-400 mg 401-500 mg	±2 mg

LITHIUM TETRABORATE, 4-9s HiPure; ≤1000 mg in #3116 vial; >1000 mg in #6133 vial

200-1000 mg	±5 mg
1001-2000 mg	±10 mg

Grinding and Sample Preparation

INTRODUCTION

No determination can be better than the procedures from which it derives. A good analysis is worthless if it follows sloppy sampling or poor preparation. Whether you're doing emission, infrared, x-ray, or other spectroscopy, or even wet chemistry, Spex products will aid in blending, diluting, fusing, grinding, and briquetting. It was no accident that our grinders and containers were chosen to prepare and transport the moon rocks for analysis by scientists all over the world.

Underlying the sampling dilemma is the nonhomogeneity of the real world. From metals to plastics, rocks to living tissues, pesticides to pharmaceuticals—a sample must represent a large, often nonuniform, whole. Most of the time the answer is to take large enough chunks of the material to be compositionally representative and reduce them to an appropriate amount of powder. Continuous mixing while the sample is pulverized assures sample homogeneity even though only a fraction of the original sample is analyzed.

An overwhelming majority of grinding problems are solved by one of the Spex impact mills. The #5100 or #8000 Mixer/Mill or #6700 Freezer/Mill reciprocates a container in space at high speed so that a ball inside it strikes the ends many times a second pulverizing the contents. The #8500 or #8510 Shatterbox, a swing mill, rotates a cylindrical container in a horizontal plane so that a puck (or a ring and a puck) inside accomplishes a similar grinding. Whichever the mill, the container must be harder than the sample, and the ball or puck is generally of the same material as the vial, jar, or dish.

CONTAMINATION

Handling a sample always contaminates it. The key to a successful, interference-free analysis is to handle the sample in such a manner that the contaminants either remain at concentrations too low to interfere or consist only of substances of no concern. For example, grinding ferrous slags in tungsten carbide containers does both: being extremely hard, WC contaminates (and, equally important, wears) minimally; furthermore tungsten, carbon, and cobalt (a binder) are not normally sought in the slag. Please contact us for advice about choosing the most suitable container from our extensive assortment.

An excellent reference on contaminants introduced during grinding is Thompson and Bankston [Appl. Spectrosc., **24**, 210 (1970)]. They reported on extensive work grinding SiO_2 and $CaCO_3$ at the Woods Hole Oceanographic Institution and concluded that agate and methacrylate contributed virtually no contaminants.

CLEANING CONTAINERS

Grinding containers can be "dry cleaned" between samples by grinding a small portion of the new sample for about a minute then discarding it. Or sand, sold as "standard sand," may do the job as well and is a good general cleaner for grinding containers.

OVERCOMING STATIC

In dry weather materials with high dielectric constants develop electric charges, so particles repel each other and do not mix. "Rinsing" with graphite powder lines the container and impactors with the conductive medium and keeps charges from building up.

WET GRINDING

Small amounts of water or alcohol often facilitate grinding and mixing, but remember that too much of certain alcohols will soften polystyrene. Submicron particle sizes are routinely attained with slurries.

INFRARED MULLS

In many infrared labs the #3111 polystyrene vial has been found suitable for the preparation of Nujol mulls and KBr pellets. The polystyrene spectrum appears as a constant background and can be subtracted out mentally.

GRINDING AIDS

Almost everyone lays claim to his own magic potion which, sprinkled in with the substance to be ground, improves grinding primarily by inhibiting caking. X-ray spectroscopists—experts with the Shatterbox—seem to prefer sodium stearate. "Boraxo," which contains an abrasive, "Tide," and "Avicel," a granular cellulose, are free of metallic elements.

FREEZE GRINDING

Although the majority of samples can be ground at room temperature, some are not friable enough. For these substances, and for temperature-sensitive ones, cooling with liquid nitrogen will generally fill the bill. Cryogenic grinding is available with either the #6700 Freezer/Mill or with the #8509 container in the Shatterbox.

SEALED GRINDING

Two reasons prevail for grinding in the #8502 Dish:
a) the need for an inert or controlled atmosphere;
b) the desirability of collecting a gas (such as CO_2) evolved during grinding. Fitted with two hose connectors, the #8502 permits flushing with or collecting gas.

Shatterbox®

For fast, efficient, reproducible grinding of production samples, the Shatterbox is unbeatable. It spins a puck and a ring inside a grinding container at 900 rpm to pulverize samples up to 70 ml quickly.

The table below summarizes results for a few of the materials the Shatterbox routinely tackles. Applications run from metals and cements through slags and fluxes to fertilizers and pesticides.

Flexibility is achieved by the choice of grinding container—consider the array on the facing page. There are extremely hard dishes, small ones, a cryogenic one, and one with gas connections.

To reduce noise decibels below OSHA limits, select an Enclosed Shatterbox (#8510)—the same Shatterbox (#8500) inside, but a lead-and-plastic-foam-composite-lined housing outside. And if you already have a Shatterbox and want the advantages of the enclosed version, you can order the housing (#8511); it comes with complete instructions for assembly. Besides silence the enclosure provides a convenient stand for the Shatterbox, supporting it at a comfortable working height of 81 cm above the floor.

To help you evaluate the Shatterbox we offer free tests of its performance. Send us up to three samples (with the completed questionnaire from inside the back cover); they will be ground at no charge, and a full report will be returned within two weeks.

No. 8510 No. 8500

(stand not included)

Grinding Tests With #8501

Material	Form as received	Time, min	Amount grams	% Passing 325 mesh
Asbestos	Fibrous	12	20	100
Cement, Portland raw mix	⩾60 mesh	2½	40*	100
Ferro-chromium	⩾100 mesh	5	25	100
Ferro-manganese	⩾200 mesh	3	25	100
Ferro-molybdenum	⩽80 mesh	4	25	100
Ferro-niobium	⩽80 mesh	3	25	100
Ferro-silicon	⩽80 mesh	4	25	100
Ferro-titanium	⩽80 mesh	6	25	100
Ferro-vanadium	⩽80 mesh	7	25	100
Fiberglas	thin sheets	2	10	100
Fluorspar	⩾100 mesh	3	50	100
Oil shale	6.4-mm	3	60	100
Pesticide	⩽100 mesh	15	50	100
Phosphate, raw mix	⩾60	2½	40	100
Iron powder	⩽80	6	5	68
Sand	⩽10	10	100	100
Slag, blast furnace	chunks	1	10**	100
Slag, open hearth	chunks	1	20	76
Transite	chunks	10	35	100

* sodium alkylarylsulfonate added, 5%
** Household detergent (Tide) added, 10%

8500 **SHATTERBOX®** grinder and blender, ⅓ hp motor, 50/60 Hz, 115 OR 230 V (specify); 33 cm diam, 60 cm height, 57 kg NET, 147 lb gross; includes #8506 silencer cover; (230 V supplied without electrical plug)

8506 **SILENCER COVER** for #8500 Shatterbox, polyurethane foam

8510 **ENCLOSED SHATTERBOX®** grinder and blender, ⅓ hp motor, 50/60 Hz, 115 OR 230 V (specify), 0-6 min timer; sound-absorbing housing 48 x 48 x 93 cm; 93 kg NET, 261 lb gross

8511 **SHATTERBOX® HOUSING**, sound-absorbing; converts #8500 to #8510; 48 x 48 x 93 cm, 35 kg NET, 114 lb gross

8507R **RACK** to hold three #8507 or #8508 dishes; 18.5 (diam) x 19.5 cm, 1.3 kg

GRINDING CONTAINERS FOR #8500 & #8510

Catalog #	Material	Outer dimensions, diam x ht, in	Recommended load, ml	Parts				
				Dish	Lid	Ring	Puck	Gasket
8501	Hardened steel	6½ x 2¾	20-50	x	x	x	x	x
8502	Hardened steel	6½ x 2¾	20-50	x	x(c)	x	x	x
8504	Tungsten carbide (a)	7 x 3	25-70	x	x	x	x	x
8505	Alumina ceramic (a)	6 x 3	20-60	x	x		x	x
8507	Hardened steel	3¾ x 2¼	10-30	x	x		x	x
8508	Tungsten carbide (a)	3¾ x 2¼	10-30	x	x		x	
8509	Hardened steel (b)	7 x 3	20-40	x	x	x	x	

(a) Because it is brittle as well as hard, this material cannot be guaranteed against chipping or breaking. Nonetheless, if the instructions provided with the dish are followed it will provide years of satisfactory service.
(b) For cryogenic grinding; includes handle (for dish) and hook (for lid).
(c) Lid has gas inlet and outlet for grinding in a controlled atmosphere.

Grinding Tests with #8509

Material	Form	Time, min	Amount, g	Final size, mesh
Aluminum	75-mm shavings	3 x ½	10	30-70
Polypropylene	3-mm pellets	3 x ¼	16	40-60
Polystyrene	12-mm pieces	2 x 1	17	100-200
Rubber, hard	50-mm strips	2 x 1	28	80-100
Rubber, soft	50-mm strips	3 x ½	27	30-40
Teflon	6-mm pellets	3 x ½	12	100-200

Cryogenic Grinding

The hardened steel dish is lowered into an LN_2 bath prior to being clamped into the Shatterbox.

8507R HOLDING THREE 8507

8507 HARDENED STEEL
8508 TUNGSTEN CARBIDE

8504

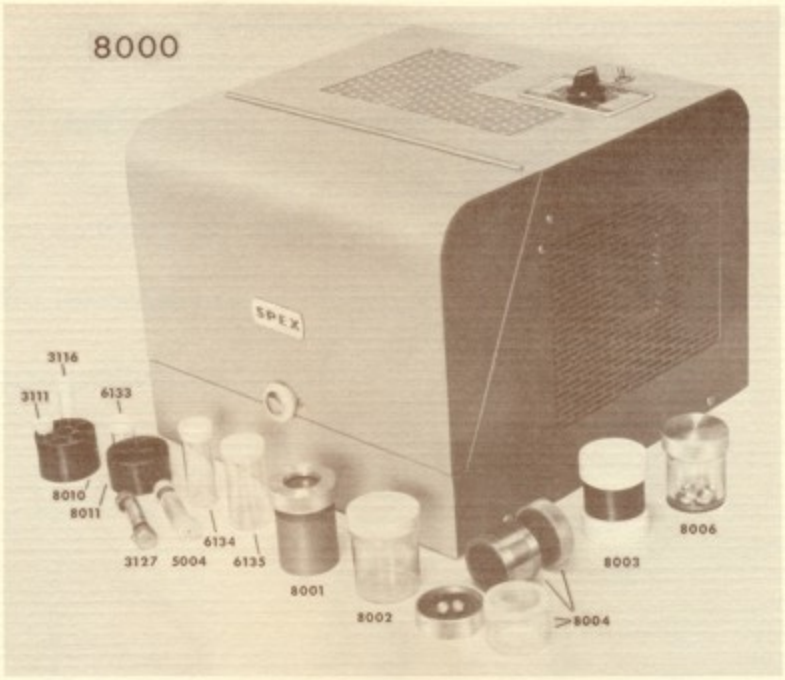
8505

8000 Spex Mixer/Mill®

Able to mix 100 ml or grind 10 ml in a single load, the #8000 offers a wide selection of grinding vials, including plastic ones which contribute no metallic contamination. With an appropriate adapter as many as seven samples can be run at one time. The automatic timer will stop the mechanism after a preset time (up to one hour), or the timer may be bypassed, and the Mixer/Mill will run until it is manually switched off.

The sheet metal case is coated with chemically resistant paint, and shock mounting allows counter-top operation, even with other instruments. The hinged door actuates an interlocking safety switch.

As for our other grinders, we invite you to submit up to three samples (with the form inside the back cover) for grinding without charge. A report and recommendations will be returned within two weeks.



8000 SPEX MIXER/MILL® to mix 10-100 ml or grind 3-10 ml; 1-hr timer; continuously variable jaws hold vials to 2¼" diam x 3" length; rugged construction and housing, shock mounted; 38 x 41 x 30 cm; 24 kg NET, 64 lb gross
115 V, 60 Hz
230 V, 50 Hz

8010 ADAPTER for seven ½" diam vials; 5.6 (diam) x 3.8 cm

8011 ADAPTER for four ¾" diam vials; 5.6 (diam) x 3.2 cm

Grinding Tests with #8000 Mixer/Mill

Material	Form	Method	Time, min	Amount, g	% Passing 325 mesh
Antimony	Pieces	L-D	5	26	97
Asbestos	Fluff	WC-D	10	*	*
Bauxite	60 mesh	TS-W	30	3	*
Bismuth	Chunks	PJ-D	20	5	75
Bone	Chunk	AC-D	10	*	55
Boron Carbide	Chunk	WC-D	15	7	100
Brake Linings	Chunk	WC-D	*	*	*
Carbon (activated)	Pieces	TS-D	10	10	90
Carnauba Wax	Piece	PJ-D	2	5	20
Cement (portland)	Powder	AC-W	30	20	100
Chrome Ore	Chunk	WC-D	10	15	39
Chromium	Chunk	WC-W	20	10	50
Cobalt		WC-W	10	10	91
Copper Shot		WC-D	15	2	95
Ferro Cr	100 mesh	WC-W	20	5	94
Ferro Nb		WC-W	60	5	10
Floor Tile	Chunk	WC-D	**	**	**
Germanium	Pieces	L-D	5	5	38
Ilmenite	Grains	WC-D	10	5	98
Limonite Ore	Grains	TS-W	30	3	100
Porcelain	Chunk	WC-D	15	6	83
Potassium Pyrosulfate	Fused/ Button	PV-D	10	5	100
Reforming Catalyst	3-mm Beads	AC-D	5	5	*
Sand	Grains	WC-D	2	12	86
Silica	Chips	L-D	30	15	*
Silica	Chips	AC-D	20	5	97
Silicon	Chunks	WC-D	15	10	92
Silicon	6-mm Lumps	L-D	10	5	30
Slag (blast furnace)		TS-W	20	3	100
Slag (copper)	100 mesh	WC-W	10	5	84
Slag (open hearth)		TS-W	20	3	100
Straw		TS-D	10	5	**
Tomato Stems		TS-D	10	5	**
Transite	Chunks	WC-D	*	*	*
Tungsten Carbide		WC-W	15	10	100
Tungsten	Lumps	WC-D	10	25	50
Welding Flux		WC-W	30	5	82
Wood	Pieces	AC-D	10	1	50
Zirconium Carbide		AC-W	30	15	100

TS—# 8001 Tool Steel Vial
AC—# 8003 Ceramic Vial
WC—# 8004 Tungsten Carbide Vial
PV—# 6133 Polystyrene Vial
PJ—# 8002 Polystyrene Jar
L—# 8006 Acrylic Vial
-D—Dry ground
-W—Wet ground (water or 1, 1, 1-trichloroethylene slurry)
* Suitable for X-ray or Emission Spectroscopy
** Satisfactory for Extractions

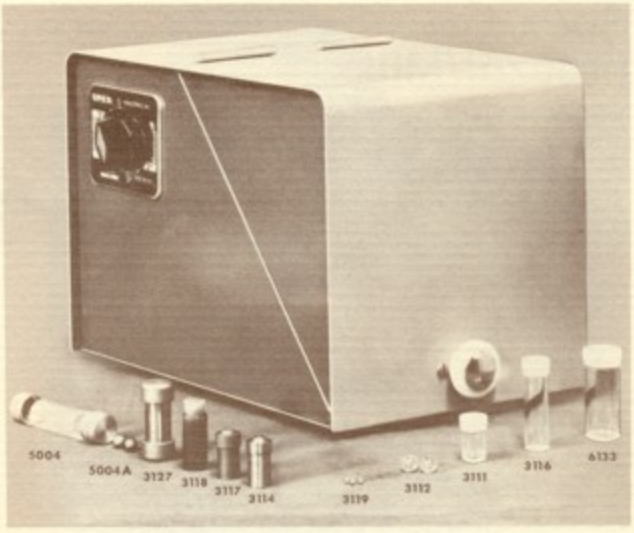
5100 Spex Mixer/Mill®

The #8000 Mixer/Mill's baby brother doesn't play around. For samples up to 10 ml the #5100 is perfectly serious about grinding or mixing—the mixing ball strikes the end of the vial more than 100 times per second for rapid, reproducible grinding and thorough mixing.

Two samples may be run at once, and vials from 1" to 2¼" long and up to ¾" in diameter are accommodated without adapters. The list of grinding vials (below) includes suitable choices for virtually any application.

A two-position timer switch sets running times up to 6 min or up to 1 hr. The #5100's housing is finished with chemically resistant paint, and the operator is protected by a safety interlock on the door's latch.

If you think the #5100 may be the solution to your grinding problems, take advantage of our free offer. Send up to three samples with the form inside the back cover; the samples and report will be back to you within two weeks.



5100 SPEX MIXER/MILL® to mix or grind up to 10 ml; 115 V, 60 Hz OR 230 V, 50 Hz (specify), dual (6 min or 1 hr) timer; continuously variable jaws hold vials to ¾" diam, 2¼" length; 30 x 20 x 20 cm; 7 kg NET, 19 lb gross

GRINDING CONTAINERS FOR #5100 & #8000

Catalog #	Vial/ Cylinder	Cap(s)	Ball(s)	Diam x ht, in	Recommended load, ml
3111	polystyrene	polyethylene		½ x 1	1
3112	———	———	3/8" methacrylate	———	———
3114	stainless steel	stainless steel	1: 1/4" steel	½ x 1	0.2-0.6
3116	polystyrene	polyethylene		½ x 2	3
3117	hardened steel	hardened steel	1: 1/4" steel	½ x 1	0.2-0.6
3118*	agate	agate	1: 1/4" agate	½ x 2	0.2-0.6
3118A	———	———	1/4" agate	———	———
3119	———	———	1/8" methacrylate	———	———
3127	hardened steel	hardened steel	1: 1/4" steel	¾ x 2	0.5-1.0
5004*	6: methacrylate	2: Teflon w/WC liner	2: 5/16" WC		0.5-1.5
5004A	———	———	5/16" WC	———	———
5004C	methacrylate				
5004W		Teflon w/WC liner			
6133	polystyrene	polyethylene		¾ x 2	5

GRINDING CONTAINERS FOR #8000

6134	polystyrene	polyethylene		1 x 3	15
6135	polystyrene	polyethylene		1¼ x 3	30
8001	hardened steel	Al w/steel liner; O-ring	2: 1/2" steel; 4: 1/4" steel	2¼ x 3	3-10
8001C		Al			
8002	polystyrene	bakelite		2⅛ x 2½	10-50
8003*	alumina ceramic w/Al support	2: alumina ceramic; 8 gaskets	1: 1/2" alumina ceramic	2¼ x 2¾	5-10
8003A	———	———	1/2" alumina ceramic	———	———
8004*	1: tungsten carbide 1: methacrylate	2: Al w/WC liner; 8 gaskets	2: 7/16" WC	2¼ x 2½	3-10
8004A	———	———	7/16" WC	———	———
8006	methacrylate	Al w/methacrylate liner; 7 gaskets	2: 1/2" methacrylate; 4: 3/8" methacrylate	2¼ x 2¾	3-10

* Because it is brittle as well as hard, this material cannot be guaranteed against chipping or breaking. Nonetheless, if the instructions provided with the vial are followed it will provide years of satisfactory service.
**C means 100; M means 1000.

Spex Freezer/Mill®

For a troublesome minority of samples, ones that simply can't be ground at room temperature, the Freezer/Mill offers a workable approach. The sample is contained in a vial with magnetic end caps and rod-pestle. The nonmagnetic center section of the vial is submersed in LN_2 while coils at the ends of the vial are energized alternately to attract the rod-pestle back and forth between them. There are as many as 30 impacts per second but without local heating to damage delicate samples.

The same free offer applies to the Freezer/Mill as to our other grinders. Send up to three samples with the form inside the back cover. Ground samples and a report will be sent to you within two weeks.

6700 SPEX FREEZER/MILL® impact grinder with self-contained LN_2 bath; 115 V, 50/60 Hz; includes #6704; 6 kg NET, 17 lb gross

6701 GRINDING VIAL, includes 2 end plugs, impactor, and 4 polycarbonate center sections

6702 CENTER CYLINDER, stainless steel; replaces center section of #6701 for grinding samples while avoiding organic contamination

6703 MICROVIAL SET, stainless steel; three 0.6-ml vials in special holder; for preparing microsamples with KBr

6704 EXTRACTOR & VIAL OPENER for handling frozen samples

Grinding Tests with Freezer/Mill

Material	Form	Weight, g	Time, min	Final size, mesh
Aluminum foil	2-mil piece	1 (b)	3 x 2	100-200
Candle wax	chunk	1.5	2	100-200
Chewing gum	chunk	1.5	2	100-200
Fish scales	10-mm flakes	1.5	2 x 2	200
Hair	dog clipping	0.5	2	200
Human vertebrae	7-mm pieces	2	2 x 2	200
Mouse skin	raw, ½ animal	2 (c)	3	200
Nylon (a)	3-mm beads	2	2 x 2 (e)	100-200
Permalloy 5	2-mm shot	2	3	30
Polyethylene	10-mil sheet	1	2	200
Rubber band	5-mm shearings	1.5	2 x 2	100
Rubber, oil-extended	5-mm shearings	1.5 (d)	2	25-50
Sheep wool	wad	0.5	2	200
Space food	stick	2	2	100
Steel wool	wad	0.5	2	100
Teflon	2-mil tape	3	2 x 2	100

(a) Three different nylons yielded similar results.
(b) 0.5 g of Tide detergent added.
(c) Equal weight of sodium sulfate as dehydrating agent.
(d) Equal amount of sand added. Purpose: ethanol-toluene extraction.
(e) Two 2-min grinds with a one-min cooling period between.

Wig-L-Bug

You've probably seen one of these in your dentist's office—it's a popular tool for triturating amalgams. It's also a very handy device for grinding and mixing samples smaller than 1 ml.

For mixing powders or preparing mulls with mineral oil, choose a plastic vial (#3111, p. 12). To prepare KBr pellets try a stainless steel vial (#3114, p. 12) and grind for less than a minute. There's also a hardened steel vial (#3117, p. 12) which may fit your needs.

3110B **WIG-L-BUG**, black housing; 115 V, 50/60 Hz; 1-min timer; includes #3113 adapter; 25 x 10 x 15 cm; 3 kg NET, 10 lb gross

3110W **WIG-L-BUG**, ivory housing; 115 V, 50/60 Hz; 1-min timer; includes #3113 adapter; 25 x 10 x 15 cm; 3 kg NET, 10 lb gross

3140 **WIG-L-BUG**, without housing, 115 V, 50/60 Hz, 30-min timer; includes #3113 adapter; 25 x 10 x 15 cm; 3 kg NET, 10 lb gross

3113 **ADAPTER** for ½" (diam) x 1" vials

3113K **ADAPTER** for glass vial of preweighed KBr

Nylon Sieves

Eliminate two sources of contamination at once. Not only do these nylon sieves contribute no metallic impurities, but they make it so easy to change screens between samples that you can also avoid cross-sample contamination.

Each sieve consists of telescoping methacrylate cylinders over which the screen is stretched as on an embroidery hoop. The screens are 100, 200, 325, and 400 mesh monofilament nylon cloth which meets ASTM specification E11-58T for size and uniformity of mesh. The assembly slips apart for cleaning.

3536 **SIEVE SET** includes 4 frames, 1 receiving tray, 1 lid, and 1 screen each 100, 200, 325, and 400 mesh

3530 **SIEVE FRAME** consisting of 2 telescoping methacrylate rings 57 (id) x 25 mm; specify for 100, 200, 325, or 400 mesh

3531 **SCREEN**, 100 mesh monofilament nylon cloth; twelve; 88-mm diam

3532 **SCREEN**, 200 mesh monofilament nylon cloth; twelve; 88-mm diam

3533 **SCREEN**, 325 mesh monofilament nylon cloth; twelve; 88-mm diam

3534 **SCREEN**, 400 mesh monofilament nylon cloth; twelve; 88-mm diam

3535 **TRAY**, metnacrylate; 57 (id) x 25 mm; 67.5 ml capacity

3546 **SIEVE SET** includes 4 frames, 1 receiving tray, 1 lid, and 1 screen each 100, 200, 325, and 400 mesh

3540 **SIEVE FRAME** consisting of 2 telescoping methacrylate rings 120 (id) x 50 mm; specify for 100, 200, 325, or 400 mesh

3541 **SCREEN**, 100 mesh monofilament nylon cloth; twelve; 150-mm diam

3542 **SCREEN**, 200 mesh monofilament nylon cloth; twelve; 150-mm diam

3543 **SCREEN**, 325 mesh monofilament nylon cloth; twelve; 150-mm diam

3544 **SCREEN**, 400 mesh monofilament nylon cloth; twelve; 150-mm diam

3545 **TRAY**, methacrylate; 120 (id) x 50 mm; 540 ml capacity

Mortars & Pestles

The prime consideration for the material of a mortar being hardness, the Knoop hardness numbers for five materials whose Mohs hardness numbers range from nine to ten are shown in the following table.

MATERIAL	KNOOP HARDNESS
Tungsten Carbide	1880
Aluminum Oxide	2100
Silicon Carbide	2480
Boron Carbide	2750
Diamond	7000

Spex offers mortars made of boron carbide and of silicon carbide.

Boron carbide is virtually inert and harder than most substances, natural or man-made. It is also unbonded, so that the only possible metallic contaminant is boron.

Silicon carbide mortars are inert to most solvents and contain no binder. They are not quite as hard or as polished as boron carbide ones, but neither are they as expensive.

The 13- and 25-mm mortars are mounted in removable plastic bases; 50-mm and larger ones are encased in aluminum. Pestles are attached to metal or plastic handles.

3201 **MORTAR & PESTLE**, boron carbide; highly polished mortar cavity 13 (diam) x 4 mm; pestle 6 mm diam

3202 **MORTAR & PESTLE**, boron carbide; highly polished mortar cavity 25 (diam) x 6 mm; pestle 13 mm diam

3205 **MORTAR & PESTLE**, boron carbide; highly polished mortar cavity 38 (diam) x 19 mm; pestle 14 mm diam

3203 **MORTAR & PESTLE**, boron carbide; highly polished mortar cavity 50 (diam) x 25 mm; pestle 14 mm diam

3204 **MORTAR & PESTLE**, boron carbide; highly polished mortar cavity 76 (diam) x 38 mm; pestle 19 mm diam

3208 **MORTAR & PESTLE**, silicon carbide; mortar cavity 76 (diam) x 38 mm; pestle 19 mm diam

Spec-Caps

These thin-walled aluminum cups eliminate the need for backing materials or binders when pressing 31-mm planchets [C.K. Matocha, Appl. Spectrosc., **20**, 252 (1966)]. Handling becomes easier because the risk of breaking the pellet is reduced. The painted outside surface prevents mold sticking and permits marking for identification and storage of the pellets.

3619 SPEC-CAP, 30 (diam) x 9 mm; produces briquet 31 (diam) x 5 mm; requires #3623 die

X-Ray Cells

Nearly every petroleum refinery in the world relies on these polypropylene sample cells for monitoring sulfur in heating oils by x-ray spectroscopy. They have also been adapted for analyzing solution residues and powders by ingenious customers. If the film window is prepared normally and then dished slightly with a rounded-end glass rod, a drop of solution placed there and warmed under an ir lamp dries to a smudge to be analyzed in situ. If powder is spread on the surface and another piece of film overlaid before snapping on the ring, the sandwiched powder is ready for x-ray analysis. Volatile samples (such as light petroleum fractions) are analyzed by venting the cell with a small pinhole and leaving a little air room for expansion.

Mylar is a suitable window for most analyses but does contain traces of Zn, P, Ca, and Sb. Kapton is virtually free of metallic impurities.

3515 EXPENDABLE X-RAY CELLS, polypropylene

3517 MYLAR, ¼-mil film, 64 mm x 92 m

3511 KAPTON, ⅓-mil film, 64 mm x 15 m

3518 ALUMINUM SPACER, specify 32, 35, or 51 mm to fit sample cavity of spectrometer

3519 SNAP-ON RINGS for #3515 cells

PressuReactor

Most silicate minerals, ores, slags, glasses, portland cements, and ferro-alloys dissolve rapidly in appropriate mineral acids at elevated temperatures and pressures. The Spex PressuReactor makes such digestions easy and safe. Reactants contact only the removable Teflon vessel and its tightly clamped Teflon lid, so contamination is avoided. Should the internal pressure exceed a safe value the Teflon lid will rupture, relieving pressure through a small hole in the outer stainless steel cap.

Constructed of 18-8 stainless steel and Teflon, the PressuReactor can be heated to 150°C in an oven or on a hotplate. Typically, 200 mg of a silicate dissolve in 5 ml of HF if held in the PressuReactor at 115°C for 15 min. The entire assembly may be immersed in water to cool it before the knurled cap is unscrewed.

A disk-type surface thermometer is attached to the top of the tilted cap, and a Teflon-covered rod for magnetic stirring is supplied.

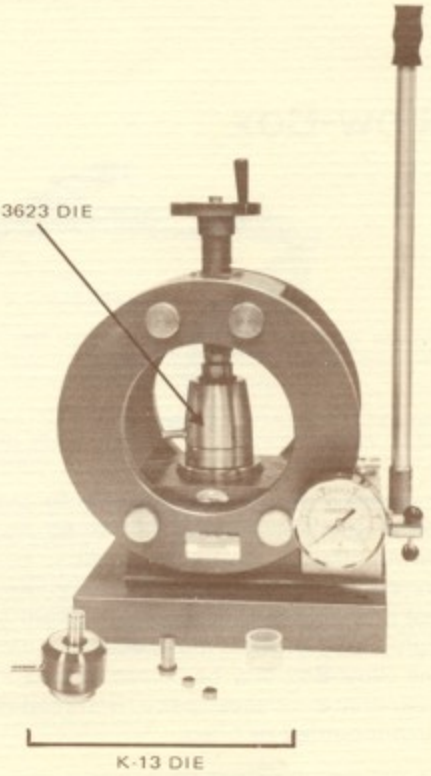
7155 PRESSUREACTOR, Teflon vessel with Teflon lid inside a screw-capped stainless steel container with contact thermometer

7156 TEFLON VESSEL with Teflon lid, replacement for that supplied in #7155

Manual Hydraulic Press

Developed for analysts and spectroscopists, the B-25 press is designed around a double-ring frame which provides unusual access to the work area from all four sides. The upstroking 92-mm diam ram has a movement of 25 mm and compresses the work against an upper screw which is fitted with a cranked handle for easy height adjustment. A pressure-relief valve helps prevent damage to specimens by allowing the maximum pressure to be regulated from 0 to 25 tons.

B-25 HYDRAULIC PRESS, manual 25 ton; 62 kg NET, 170 lb gross



Motorized Hydraulic Press

The X-Press 30-ton motorized hydraulic press was tailored specifically for the busy analytical lab which needs more than just an occasional pellet. Whether it is to be a 13-mm disk of KBr for ir analysis or a 44-mm planchet for x-ray analysis, total elapsed time from powder to finished pellet is under 2 min. And no muscles are required, for the X-Press is fully motorized!

When the fail-safe switch is activated the upstroking ram compresses the pellet against an adjustable screw, and in less than 30 sec the desired pressure is reached. There's no need to check this carefully—a preset pressure-relief valve assures that all pellets are pressed alike.

Not only was the X-Press conceived for efficient and rapid pressings, safety was also a foremost consideration. A transparent polycarbonate sliding door must be closed against an interlock switch before the power can be turned on. Hands are thereby kept out during operation. Properly set the pressure-relief valve prevents application of dangerous forces to a small-diameter die.

3624 **X-PRESS** motorized hydraulic press, 30-ton; specify 115, 60 Hz OR 230 V, 50 Hz 150 lb gross

3621 **DIE**, 44-mm diam; requires 30-ton press

3623 **DIE**, evacuable, 31-mm id; produces pellets up to 8 mm thick; 4.5 kg

3623C **TUNGSTEN CARBIDE PELLETS**, 31-mm diam, for #3623 die; (not guaranteed against chipping or breaking)

K-13 **DIE**, evacuable, 13-mm id; produces pellets up to 6 mm thick; 1.4 kg

SPECIFICATIONS

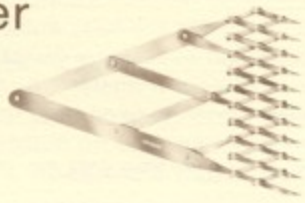
Force	0-30 tons
Platen movement	3 cm
Platen diam	8 cm
Max daylight	15 cm
Min daylight	5 cm
Upper screw adjustment	10 cm
Height	50 cm
Depth	60 cm
Width	35 cm
Power	115 V, 60 Hz OR 230 V, 50 Hz; ⅓ hp motor
Net weight	55 kg

Glow-Box

A versatile, convenient light box for viewing spectrographic plates or film or for illuminating samples during titration, for tracing against, or for overlaying graphs for comparison. The illuminated surface (28 x 23 cm) is translucent Plexiglas, the light source is a high-intensity, rapid-start, cool, circular fluorescent lamp. The Glow-Box may be stored in (and even operated in) a desk drawer to save space. Retractable legs allow it to be flush-mounted or tilted.

3710 **GLOW-BOX** with carrying handle; finished in baked hammertone gray enamel; 22-W circular fluorescent lamp, 115 Vac; 30 x 30 x 10 cm; 3 kg

Spacing Divider



Recommended for spectrographic wavelength interpolation, this drafting tool has eleven teeth which always divide the space between the outside two into ten equal parts. The teeth are numbered, left to right on one side, right to left on the other.

3506 **SPACING DIVIDER**, 15 cm length, stainless steel; maximum spread 23 mm, minimum distance between teeth 3 mm

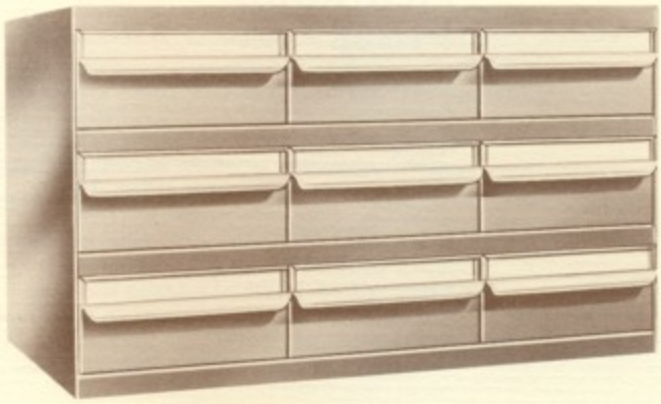
Rack & Handling Tongs

7151 **RACK & HANDLING TONGS** for six #7152 crucibles; rack of heli-arc welded high-temperature wire

7151R **RACK**, as in #7151

7152 **CRUCIBLE**, graphite (regular grade, not high purity); 32 (diam) x 25 mm; 9 ml capacity

Plate Storage Cabinet



Here's a storage cabinet for spectrographic plates which don't fit into ordinary office file cabinets. The unit has nine drawers (28 x 12 x 30 cm) and two separators per drawer. About 1000 plates in envelopes can be stored in the unit, and the separators and drawer fronts may be labeled for identification.

3820 **PLATE STORAGE CABINET** with nine drawers; steel, welded frame construction, finished in gray baked enamel; 51 x 86 x 30 cm; 34 kg

Staticmaster Brushes

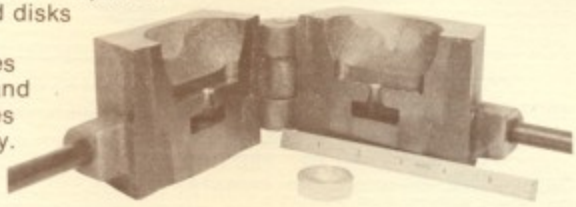
To remove dust from smooth surfaces, especially glass plates, simply brush with a Staticmaster. Small particles are actually attracted to the brush so they don't settle back on the surface.

3901 **STATICMASTER BRUSH**, 76 mm; model 3T500 (500 microcurie polonium element)

3902 **STATICMASTER BRUSH**, 25 mm; model 1C200 (200 microcurie polonium element)

Book Mold

This cast-iron book mold for preparing 32 (diam) x 10 mm disks of low-melting alloys permits spectrographers to match their samples to standard disks and so facilitates setups and increases accuracy.



The large mass of the mold quickly freezes the casting, and the sample can be removed almost immediately. The disk is cast horizontally, promoting fast chilling and resulting in small, uniform grain structure on the surface to be anlyzed. A minimum of machining or sanding is required because the faces of the mold are quite smooth.

3904 **BOOK MOLD** for casting disks about 32 (diam) x 10 mm; 410 x 76 x 76 mm; 5.4 kg

Spectroscopic Plates & Film

EMULSION	MOST USEFUL SPECTRAL RANGE	APPLICATIONS
Spectrum Analysis #1	2500-4400A	Moderately slow, fine grained, high contrast and resolving power. Wavelength range minimizes overlapping orders. Most popular emulsion for quantitative and semiquantitative work.
Spectrum Analysis #3	2500-5000A	Speed about twice that of SA#1 at 3000Å, moderately coarse grain, medium contrast and resolving power. Excellent when wide concentration range coverage is more important than precision.
#33	2500-4400A	This emulsion strikes an average between SA#1 and SA#3 in speed and is superior to SA#3 in graininess. For trace analysis when background interferes using SA#3.
103-0 *	2500-5000A	Very fast (about 4 times that of SA#1 under similar exposure conditions), moderately coarse grain, medium contrast low resolving power emulsion. Most useful for analysis of micro-samples with weak lines or short duration exposures.
103-F *	2500-6750A	Extended wavelength coverage for 103-0 type emulsion. Particularly useful for Na and Li determinations.
1-N *	2500-8750A	Very fast particularly in the region 6750-8750Å, coarse grain, medium contrast and resolving power. Particularly useful for the analysis of K, Rb and Cs. Despite its broad wavelength coverage it should not be used as a general emulsion because of granularity and low speed in the u.v. portion of the spectrum. Provisions for deep-freeze storage is recommended.

PLATES & FILM

Emulsion	Type	Size	Kodak #
SA #1		2" x 10"	—
		4" x 10"	—
	darkroom	35 mm x 100'	SA 421
	daylight	35 mm x 100'	SA 413
SA #3		4" x 10"	—
	daylight	35 mm x 100'	SP 413
#33		4" x 10"	—
103-0*	daylight	35mm x 100'	SP 417
103-F*		2" x 10"	—
IV-F*		4" x 10"	—
I-N*			
IV-N*			

A 15-roll minimum is required by Kodak for 103-0, 103-F, IV-F, I-N, and IV-N films.

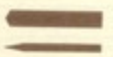
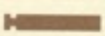
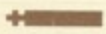
*Since the manufacturer recommends keeping these emulsions at temperatures under 13°C shipments are normally packaged with dry ice and sent via the fastest means on Tuesdays and Wednesdays. There is a $15 dry ice packaging charge.

**2" x 10" and 4" x 10" plates come 12 x 3 dz per case now. (Note that this is a change from 15 x 3 doz and 8 x 3 doz, respectively.)

PHOTOGRAPHIC CHEMICALS

D-19 DEVELOPER
KODAK FIXER
KODAK RAPID FIXER
INDICATOR STOP BATH

Spectroscopic Preformed Electrodes

	Diam	Description	ASTM No.	SPEX HPND+	SPEX HPHD#	NATIONAL AGKSP+	NATIONAL SPK#
				SAMPLE ELECTRODES			
				Necked Crater			
	1/4"	5/32" deep	S-12	**4000**	4000D	**L-3912**	L-3712
		3/16" deep	S-4	**4021**	4021D		
		3/16" deep		**4042**	4042D	**L-4018**	L-4218
	3/16"	3/16" deep	S-13	**4001**	4001D	**L-3903**	L-3703
		3/32" deep		**4004**	4004D	**L-3906**	L-3706
		3/16" deep	S-14	**4005**	4005D	**L-3909**	L-3709
		3/16" deep		**4029**	4029D	**L-4000**	L-4200
		3/32" deep		**4030**	4030D	**L-4006**	L-4206
	1/8"	1/8" deep		**4033**	4033D	**L-3905**	L-3706
				Crater			
	1/4"	3/16" deep	S-8	**4002**	4002D	**L-3900**	L-3700
		1/16" deep	S-5	**4016**	4016D	**L-3982**	L-3782
	1/8"	1/4" deep		**4020**	4020D	**L-3979**	L-3779
		0.059" deep		**4034**	4034D	**L-3975**	L-3775
				Rotating Disk			
	1/2"	1/8" thick	D-1	**4011**	4011D	**L-4075**	L-4275
		1/5" thick	D-2	**4027**	4027D	**L-4072**	L-4272
		1/5" thick	D-3	**4028**	4028D	**L-4081**	—
				Carrier Distillation			
	1/8"	1½" long pedestal	S-1	**4017**	4017D	**L-3919**	L-3719
				COUNTER ELECTRODES			
				Pointed			
	1/4"	120°	C-2	**4010**	4010D	**L-3966**	L-3766
	1/8"		C-1	**4019**	4019D	**L-4036**	L-4236
				Rounded			
	1/4"	1/16"r	C-5	**4041**	4041D	**L-3957**	L-3757
	3/16"	1/16"r		**4039**	4039D	**L-3951**	L-3751
		1/16"r, 2" long		**4040**	4040D	**L-3954**	L-3754
	1/8"	1/32"r		**4073**	4073D	**L-4037**	L-4237
				Flat			
	1/8"		C-6	**4071**	4071D	**L-3922**	L-3722
				Flat Neck			
	1/4"	1½" long	C-8	**4007**	4007D	**L-3960**	L-3760
				Undercut			
	1/4"	1½" long	C-7	**4008**	4008D	**L-3963**	L-3763

+HPND and AGKSP are 1.61g/ml density graphite.
#HPHD and SPK are 1.90g/ml density graphite; some prices vary, please confirm.
The **impurity content** of all items is guaranteed to be a **maximum of 6 ppm** for the total of all elements.
For any electrode or graphite product not listed here, please contact us. We shall happily quote on special orders and quantities.

GRAPHITE RODS-12" LONG

Diam	SPEX BRAND HPND+**	HPHD#**	NATIONAL BRAND AGKSP+**	SPK#**	SPEX REG	NAT'L REG
1/2"	**4084**					
5/16"	**4085**	4085D	**L-3812**	L-3832		
1/4"	**4086**	4086D	**L-3809**	L-3829	**4090**	**L-4309**
3/16"	**4087**	4087D	**L-3806**	L-3826	**4091**	**L-4306**
1/8"	**4088**	4088D	**L-3803**	L-3823	**4092**	**L-4303**

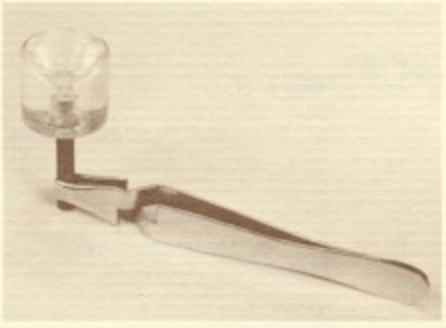
**Also available in 4" and 6" lengths upon request.

GRAPHITE POWDER

		SPEX	NAT'L
4061	≤100 mesh, for buffering	4061	SP-2x
4062	65-75% ≤200 mesh for briquetting	—	SP-1
4063	≤200 mesh for briquetting	4063	SP-1C
4064	≤200 mesh for buffering	4064	SP-2
4065	<1μm	4065	—

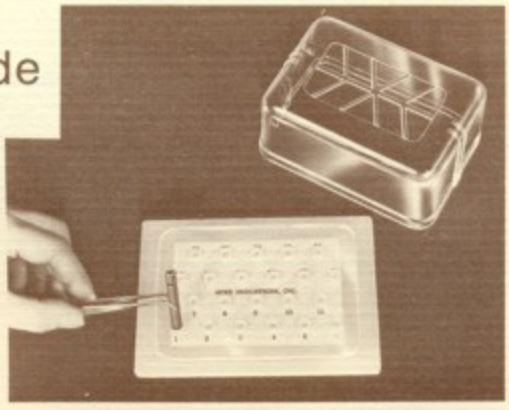
+HPND and AGKSP are 1.61g/ml density graphite.
#HPHD and SPK are 1.90g/ml density graphite; some prices vary, please confirm.
The **impurity content** of all items is guaranteed to be a **maximum of 6 ppm** for the total of all elements.
For any electrode or graphite product not listed here, please contact us. We shall happily quote on special orders and quantities.

Electrode Funnel & Tweezers



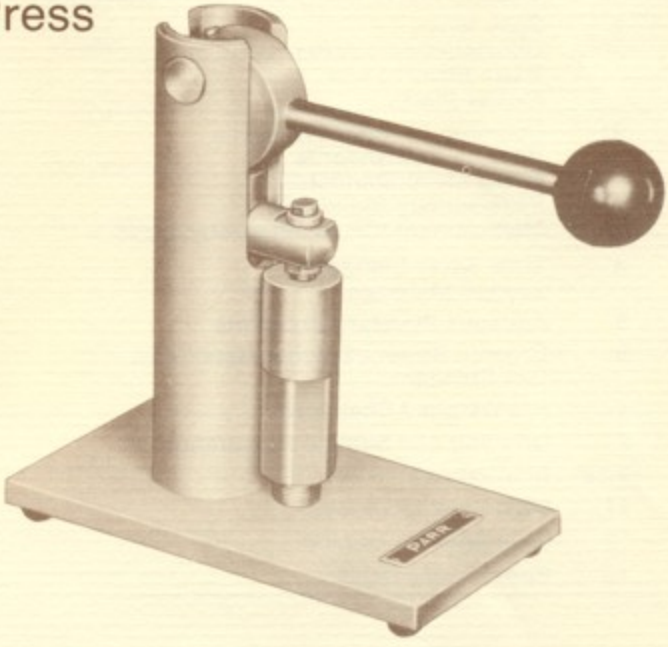
3001 FUNNEL for filling 1/4" electrodes
3002 FUNNEL for filling 3/16" electrodes
3003 FUNNEL for filling 1/8" electrodes
3503 TWEEZERS, stainless steel, for handling spectroscopic graphite electrodes

Plastic Electrode Stand



3051 PLASTIC ELECTRODE STAND for 1/4" electrodes
3052 PLASTIC ELECTRODE STAND for 3/16" electrodes
3053 PLASTIC ELECTRODE STAND for 1/8" electrodes

Parr Pellet Press



This hand-operated pellet press provides enough force against a small area to prepare, from powder, a suitable tablet for the cup of an electrode. The plunger and die set #3626 produces pellets the proper size for **4005**, **4029**, and **4030** preforms, while pellets from the #3627 die set fit **4002**, **4021**, and **4042** preforms.

3625 PELLET PRESS, hand-operated, without plunger and die; 23 x 13 x 25 cm; 8 kg
3626 PLUNGER & DIE for preparing 3.0-mm diam pellets; fill height of die 19 mm
3627 PLUNGER & DIE for preparing 3.8-mm diam pellets; fill height of die 19 mm

Ordering Information

Terms are net 30 days to rated firms. To avoid delays purchasers who have not transacted any previous business with Spex Industries should include commercial references or remittance with the initial order.

Shipments are FOB Metuchen, N.J. A minimum order of $25.00 is required.

Guarantee

Our products are guaranteed:

(1) to conform to the specifications of the most recent model of the item;
(2) against defects of workmanship and parts for one year from the date of the original shipment.

Although catalog information is as representative of the product as possible, we must reserve the right to make changes in specifications or prices and also to delete and add items.

Contents

Credits

Cover: Collection Fritz Ducommun
The Science Museum, London

SPEX INDUSTRIES, INC. • BOX 798, METUCHEN, N.J. 08840 • ☎ (201)-549-7144

Questionnaire for Test Grinding of Samples

(One, two, or three samples will be ground at no charge, and a report and recommendations will be returned within two weeks.)

Spex Grinder for Test: _____

Sample Composition: _____

_____

Quantity to be Ground or Mixed per Load: _____

Number of Samples per Day: _____

Purpose of Grinding:

emission spectrography _____ x-ray spectrography _____

extraction _____ other _____

Particle Size after Grinding: _____

If contamination (~0.1%) from any of the following is objectionable, specify which:

aluminum _____ cobalt _____

acrylic _____ iron _____

carbon _____ polystyrene _____

chromium _____ tungsten _____

Notes or Comments: _____

_____

_____

_____

For return of sample and report:

Name and Title: _____

Company Name: _____

Mailing Address: _____

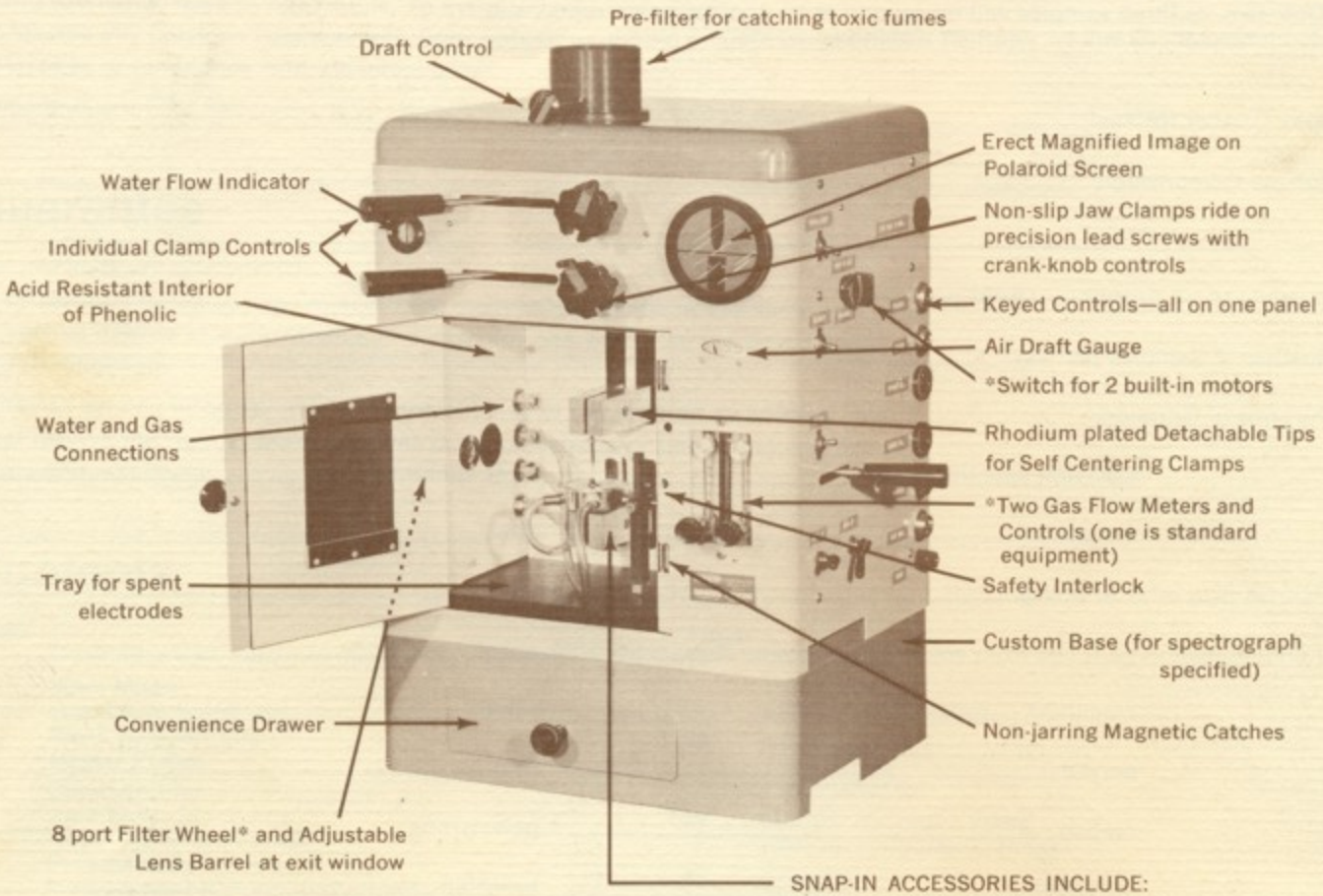
_____

Phone: _____

Date: _____

Mail to Spex Industries, Inc., P.O. Box 798, Metuchen, N.J. 08840.

Arc/Spark Stand



SNAP-IN ACCESSORIES INCLUDE:
*Stallwood Jet (shown) for cleaning up background and stabilizing arc
*Petrey Stand for point-to-plane work
*Atmosphere Chamber for Petrey Stand
*Combination Analyzer (Rotrode and Platrode)

*OPTIONAL ACCESSORIES

Ask for separate detailed Arc/Spark Stand catalog.

9010 Arc/Spark Stand, 115V, 50-60 Hz, includes Flowmeter and Water Cooling Connections, specify type of spectrograph and the direction light must emerge as operator views stand, 38 x 31 x 54 cm, 59 kg

9010A Adapter For B&L Spectrograph

All Others

SPEX INDUSTRIES, INC./P.O.BOX 798/METUCHEN, N. J. 08840/☎(201) 549-7144

AMBRIEX S.A.
Attn: Mr. Antonio C.O. de Barros
Rua Tupi 536, 01233
Sao Paulo, BRAZIL

INSTRUMENTALIA S.R.L.
J.E. Uriburu 1076
P.O.B. 7
Buenos Aires, ARGENTINA

SEISHIN TRADING CO. LTD.
43, Sannomiya-cho
1-chome, Ikuta-ku
Kobe, JAPAN

GLEN CRESTON
37 The Broadway
Stanmore, Middlesex
ENGLAND

LANDSEAS CORP.
King George St.
P.O. Box 23011
Tel Aviv, ISRAEL

SPEX INDUSTRIES GmbH
7 Stuttgart 40
Weikersheimer Str. 15
WEST GERMANY