PRESSURE DIFFERENTIAL GATE VALVE*

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A tandem acceleration extended stationary arc duoplasmatron used for 1 pulse/s H^- injection into the Argonne National Laboratory booster is undergoing further development for 30 Hz operation. The H^- current is obtained from an H^+ beam by charge exchange in hydrogen.

Pumping of the hydrogen target gas is accomplished by gettering on the ≃ 3, 000 in^2 interior surface of a stainless steel sublimation chamber. Deposition of titanium on the gettering surfaces is obtained from an Ultek Model 214-5000 bulk titanium sublimator.

Developmental changes and necessary repairs to H^- source in the past have necessitated letup of the sublimation vessel to atmosphere. Besides saturating the active gettering surfaces with such letups, any peeling or cracked titanium films become gas traps, and all surfaces absorb moisture, even when exposed for a short period to the surrounding environment. Since the most satisfactory operation is obtained by preconditioning the vessel down to ultimates of 2 to 3 x 10^{-8} Torr, letup to atmosphere, even with dry nitrogen, does cut deeply into valuable operating time. Installation of a commercially available valve was impractical since a valve thickness > 1 1/8 in would affect existing beam geometry.

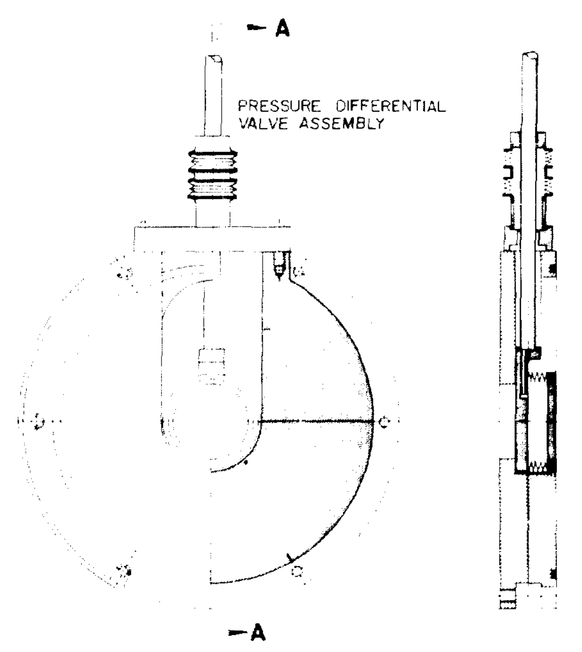
The solution was the design and fabrication of a 1 1/2 in gate valve with its thickness held to 1 1/8 in. The valve gate consists of two disks separated by a short length of bellows. One disk, moving with the expansion and contraction of the bellows, contains the gasket in its outer face. The other disk contains a leak path from its edge to the interior of the bellows. The shaft is welded to the disk containing the leak path and exposes the leak path, through its hollow center, to the exterior of the valve housing. Evacuation of the bellows through the center of the shaft permits linear motion of the valve, by manual push or pull, to closed or open position. Letup of the bellows' interior to atmosphere holds the valve gate in the position it was placed manually. (See diagram below.)

The valve thickness was minimized by using the vessel's outer surface as the sealing surface. A slot in the valve housing accommodates movement of the gate to open or closed position. It is conceivable that without any increase in thickness, this valve can be built to effectively seal a 3 in port. With no more than a 5/8 in increase in thickness (1 3/4 in total), 6 to 8 in valves can be successfully built. Since the shaft is sealed by bellows, more freedom of the shaft is permitted and therefore sealing can be accomplished in both directions, if so desired. For this type of operation, however, a separate pumpout for the valve housing is necessary.

In the smaller size valve, atmospheric pressure in the interior of the bellows may not be sufficient to completely compress the gasket for a vacuum-tight seal. Pressurization from a gas cylinder to 2 or 3 atmospheres is permissible if the proper bellows is selected when the valve is fabricated.

Summary

A 1 1/2 in isolation gate valve was designed and built to prevent vacuum vessel letup to atmosphere in the event of ion source component failure. To assure no effect on existing beam geometry, the valve thickness was held to 1 1/8 in. The valve gate consists of two disks separated by a short length of bellows. One disk, moving with the expansion and contraction of the bellows, contains the gasket in its outer face. The other disk contains a leak path from its edge to the interior of the bellows. The shaft is welded to the disk containing the leak path and exposes the leak path, through its hollow center, to the exterior of the valve housing. Evacuation of the bellows through the center of the shaft permits linear motion of the valve, by manual push or pull, to closed or open position. Letup of the bellows' interior to atmosphere holds the valve gate in the position it was placed manually.



SECTION A-A
FULL SECTION

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