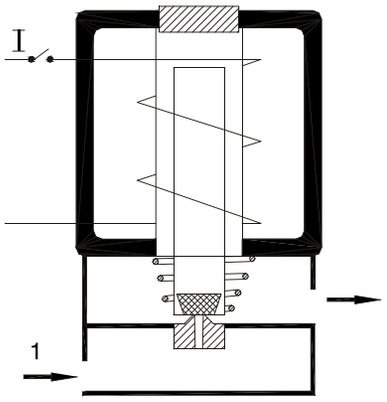
FEATURES AND OPERATING PRINCIPLES - VALVE

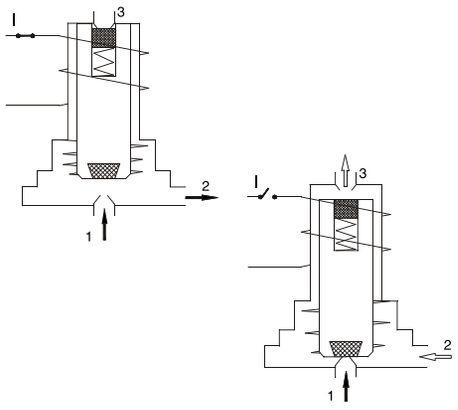
DIRECT ACTING VALVE

(A)



The Solenoid is directly responsible for opening and closing the ports and thereby controlling the direction of fluid flow in the Direct Acting Solenoid Valve.

(B)



On energising the Solenoid, the electromagnetic field generated pulls the plunger thereby blocking orifice at Port-3 and opening passage from Port-1 to Port-2.

On de-energising the solenoid, plunger drops down, thus opening passage between Port-2 and Port-3 and blocks Port-1.

In Normally Closed (NC) 3/2 Way Valve, pressure is applied at Port-1, apparatus is connected at Port-2 and Exhaust is at Port-3.

In Normally Open (NO) 3/2 Way Valve, pressure is applied at Port-3, apparatus is connected at Port-2 and Exhaust is at Port-1.

CAUTION

3/2 NC Valve cannot be converted to 3/2 NO Valve by change of pressure connection. The valve needs change of Springs and other Components which is to be done at the assembly stage.

PILOT OPERATED VALVE :

Larger flow calls for bigger orifice.

In a Direct Acting Valve having a bigger orifice, a strong spring is required to hold the pressure against the bigger orifice, requiring a high power solenoid. The high power consumption leads to high inrush, overheating and high back surges.

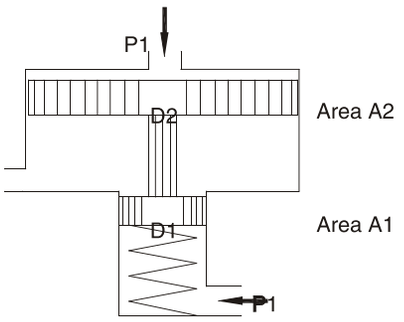
To overcome such situations, **ROTEX** offers **Internal Pilot Operated Solenoid Valve** which uses the media pressure to operate the valve. Working principles are :

FEATURES AND OPERATING PRINCIPLES - VALVE

PILOT VALVE OPERATING PRINCIPLE

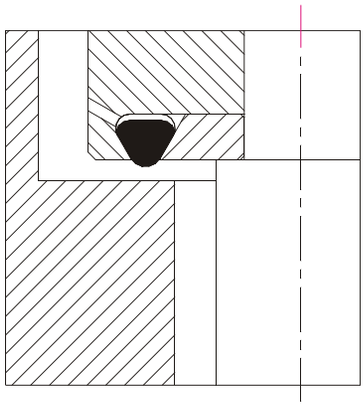
ROTEX Pilot Operated Solenoid Valve uses the POPPET operation principle. The Poppet Technology, which is the essence of the high performance delivered by our products, has been mastered by us ever since our inception. The basic features of the poppet operation are :

(1) OPERATING PRINCIPLE



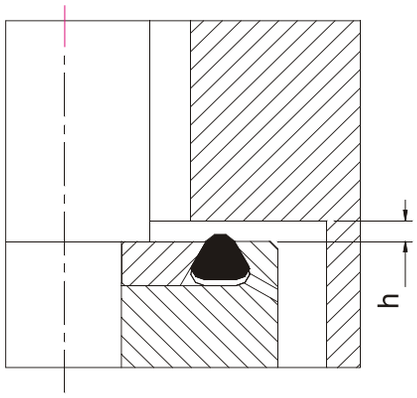
The Poppet Technology works on the differential area principle. As illustrated in the figure here, on energisation, pressure P_1 is acting simultaneously on both areas A2($/_4 D_2^2$) and A1($/_4 D_1^2$). However, as a result of the area A2 being larger than A1, the entire assembly experiences a downward force which moves the assembly downward. On deenergisation poppet moves up due to spring and pressure on area A1.

(2) ZERO LEAK SOFT SEALING



The above principle is utilised in the operation of a valve by incorporating a seat in the poppet assembly. This helps in opening or closing the port by either lifting the seat or lowering the seat on the surface of the valve body. The seat consists of an 'O' ring placed and retained between the valve disc and the seat holder. Each time the assembly operates, the 'O' ring slides in the cavity thereby eliminating any impact observed by the 'O' ring. The small vent hole relieves the pressure during the movement of the seat. This results in a long life of the 'O' ring. As a result of the differential area, the pressure itself assists in sealing the port by creating a positive force. This makes the Poppet type Solenoid Valves Soft Sealing Zero Leak Valves.

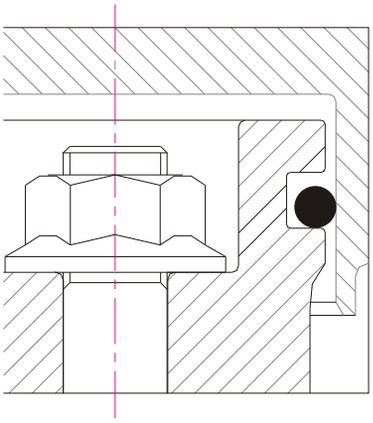
(3)HIGH SPEED OPERATION



A small movement of the poppet (h) creates a large opening equal to the orifice. As a result, the poppet operates within a time of 10 ms to 40 ms (depending on the size of the Pilot Operated Solenoid Valve). Each time the valve is operated, a self cleaning action takes place.

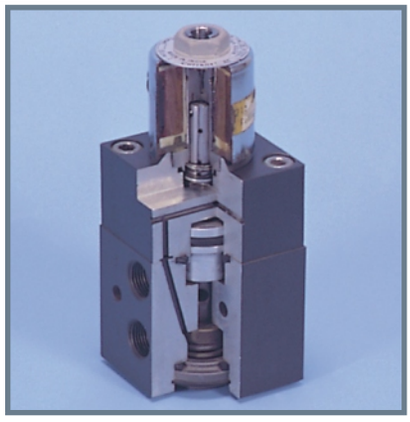
FEATURES AND OPERATING PRINCIPLES - VALVE

(4) NON WEARING PARTS



The poppet construction utilises a mushroom head piston with unique floating 'O' rings. These 'O' rings, fitted on the piston, do not slide during the piston movement but, flex in their position. As a result of this non-wearing characteristic, the seals last for millions of operations giving trouble free operations. Similarly, the seat 'O' ring opens or closes the port by seating or unseating, thus eliminating wear and tear unlike in the conventional construction where the sliding of 'O' rings/Seals over the ports lead to seal failures or poor performance.

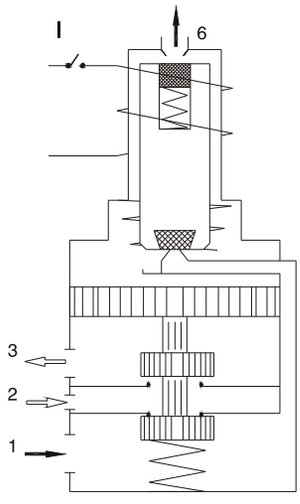
(5) HIGH RELIABILITY



The typical poppet construction, as employed in our solenoid valves, is illustrated here.

The complete poppet assembly assembled on the single shaft, is guided in the bottom cover and along the piston in the top cover/body. This ensures a perfect alignment, thereby delivering the right operation everytime the valve is energised/deenergised. The Stainless Steel, high performance spring at the bottom is responsible in resetting the poppet mechanism everytime the solenoid valve is deenergised. This together results in the high realibility of operation of the poppet mechanism.

INTERNAL PILOT OPERATED POPPET VALVE OPERATION



When pressure is applied at inlet port, a part of media from the inlet is drawn under the plunger through the pilot passage.

On energisation of the solenoid, the pilot pressure acts on the piston thus, pushing the poppet assembly down and thereby connecting inlet to outlet. On deenergising the solenoid, the pilot air is vented through pilot exhaust. There by the spring pushes the poppet assembly up and opening outlet to exhaust and disconnecting inlet.

NOTE : To avoid pressure drop, ensure that the inlet port of the valve is connected with pipe/tube having ID orifice of the valve.

In the event of non-availability of sufficient media pressure, ROTEX offers **External Pilot Operated Solenoid Valve** which uses an external source to operate the Valve. The External Pilot Operated Solenoid Valves are also used for aggressive media, isolation of media, safety shut down applications. The external pilot pressure to be minimum 3 bar or to media pressure, whichever is higher.

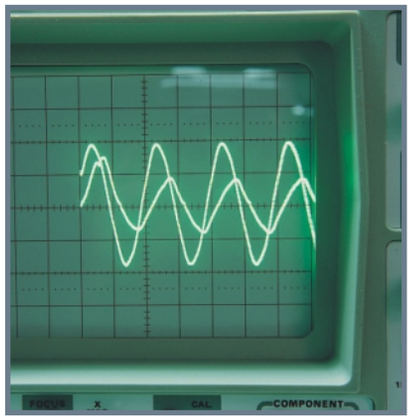
ROTEX offers Special Solenoid Valve to work at a lower external pilot pressure than main media pressure (Refer Catalogue).

FEATURES AND OPERATING PRINCIPLES - SOLENOID

The Solenoid is an important part of a Solenoid Valve which is fully responsible in the prolonged and continuous operation of the Solenoid Valve.

ROTEX Solenoids offer following characteristics to ensure continuous rating and nearly unlimited durability.

(1) LOW INRUSH



INRUSH : a momentary surge of current is a phenomenon as a result of the movement of the plunger when a solenoid is energised.

The inrush is observed in solenoid for use on alternating voltage (AC) only and is not applicable to Direct Voltage (DC).

Inrush current in the **ROTEX** solenoid is limited to 1.5 times the holding (steady state) current. This is result of the following :

- Low power consumption.
- Low Plunger Strokes.
- Non sliding plunger movement.

The information is for a Solenoid 6W for AC 50 Hz. Solenoid 11W has a built in rectifier, as a result, Inrush is not observed in 11W Solenoid for AC application. DC solenoids are 8W and 11W.

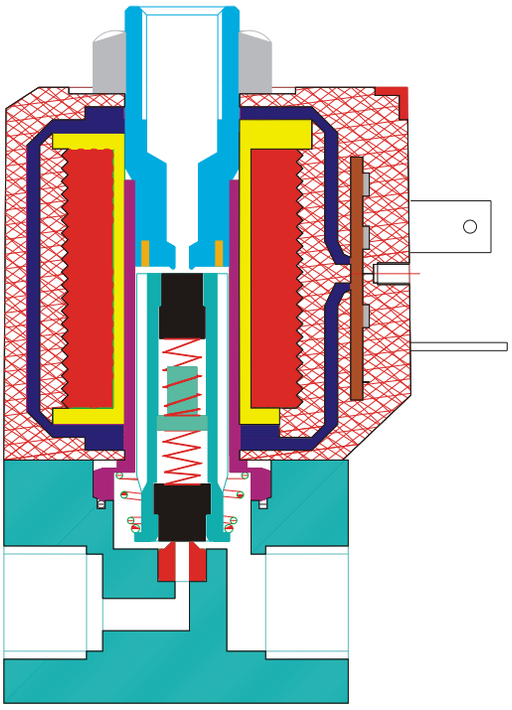
(2) LOW TEMPERATURE RISE

As a result of the highly efficient solenoid construction, the temperature rise of the solenoid under continuous energisation is limited to less than 70ºC. This is also a result of the special heat transmitting insulation coating and the heat conducting enclosure. As a result of the low temperature rise, all **ROTEX** Solenoids are continuous duty rated.

In order to find the temperature rise of the solenoid, **ROTEX** measures the resistance of the solenoid on energisation and after continuous energisation once stabilised in hot condition.

For special application, **ROTEX** can deliver Solenoid Valves having temperature rise less than 5º C.

(3) HIGHLY EFFICIENT SOLENOID CONSTRUCTION



All **ROTEX** solenoids are constructed with magnetic path enclosures surrounding the basic solenoid. As a result, in a **ROTEX** solenoid, all the generated electro magnetic flux is used in order to lift and hold the plunger. **ROTEX** solenoid valves offer higher pressure to orifice rating with a lower power consumption. Thus, demonstrating the highly efficient solenoid design and operation.

FEATURES AND OPERATING PRINCIPLES

(4) INSULATION CLASS

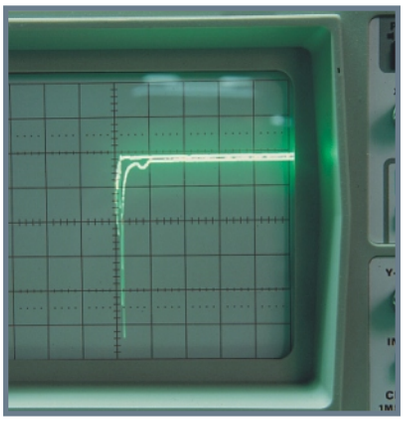
The low temperature rise of the **ROTEX** solenoid (less than 70ºC) results in the usage of class F insulation for all solenoids upto an Ambient tmperature of 85ºC. For Ambient temperature upto 110ºC, **ROTEX** uses a Class H insulation.

The selection of insulation is a function of ambient temperature and the internal temperature rise of the solenoid. The temperature limit for Class F insulation is 155ºC and for Class H insulation is 180ºC.

ROTEX also manufactures on demand, Solenoids with C Class insulation for ambient temperature upto 150ºC.

This goes to prove that using a higher class of insulation does not indicate a better solenoid but the internal temperature rise decides the performance of the Solenoid under operating condition.

(5) SURGE SUPPRESSION



Any solenoid is an energy storing device and each time it is deenergised the energy is released in circuit in the form of a surge which may affect the switching circuit. Higher the power consumption of the solenoid, higher is the surge. **ROTEX** uses solenoids with a maximum of 11 Watt power consumption. In order to absorb the surge, **ROTEX** uses a surge suppressor device in all solenoids above 10 Watt power consumption and in all Flameproof / Explosionproof solenoids as a standard.

The surge suppressor device reduces the surge down to 500V, thus protecting expensive switching equipment.

(6) FULL INTERCHANGEABILITY

For the same size of solenoid (14mm or 18mm inside diameter), all enclosure variation are fully interchangeable i.e. as a user, you can change the enclosure from flying lead to Explosionproof or terminal box without the change of any other components. More important, ROTEX offers full interchangeability of solenoids for a change in operating voltage or type of current (AC or DC) without affecting the pressure or flow rating of the valve.