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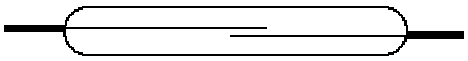
The selection of reed switches for valve monitoring applications

A reed switch is usually selected to avoid the problems of icing and corrosion that can occasionally be a problem with mechanical switches. A reed switch is sometimes referred to as a proximity switch but it is important to understand that although there is no contact with the cams there are moving parts within the switch that behave in a similar way to the contacts within a mechanical switch.

Construction: A reed switch has two ferromagnetic reeds which are hermetically sealed into a glass capsule which is then mounted in a plastic or aluminium housing. The materials of construction will be selected to be compatible with the operating temperature range of the reed switch. The capsule may contain either inert gases or a vacuum to prevent corrosion. The flattened reeds overlap and are separated by a small gap in the contact area.

The presence of a magnetic field from a magnet mounted in the switch cam causes the reeds close. They open again when the magnetic field is removed.

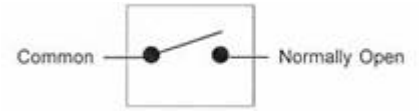


Contact materials: Precious or semi-precious metals (e.g. Rhodium, Ruthenium, Tungsten) or mercury wetted. Rhodium and Tungsten are the materials commonly used in switches for valve position monitoring applications.

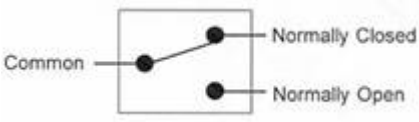
Ruthenium has similar properties to Rhodium and is lower cost. However it has to be applied to gold plating because it cannot usually be directly coated on copper or steel.

Mercury wetted reed switches contain a pool of mercury at one end and are operated vertically. The contacts on the reeds are covered with a mercury film by capillary action and each operation of the switch renews this mercury film contact. This process gives them a long life and makes them suitable for switching very high loads. (They are very expensive and are rarely if ever used on valve position monitoring applications).

Contact configurations: Like a mechanical switch the contacts in a reed switch are defined as S.P.S.T (Single pole, single throw) or S.P.D.T (Single pole, double throw).



The diagram above shows the layout of an S.P.S.T. reed switch. Contacts are sealed within a glass capsule in an encapsulated housing.



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The diagram above shows the layout of an S.P.D.T. reed switch. Contacts are sealed within a glass capsule in an encapsulated housing.

As is the case with mechanical switches a pair of S.P.D.T reed switches can act as a single D.P.D.T (double pole, double throw) switch by mechanically linking the associated switch cams.

Ratings: Reed switches cannot handle as much current as mechanical switches. A typical reed switch application would be switching a resistive load of no more than 1 amp at 24VDC. The current handling capacity of a reed switch is significantly reduced if it is called upon to switch an inductive load.

As the load increases more heat is generated and eventually at some point greater than 1 amp, the melting point of Rhodium (1964 degrees C) will be exceeded.

Tungsten has a higher melting point than Rhodium (3422 degrees C) and therefore it is more suited for loads above 1 amp and for switching damaging inductive loads.

Rhodium contacts have a low contact resistance and are ideal for switching low loads. Tungsten on the other hand has a higher contact resistance that does not make them suitable for switching resistive loads below approximately 80mA.

As PLC inputs normally operate at approximately 10 to 20mA, Rhodium contacts are recommended for this application. Using Tungsten could result in non contact faults.

K Controls therefore offers Rhodium contacts for resistive loads up to 1 amp at 24VDC and Tungsten contacts for resistive loads in the range 80mA to 2.4 amps at 24VDC.

Inductive loads: Any coil based device (relay or solenoid) is an inductive load.

When the device is switched off the magnetic field collapses and this induces a high voltage spike in the opposite direction as the switch contacts open.

This voltage actually breaks down across the switch contacts. This wears the contacts and blows the contact material away to reveal the ferrous material beneath (this process blackens the glass).

With DC inductive loads applying a zener diode across the switch contacts can overcome this problem. The high reverse voltage will then break down across the diode and not across the switch contacts.

With AC inductive loads an AC Varistor (which is essentially a back to back diode) would be used in place of a zener diode.

Lamp Loads: A similar problem can arise if the switches are operating lamps (lamp load). When the lamp is switched on the resistance is low for a few moments until the resistance rises along with the temperature.

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This surge of current at low resistance passes through the reed blades and they can weld themselves together, sometimes on first contact.

For switching bulbs a bleed resistor can be fitted in parallel with the switch. The resistance should be such that the bulb filament is kept hot but doesn't glow. A resistor can be connected in series instead but this reduces the brightness of the bulb.

Capacitive Loads: There can be similar problems with capacitive loads. (As a result of long cable runs or PLC's with capacitive inputs).With capacitive loads a choke can be applied across the switch contacts. A choke is essentially a coil that slows down the voltage spike to prevent contact damage.

Diodes, varistors and chokes can either be incorporated into the appropriate switch housings or installed across the terminals of the associated switchbox.

Summary: Reed switch contact selection - a general guide:

Lower resistive loads : Rhodium Contacts
Higher resistive loads: Tungsten Contacts
Inductive loads: Tungsten Contacts
Lamp loads: Tungsten Contacts
Lower capacitive loads: Protected Rhodium Contacts
Higher capacitive loads: Tungsten Contacts

Each application should be individually assessed. Please contact K Controls.

Similar documents covering mechanical switches and inductive proximity switches are available on request.