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# All-Glass Sorption Vacuum Trap

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THE cold trap and the sorption trap[1] are the two most often used means to secure ultrahigh vacuum of the order of $10^{-10}$ to $10^{-11}$ Torr. When using mercury pumps, the cold trap is essential. Due to cost, liquid nitrogen handling problems, icing, and re-evaporation conditions, the sorption trap is replacing the cold trap today, especially in small vacuum systems. Sorption traps have an extremely large adsorbing area compressed into a very small space and provide efficient trapping for most gases, as well as for the hydrocarbon molecules from present day pump fluids.

One disadvantage of the sorption trap is the dust associated with the adsorbents used. This dust can find its way into a system causing impurity problems or possibly damage to valve seats in expensive ultrahigh vacuum valves. This is particularly true if a system is inadvertently broken during operation.

A trap entirely of glass was designed to overcome the dust problem and was found to offer some other advantages as well. The glass used as the trapping agent is a commercially available, 96% silica, porous glass available in many sizes and shapes.[2] It has about 28% void space by volume with average pore diameters of 40 Å and an internal surface area of 200 sq m/g. The sorbent area is on the order of $\frac{1}{3}$–$\frac{1}{4}$ the area, per unit weight, of alumina or zeolite. The trap was made from five 3-mm-thick, 5-cm-diam disks. The disks were supported within Pyrex tubing (as illustrated) by paddling the tubing to surround the disk edges and to space them approximately 12.7 mm apart. A V slot, having an area equivalent to the cross section of a 16-mm tube, was cut into each disk. The slots were staggered to provide an optically dense bafflle through the trap.

Some cracking of the disks was encountered during the construction due to the strains set up in grinding the V slots. It is recommended that a flat be ground on the edge of the disk instead of the V slot to reduce this possibility.

The trap was tested using a two-stage, air-cooled, glass diffusion pump with one of the new low vapor pressure silicone pump fluids, although considerable relative improvement would be expected with any pump fluid. No cooled baffle was used. After baking at 400°C for 15 h, a pressure of $2\times10^{-10}$ Torr was obtained as read with an ordinary Bayard-Alpert gauge; this is considered the limit of the gauge capability. The pressure remained at the $2\times10^{-10}$ reading for more than 500 h, at which time the test was discontinued. The trap was replaced with a blank line section of similar external configuration. After a 15-h bakeout at 400°C, a pressure of $1\times10^{-9}$ Torr was obtained. This pressure began to rise immediately, reaching $2\times10^{-8}$ Torr in one day and remaining there. Baking restored the $1\times10^{-9}$ Torr pressure temporarily. Thus the improvement realized from the sorption trap was at least a factor of 100 or comparable to that of a zeolite or alumina trap.

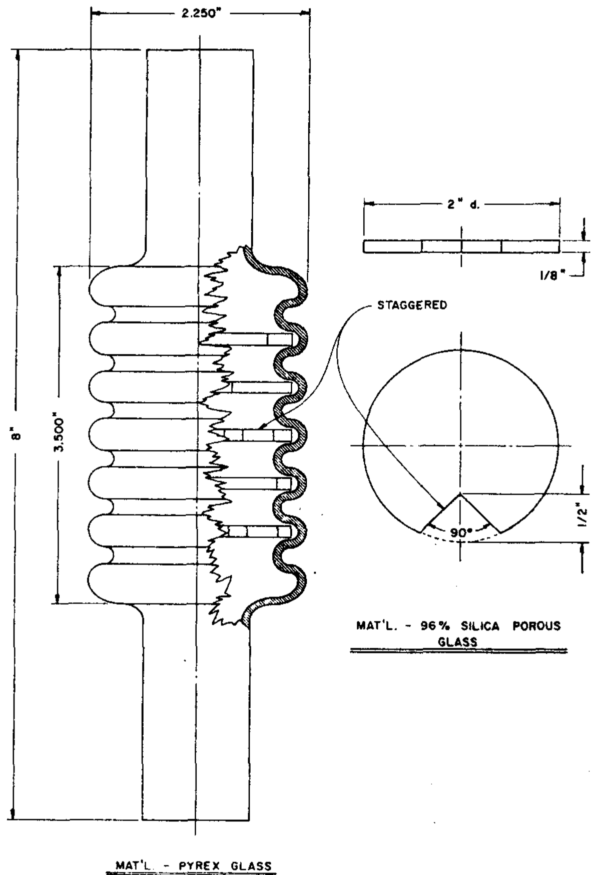


Fig. 1. All-glass sorption vacuum trap.

These traps are easily and inexpensively constructed and are particularly suited to glass systems. They are readily baked to 450°C and offer the advantage of mounting in any position. The trapping medium is held in place, and should the system break elsewhere, problems are not compounded by the trapping medium being blown into the rest of the system.

[1] Andrew Guthrie, *Vacuum Technology* (John Wiley & Sons, Inc., New York 1963), Chap. 8, pp. 249–252; Chap. 11, pp. 322–349; Bibl., pp. 520–521.

[2] Corning type 7930 porous glass was used,

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