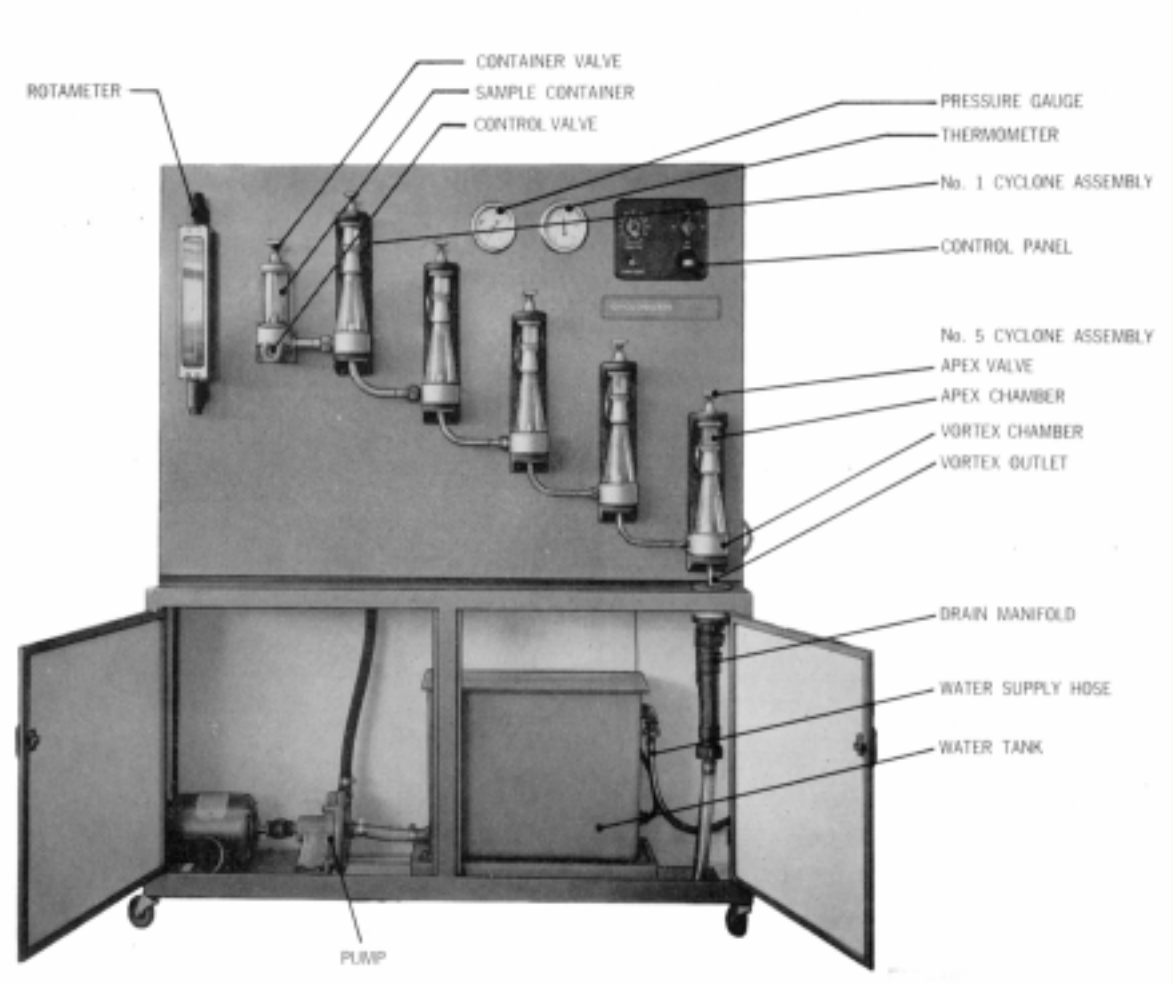
CYCLOSIZER

For Sub-Sieve Sizing



Sepor

SEPOR INC
718 N. FRIES AVE
P.O.BOX 578
WILMINGTON, CA 90748
PHONE: 310-830-6601
FAX : 310-830-9336

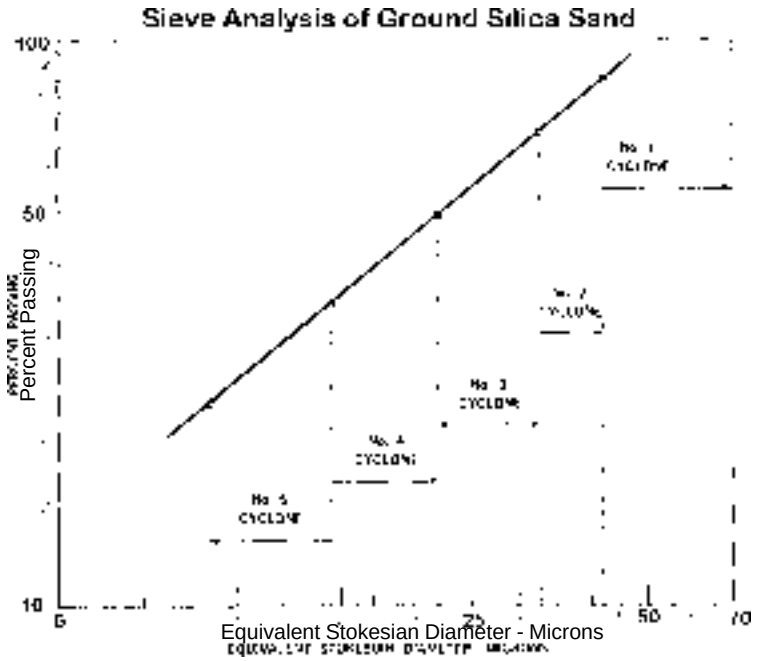
INTRODUCTION

The Cyclosizer is a laboratory precision apparatus for the rapid and accurate determination of particle size distribution within the sub-sieve range.
Particles are separated according to their Stokesian settling characteristics by a principle based on the well known hydraulic cyclone principle. The effective separating range is 50 to 8 microns for material of a specific gravity similar to quartz (SG 2.7), but the lower limit may extend down to 4 microns for particles of high specific gravity (for example - Galena with its SG of 7.5). Samples of up to 100 grams of minus 200 mesh or minus 325 mesh material may be separated into five fractions. The time required for an effective separation can range from 10 minutes to as long as 30 minutes. Extra time is required for dewatering and drying and weighing the separate fractions.

The apparatus consists of five 3 inch diameter cyclones and ancillary equipment all mounted on a console cabinet with all necessary controls and gauges. The unit is shipped completely assembled and ready for use. It required as service items, single phase power, clean water at 9 to 14 liters per minute and a floor drainage point.

Size Analysis of Ground Silica Sand

After 30 Minutes Elutriation



APPLICATIONS

Most particles that have a specific gravity higher than 1.4, are insoluble in water and are naturally non-coherent, and can be rapidly sized in the sub-sieve range with the Cyclosizer. The apparatus has application in many process industries associated with finely sized materials. For example:

Ore and Coal Processing
Ceramic Processing
Manufacturing of Filters, Pigments and Abrasives
Fertilizer and Chemical Manufacturing
Cement Manufacture
Power Generation

The speed, precision and reproducibility of determinations with the Cyclosizer are such that it can readily be applied to the fields of Laboratory Testing; Plant Process Control and Research.
Materials such as pyrite, chalcopyrite, galena, sphalerite, cassiterite, iron ores, gold ores, tailings classification, flotation circuits, silica filters, whiting, clays and soils, prepared chemicals such as alumina, lead sulphate, lead oxide, zinc dust, zinc oxide, silicon carbide, pulverized coal, flyash, magnetite and ferrosilicon, have all been successfully classified using the Cyclosizer.
The Cyclosizer has a particular application in the mining and associated mineral process industries for the study and control of classification circuits using equipment based on Stokes' law. Also, in the related field of liberation studies, the Cyclosizer will prepare closely sized fractions in sufficient quantity for chemical analyses, mineralogical assessment and microscopic examination.

Limiting Particle Sizes

Typical values of the limiting particle sizes for each cyclone at different levels of particle specific gravity.

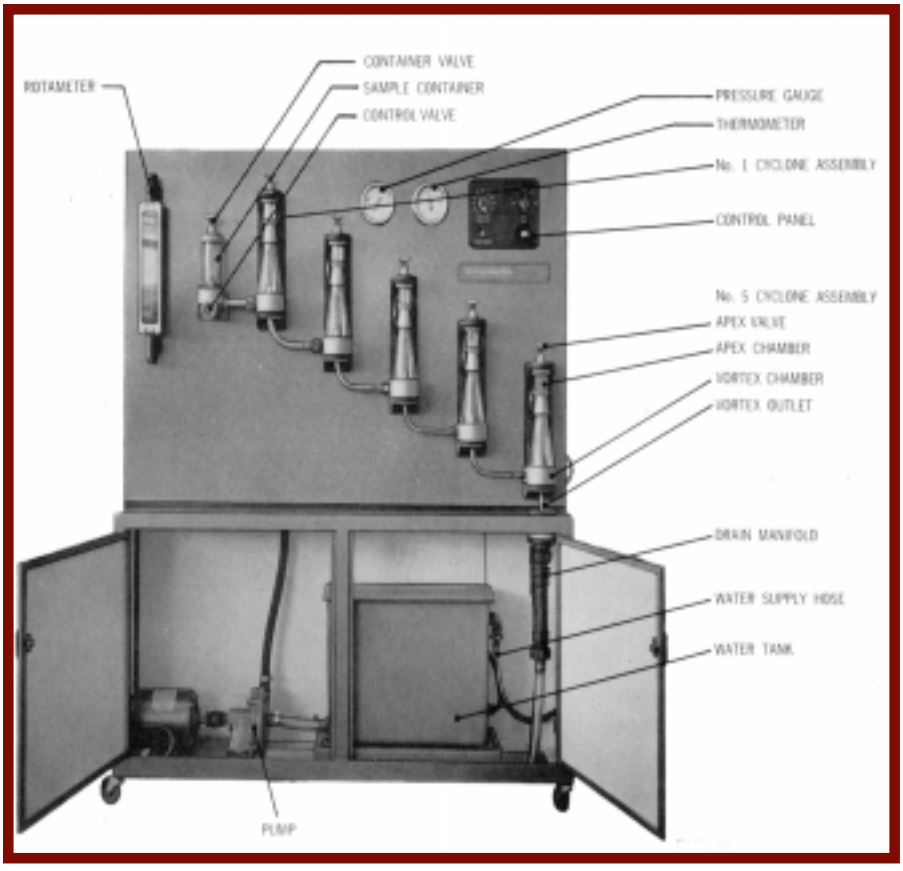
Cyclone No.	Equivalent Stokesian Dia. (Microns) Quarts	Equivalent Stokesian Dia. (Microns) Pyrite	Equivalent Stokesian Dia. (Microns) Galena
1	44	27	22
2	35	22	18
3	23	14	11
4	15	9	8

DESCRIPTION

The five cyclones which form the basis of the Cyclosizer are arranged in series such that the overflow of one unit is the feed for the next in line. The individual units are in the "upside down" position with reference to conventional arrangements and at the apex of each chamber. Water is pumped through the five units at a specified rate (as indicated on a rotometer) and a sample of solids is introduced from a separate container into the stream ahead of the cyclones. The introduction of the sample is spread over five minutes.

In passing through the cyclones, the solids are distributed to the five cyclones in accordance with their Stokesian sizing. The initial distribution is only approximate with each apex chamber containing an excess of undersize material. With continued flow of water after the initial distribution, particles smaller than a "limiting size" for each cyclone are gradually elutriated to the overflow. Each cyclone is thus analogous to a sieve in which the aperture is dependent on flowrate and the Stokes' Law variables, i.e. the liquid viscosity and the specific gravity differential between solid and liquid. Typical values of the limiting sizes for each cyclone are shown in the table on the preceding page. (Limiting Particle Sizes)

The precision of separation improves with increase in elutriation time, but 10 minutes' elutriation is often quite adequate and it is rarely necessary to exceed 30 minutes. When the allotted elutriation time has elapsed, the sized fractions are collected by discharging the contents of each apex chamber into separate beakers. The solids are settled, decanted (or filtered) and dried and weighed to determine the size distribution. Solids passing the No. 5 cyclone are determined by difference.



OPERATION

Complete details of the operating procedure for the Cyclosizer are given in the Operating manual, which is supplied with the unit. The following example outlines the general procedure but, depending on the ultimate purpose of the analysis, a more or less detailed approach may be desired.

1. Weigh out the sample, slurry with water and transfer to the sample container.

2. Fit sample container on panel, start pump and pass water through the Cyclosizer to expel air.

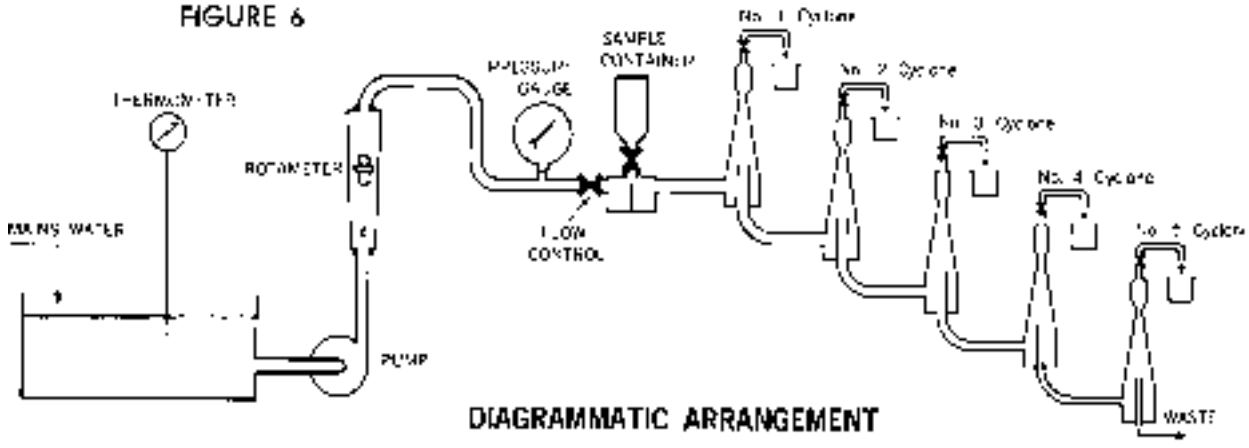
3. Set water flow at 25% greater than the pre-determined separation flowrate, open port on sample container and obtain a preliminary distribution of solids to the cyclones (five minutes).

4. Reduce flowrate to the pre-determined value and elutriate for 10 to 30 minutes, depending on precision required.

5. When elutriating is complete, increase the flowrate and discharge the solids of each apex chamber in turn through the apex valve. Collect the discharged solids in separate beakers.

6. Filter, dry and weigh each fraction and calculate solids passing No. 5 cyclone by difference.

FIGURE 6



DIAGRAMMATIC ARRANGEMENT

PRINCIPLE OF SEPARATION

The principle of the Cyclosizer is based on a conventional hydraulic operation in which the apex discharge solids are repulped with water and repassed through the same cyclone many timed at the same liquid flowrate. By this process, the slower settling rate particles are gradually eliminated through the overflow until as the number of passes approaches infinity, no more particles are removed in the overflow and all the particles which remain in the final apex discharge are found to have settling rates equal to or greater than that of a well defined "limiting size".

For homogenous particles, this "limiting size" depends on the usual cyclone variables, i.e., liquid flowrate, feed inlet diameter and vortex finder diameter. For a fixed flowrate, decrease in either or both of these diameters results in a smaller "limiting size".

In the Cyclosizer, the principle of repassing the apex discharge is achieved by the closed apex chamber and the "upside down" mounting. Particles fed into this system respond in the usual manner with the larger moving towards the conical wall and upwards, with a portion of the water, to the apex chamber. The solids then tend to be carried back by the water flow into the conical portion of the cyclone, where they are re-centrifuged and given a further opportunity of leaving via the vortex finder.

Particles less than the limiting size for each unit tend to remain with the water flow, leaving the cyclone through the vortex finder. After the preliminary distribution of particles throughout the five units, the approach to ideal separation increases with time of elutriation..

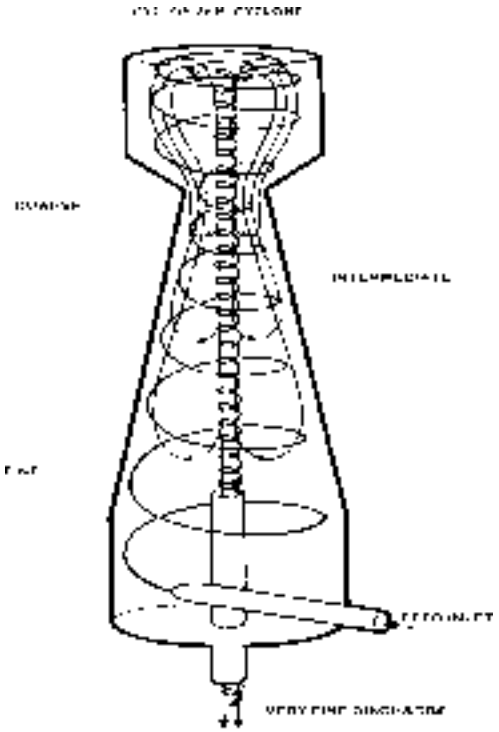
The different values for the limiting sizes for successive cyclones, which have the same total flowrate because of the series arrangement, are achieved by decreasing both inlet and vortex finder diameters. This develops a progressively greater centrifugal force for each successive stage.

SPECIFICATIONS

The Cyclones have glass bodies with machined brass vortex and apex fittings finished in baked enamel. Interconnecting tubing in brass, cyclone support brackets finished in baked enamel. The Rotameters are Brooks Rotameter with metric scale and brass fittings. The Pump is a Warman mechanically sealed water pump with wet end parts in brass, stainless steel shaft and single phase motor. The pump is fed from a fiberglass feed tank fitted with a ball float valve. A pressure gauge is fitted to the pump discharge line and a temperature gauge shows the temperature of water in the feed tank. The Cabinet is a sheet metal cabinet finished inside in white enamel and outside in green enamel. Doors in the front of the cabinet allow access to the feed tank and pump. The cabinet is mounted on castors. The Electrical Controls are configured in a panel comprising a pump switch and indicating light, process timer (0-60 minutes) with alarm buzzer. The Cyclosizer is supplied to operate from a 230V/1 Ph/50 or 60 Hz AC electrical supply. Other electrical requirements may be accommodated upon request.

Shipping Data:

Length: 65 In.162.6 cm) Width: 19 In. (48.3 cm)
Height: 73 In. (185.4 cm)
Net Weight: 601 lbs. (273 Kg) Gross Weight: 850 lbs. (386 Kg)
1.45 Cubic meters Packed



Flow Diagram In Cyclone