PRODUCT DATA

QUANTACHROME CORPORATION

# QUANTASORB

SURFACE AREA ANALYZER

## QUANTASORB®

**EASY & RAPID MEASUREMENTS OF:**

1. Specific surface area
2. Average pore volume
3. Pore size distributions
4. Adsorption isotherms
5. Desorption isotherms
6. Average particle size (for non-porous powders)
7. True powder density
8. Permeametry

**APPLICATIONS:**

| | |
|---|---|
| CERAMICS | PHARMACEUTICALS |
| CATALYSTS | CARBON BLACKS |
| SILICA, ALUMINA, ETC. | COSMETICS |
| DESICCANTS | CEMENT |
| ION EXCHANGE RESINS | FILLERS |
| ABRASIVES | FERTILIZERS |
| POWDERED METALS | ATOMIC ENERGY |
| AIR POLLUTION | POWDERED FOOD |

For research and quality control

**THE QUANTASORB®** is more than just an instrument. It is a powder characterization system. Dependable, rugged, extremely rapid and versatile.

*Pat. #3555912 and other patents granted.

## PRINCIPLE OF OPERATION

Mixtures of helium and nitrogen gas are passed through a small U-shaped cell containing the sample. At liquid nitrogen temperature, helium will not adsorb on any surface while nitrogen will physically adsorb on all substances. The amount of nitrogen adsorbed at various partial pressures can then be used to calculate the sample's surface area and pore structure.

Adsorption and desorption occur when the sample is immersed into and then withdrawn from a liquid nitrogen filled Dewar flask. Changes in the ratio of He to $N_2$ in the flowing stream, due to adsorption and desorption, are sensed by a specially designed thermal conductivity detector. The signals delivered by the detector are nearly Gaussian in shape. The instantaneous signal height is proportional to the rate of adsorption or desorption and the total integrated area under the curve is proportional to the quantity of gas adsorbed.

## ADVANTAGES OF THE QUANTASORB®

SPEED — Unlike classical vacuum sorption systems which require extensive time to equilibrate, the QUANTASORB drives toward rapid equilibrium by constantly bringing a fresh supply of adsorbate gas to the sample. In this manner data acquisition for a 3-point B.E.T. determination (more points are rarely necessary) generally takes approximately 30 minutes. Single point B.E.T. analysis can be completed in about 10 minutes.

Because of the QUANTASORB'S great sensitivity less than one gram of sample is used. This small sample requirement greatly decreases the time necessary for sample outgassing.

VERSATILITY — The QUANTASORB is not restricted to only nitrogen as the adsorbate. For example, butane, adsorbed at O°C and desorbed above 150°C, often gives results comparable to nitrogen adsorption.

The concentration of $N_2$ in He can be controlled, accurately and reproducibly, by using the high precision 15 cm flow meters. The flow meters are operated under adjustable input pressures in order to extend their range. Input pressures are indicated by a precision pressure gauge. Equal flow readings at the same input pressure will always guarantee correct and reproducible $N_2$ to He ratios.

For very rapid operation, pre-mixed gases are convenient. The QUANTASORB contains a multi-port gas selector valve which enables the user to simply "dial in" the concentration required.

EASE OF USE — Sample cells, simple to fill and easy to clean, are installed in self-sealing "Quick-Connect" fittings. The "Quick-Connect" fittings automatically snap closed when the sample cell is disconnected from the QUANTASORB. This enables samples to be transferred from the outgassing station to the test station with no contamination. A large thermocouple gauge on the front panel indicates the outgassing temperature.

The operation of the QUANTASORB is less complex than a simple hot wire gas chromatograph. An operator can learn to operate the QUANTASORB to peak performance in only a few minutes. All operating controls are readily accessible and ease of manipulation is truly outstanding.

A built-in digital integrator automatically integrates the signals as they are generated. The integrator provides the data which, when used with the QUANTASORB data sheets, guides the user through rapid and simple calcuations for both multi- and single-point B.E.T. calculations.

Because the QUANTASORB is a continuous flow instrument **NO CORRECTIONS ARE REQUIRED FOR THE SAMPLE CELL VOID VOLUME.** The detector senses only the change in concentration due to adsorption.

## ACCURACY and PRECISION

On clean surfaces, reproducibility is consistently within 1.0% regardless of the sample's specific area.

Although there exists no sample whose surface area is known absolutely, the QUANTASORB matches results obtained by other sorption instruments in all cases to within 3% and 92% of all samples to within 2%. These results were compiled on hundreds of samples over a period of years.

## ACCESSORIES SUPPLIED

1. 30 ft. of ⅛" copper tubing (5-6ft. lengths) with "Quick-Connect" attachments.
2. Two Dewar Flasks, Flask Clamps and Clamp Holders.
3. Four sample cells including one cell for ultra-low area measurements.
4. Two cell holder assemblies.
5. Heating mantle and clamp.
6. Bubble meter for flow calibration.
7. Three precision gas syringes.
8. Spare o-rings and septums.

## SPECIAL FEATURES

COMPACT — The QUANTASORB is smaller and lighter than any comparable instrument.

RELIABILITY — All measurements are made at atmospheric (ambient) pressure thereby avoiding costly repairs and down time due to high pressure or vacuum leaks.

Each data point is independently determined thereby avoiding the possibility of cumulative errors.

Adsorption and desorption signals, nearly Gaussian, can be height attenuated and width broadened by proportioning the gas flow through the sample cell and its by-pass. Thus, signals which normally would have to be attenuated electronically with subsequent loss of signal area can be increased in width and decreased in amplitude with no loss in area under the signal curve.

**STANDARD ACCESSORIES** — The built-in electronic integrator will accept external signals of 1, 3, 10 and 100 mv as well as 1, 3 and 10 V. A switch on the back panel indicates internal and external input signals.

A saturated vapor pressure gauge is a standard feature of the QUANTASORB for simple and accurate saturated vapor pressure measurements when highly precise B.E.T. determinations are needed.

An outgassing station with the thermocouple and temperature gauge for proper sample conditioning is a standard feature of the QUANTASORB. Proper sample conditioning is important for accurate surface area measurement.

The required sample size varies with the sample's specific surface area and density. Generally for high surface area materials such as carbon black or alumina, 0.01-0.1 gram will suffice. Surface areas in the order of one square meter per gram will require the use of approximately one gram of sample. The volume of the standard sample cell is about 2.5 cc. A special cell is provided for ultra-low (0-2000 $cm^2$) surface area measurements.

For construction of entire isotherms "Quick-Connect" fittings permit rapid interchange of five gas input lines.

High purity gases are commonly available. However, a cold trap is provided to guarantee gas purity.

Calibration of signals is achieved by injecting known volumes of adsorbate into the flow stream. Precision gas sampling syringes are supplied with the QUANTASORB insuring rapid and precise calibration of each data point.

## OPTIONAL ACCESSORIES

1. Pycnometer Cell for true powder density measurements.
2. Quantector — multiple outgassing station.
3. Strip-Chart Recorder, 1 mv full scale.

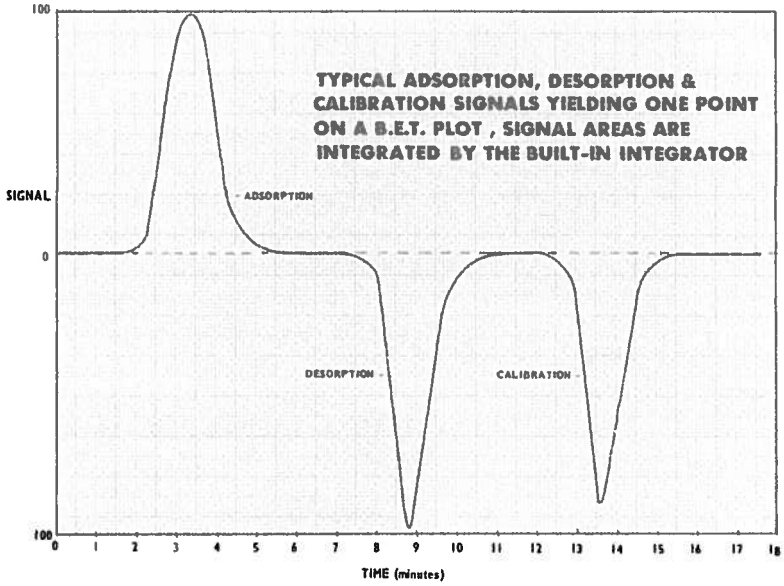
## REQUIRED ACCESSORIES

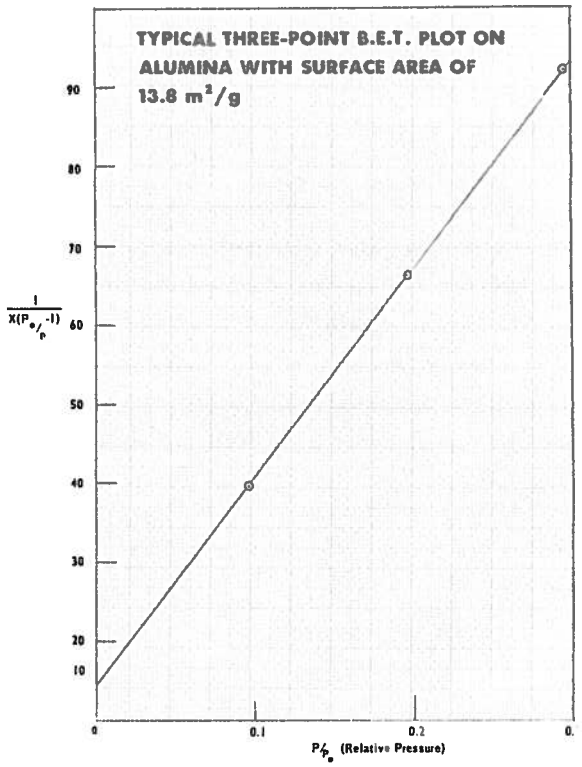
1. Helium and Nitrogen or pre-mixed gases with regulators.
2. Liquid nitrogen or other coolant depending on the adsorbate used.

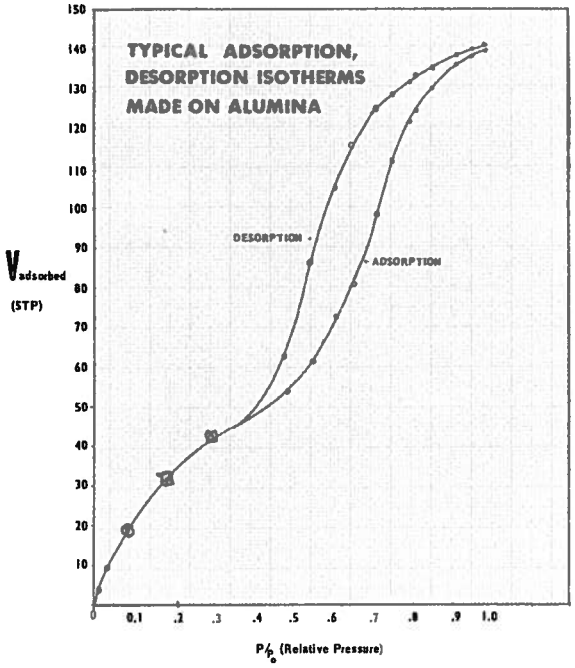
## SPECIFICATIONS

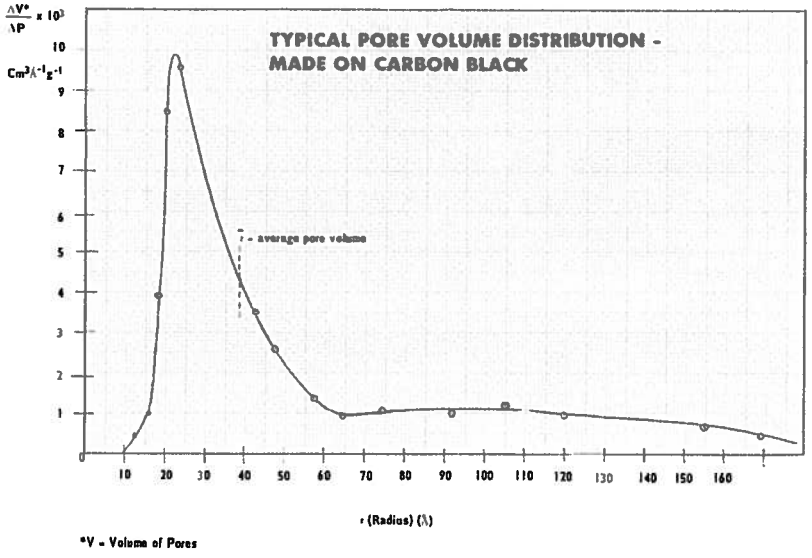
Power — 110 - 120 VAC, 60 Hz.
Size — 22" x 14" x 22"
Weight — 48 lbs.

# TYPICAL DATA OBTAINED WITH THE QUANTASORB®

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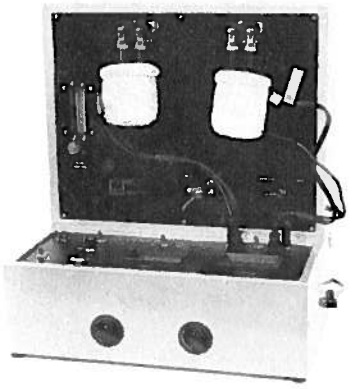
PRODUCT DATA

# MONOTECTOR

DUAL
OUTGASSING
STATION

- COMPATIBILITY — The MONOTECTOR is designed to be compatible with the MONOSORB Surface Area Analyzer. Samples outgassed on the MONOTECTOR are transferred to the MONOSORB rapidly, with ease and without sample contamination. Thereby, maximum advantage can be taken of the MONOSORB'S extreme speed by having two additional outgassing stations. The MONOTECTOR eliminates the waiting period between the completion of an analysis and the preparation of a subsequent sample.



- OPERATION — The MONOTECTOR uses the same flow method that is employed in the MONOSORB for the detection of contaminants. A flow of carrier gas (usually Helium) of only 10-20 cc/min. purges two sample cells simultaneously. By means of a simple valve arrangement the flow through one sample cell is directed to a hot wire detector while the other is vented. A clean reference flow is used to compare the signals coming from the sample cells. When the samples are thoroughly outgassed, the signal from a sample cell will be identical to that from the reference flow.

- HEATING — Samples may be heated to 400°C using the heating mantles provided with the MONOTECTOR. Temperature control is established with two 110V variable transformers and the temperatures are indicated on the front panel thermocouple gauge. Because of the small sample weights required by the MONOSORB, outgassing of samples on the MONOTECTOR is usually completed rapidly; enabling studies to be made on the optimum outgassing conditions as well as the effects of outgassing conditions on surface area.

- SENSITIVITY — The Sensitivity limit of the MONOTECTOR exceeds that of the MONOSORB. Therefore, samples can be outgassed beyond the limits of impurity detection during absorption studies. Two sensitivity positions (1X and 10X) enable a wide range of impurity concentrations to be monitored. In addition, the MONOTECTOR'S sensitivity can be greatly increased, if necessary, with simple internal adjustments.

- RESPONSE — At nominal flow rates, the response time is about ten seconds. No time is wasted and there is no guessing about when a sample is properly outgassed.

- SPECIFICATIONS

Electrical: 110V 60 Hz
Weight: 30 lbs. (16 kg)
Height: 21" (53 cm)
Width: 21" (53 cm)
Length: 14" (36 cm)

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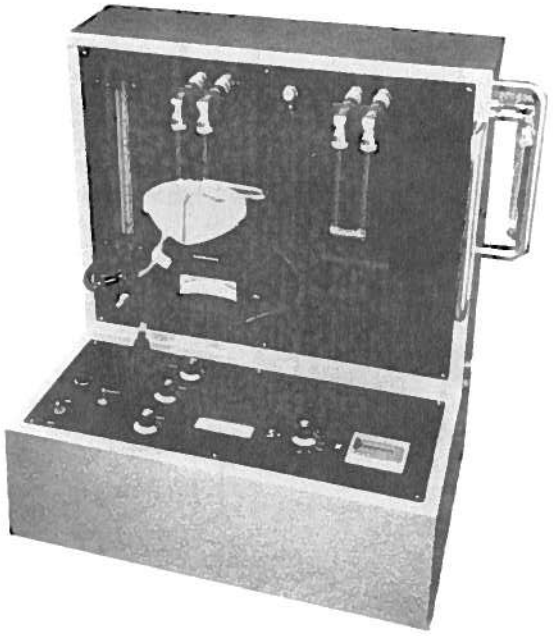
MONOSORB
DIRECT READING
SURFACE AREA
ANALYZER

# MONOSORB

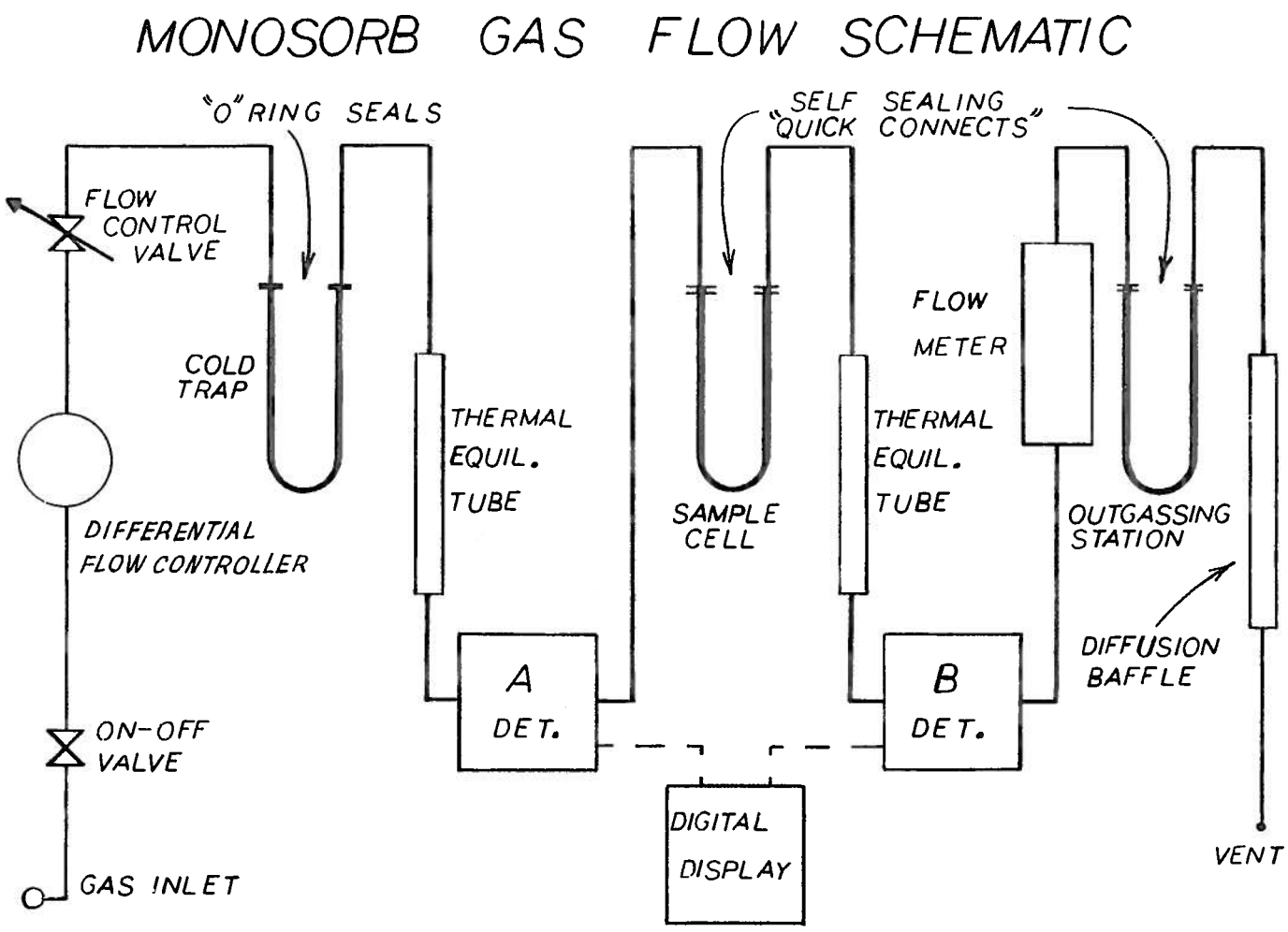
A low cost quality control and research instrument for **Rapid, Accurate** and **Automatic** Powder Surface Area Measurements.



- **DIRECT DIGITAL** Presentation of Surface Area.
- **DYNAMIC FLOW METHOD.** Complete measurement in less than 10 minutes.
- **MEASURES** from 0.1$m^2/g$ to no known upper limit.
- **ALL METAL** construction.
- **SELF-CONTAINED** outgassing station.
- **NO DEAD VOLUME** corrections are necessary.
- **SAMPLE CELLS** are simple U-tubes. Easy to fill, easy to clean.
- **LESS THAN** 1 gram of sample is usually adequate.
- **OPERATES from** one tank of premixed gas which will last for years.

## OPERATION

The basic flow diagram is shown in the schematic below.




Samples are outgassed using the outgassing station built into the MONOSORB. Outgassing is accomplished by heating with flowing gas as a purge. A thermocouple gauge and temperature regulator are both on the front panel. When the sample is transferred to the measuring station automatic sealing "Quick Connect" couplings prevent contamination. A Dewar flask, filled with liquid nitrogen (or other coolant) is raised to cover the cell. In two to three minutes adsorption is complete, the bath is lowered and the desorption signal is monitored. This signal is automatically displayed as the sample Surface Area on the digital integrator. The MONOSORB is then ready for the next sample to be transferred from the outgassing station and measured.

The change in the concentration of the flowing mixture due to desorption is monitored on a thermal conductivity bridge. The bridge compares the thermal conductivity of the flowing gas before and after the sample cell. During the desorption process the "B" detector (see diagram) detects a richer nitrogen concentration than the "A" detector. The area under the signal-time curve is automatically integrated and presented as the sample surface area. Flow rates through the MONOSORB are less than 15cc/min. A standard laboratory tank (280 Cu.Ft.) lasts for years.

## THE STATE OF THE ART

The MONOSORB utilizes the most modern and reliable method for extremely rapid and accurate B.E.T. surface area measurements. The MONOSORB uses a small continuous flow of gas which drives the system to rapid equilibration without the lengthy time delay associated with competitive instruments. The dynamic flow method requires no vacuum equipment and in fact, has no moving parts, except for the digital display. The dynamic flow technique does not require dead volume measurements and several complete area determinations can be made on the MONOSORB before the dead volume measurement can be completed, on one sample, by other methods. The MONOSORB's high sensitivity allows the use of samples weighing less than one gram. This saves further time when outgassing the powder.

The MONOSORB utilizes the modified B.E.T. equation for single point determinations. Unlike other one point techniques the MONOSORB permits the user to choose the correct concentration of adsorbate to give results identical to the multipoint method. Also, unlike other techniques, the MONOSORB can be used with many different adsorbates.

Sample cells are U-tubes — easy to fill and clean. Only one size sample cell is required.

## CALIBRATION

An efficent and rapid means of maintaining the calibration of the MONOSORB is an integral part of its design. This means that years after its purchase the user will obtain data as reliable as that from a new instrument.

## ACCURACY AND REPRODUCIBILITY

Reproductibility of the MONOSORB is better than 0.5%. The MONOSORB'S accuracy is limited by the applicability of the one point method which is usually better than 5% and often errors less than 1-2% are found. A means of correcting even these small errors are discussed in the MONOSORB Instruction Manual.

## SPEED

The Monosorb requires approximately seven minutes to complete an analysis. This extreme speed, with high accuracy and reproducibility, makes the Monosorb a powerful quality control and research instrument.

## SIMPLICITY

The Monosorb is simpler to operate than any other competitive instrument. Unskilled personnel can operate the Monosorb in a matter of minutes.

## ACCESSORIES

One tank of premixed gas 0.3 mole fraction nitrogen in helium and pressure regulator. All other hardware required for operation is supplied.

## SPECIFICATIONS

Height: 21"
Width: 18"
Depth: 14"
Weight: 35 lbs. (Portable)
Power: 115V 60 Hz

## APPLICATIONS:

CERAMICS
CATALYSTS
SILICA, ALUMINA, ETC.
DESICCANTS
ION EXCHANGE RESINS
ABRASIVES
POWDERED METALS
AIR POLLUTION
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