



TECHNOLOGY NOTE

V10 FAST ACTING VALVE

This piece of equipment is a vacuum valve with very fast closing time (18 milliseconds). The closing time is of more importance than the sealing efficiency between the high and low pressure regions (average leak rate = $1 \text{ T}\cdot\ell/\text{sec}$).

Function

This valve has been designed to protect the ISR against shock waves produced by inadvertant air inrush. Certain chambers in the ISR are extremely fragile and susceptible to sudden rupture because of their thin wall construction - a necessary requirement for physicists looking for secondary particles. The Fast Acting Valves are therefore employed to protect other delicate equipment installed inside the vacuum system of the ISR against shock waves produced by rupture of the thin chamber walls. A complex system for detection and operation closes the fast acting valves in the case of accident and subsequently closes the neighbouring Sector Valves, the latter having a slower closing speed, but being completely leak tight eventually isolate the affected part of the ISR from its neighbouring vacuum section.

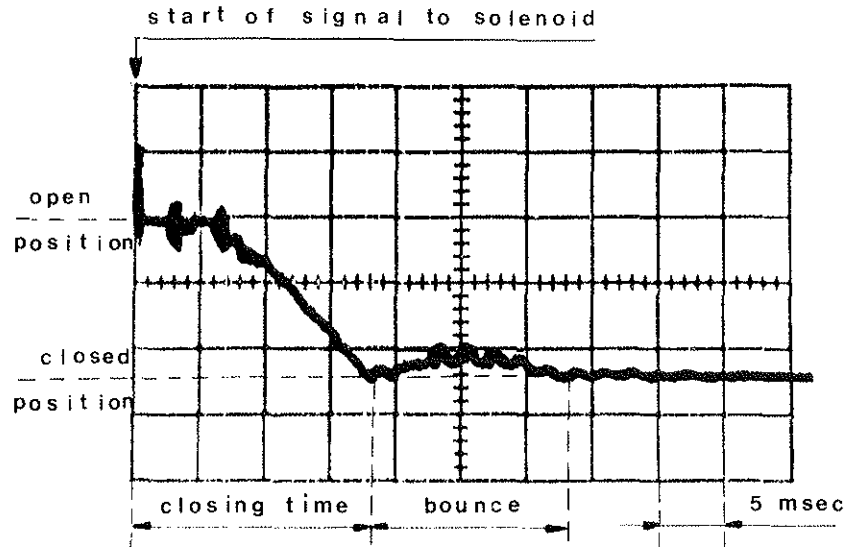
Operation

An oblong gate (1) is supported by two axes pivoted above the centre-line of the proton beam. Two spiral springs (3) hold the gate against the seat (2) when the valve is closed. Opening of the valve is effected by a crank system (4) powered by an electric motor. This in turn operates a lever (5) which retracts the gate from its closed position, and by rotating it through approximately 90° hooks it onto a "latch" (7). The lever now disengages from the gate and the valve is ready for operation.

Closure of the valve is brought about by the operation of the electro-magnet (9) upon receipt of an electrical pulse from the detection system. Pushed through a small angle, the pivoted "latch"(7) releases the gate, which, powered by the two spiral springs (3) comes to rest against the seat.

Performance

Closure time, from the arrival of the electrical impulse to the contact between the gate and the seat, is 18 msec. There follows a certain period of "bounce" between the gate and the seat which lasts approximately 15 msec depending upon the degree of air pressure exerted on the gate.



Construction

The Fast Acting Valve is constructed in accordance with the usual standards required for components in the ISR Vacuum System:

- (1) Must be bakeable at 300°C.
- (2) No measurable external leak.
- (3) Materials used should have a low degassing rate and be non-magnetic.

These conditions imply the construction of an all metal valve, and consequently the use of welded metal bellows in all moving parts.

The body and connecting flanges of the valve are constructed of stainless steel type 316 L + N from previously degassed sheets following the techniques devised for the fabrication of other components in the ISR Vacuum System.

Moving parts involved in the closure of the valve have to be mechanically strong and at the same time of light-weight construction. Titanium alloys offer the best solution to these two contradictory requirements. Titanium alloy is also used for the construction of the two spiral springs which have to remain under tension for the majority of the time and notably during bakeouts at 300°C.

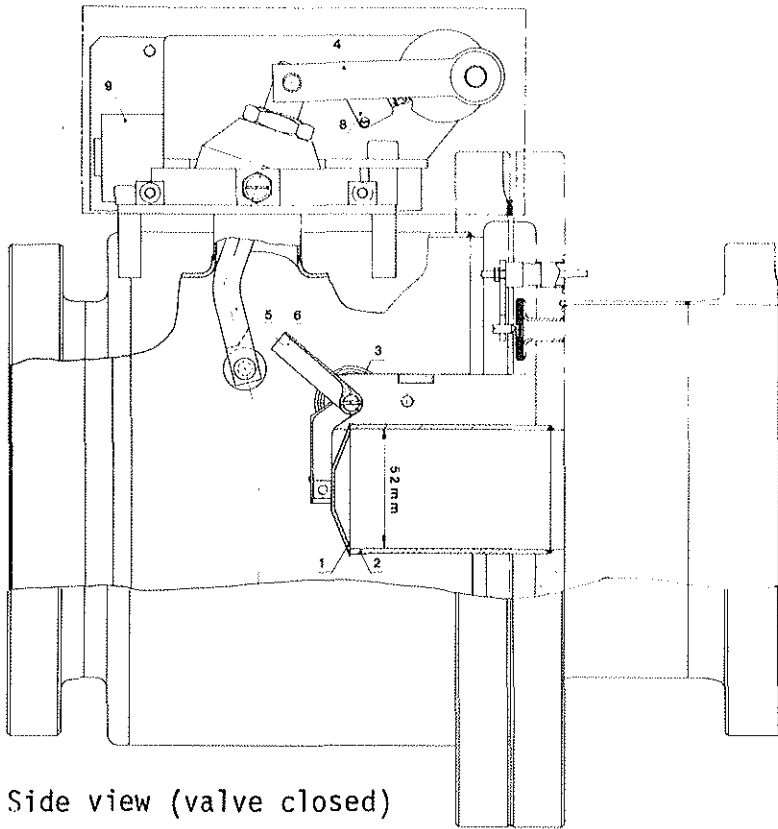
For further details:

General design: J. Delfosse.

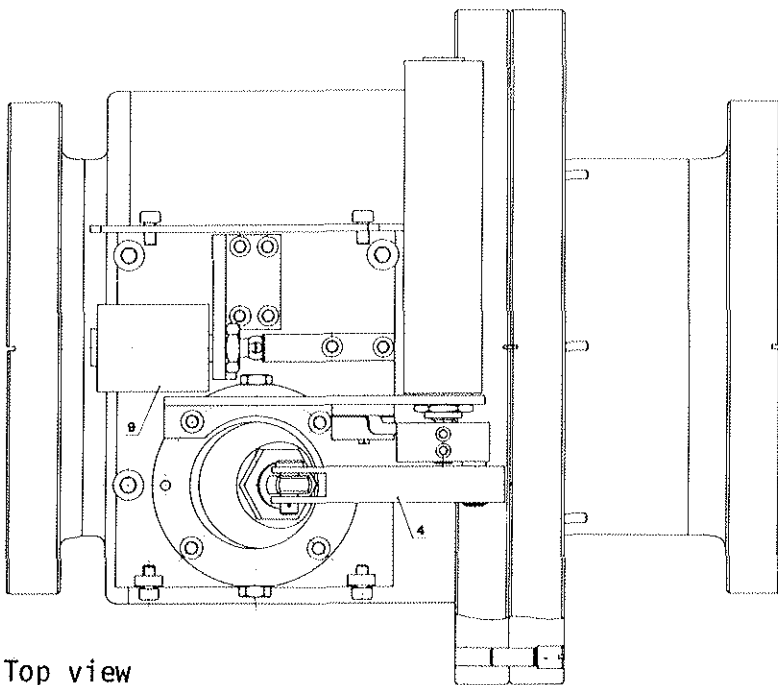
Construction: West Workshop.

28 February 1974.

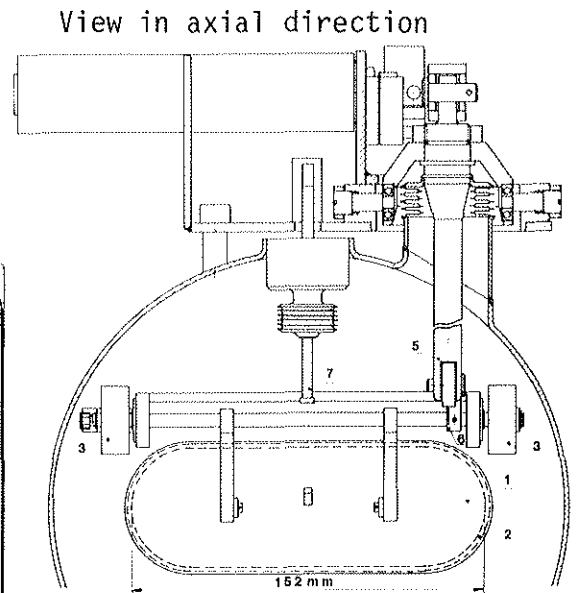
Fast acting valve



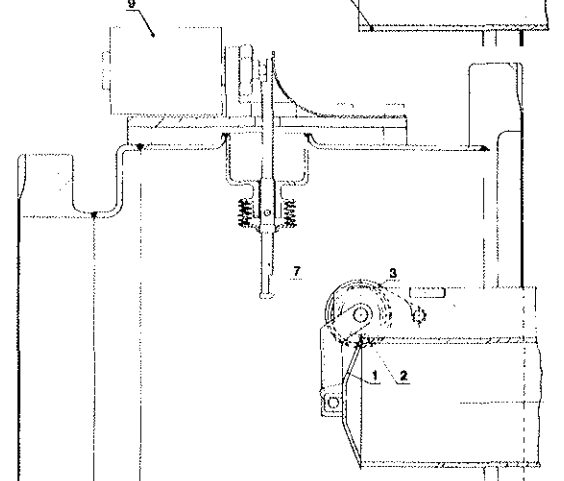
Side view (valve closed)



Top view



Open position



Closed position