

Handling and Load Precautions when using Reed Switches in various Sensor and Relay Applications

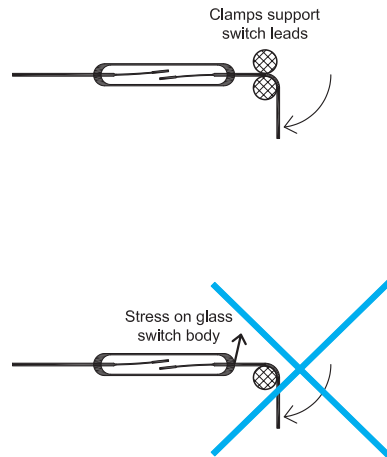
Cutting and Bending a Reed Switch

Many users of Reed Switches for sensor and reed relay applications try to make the sensors and or relays themselves internally. Often however, they do not observe some basic precautions and preventive measures to insure reliable operation of the switch. Below we try to cover the key areas that users and manufacturers must observe.

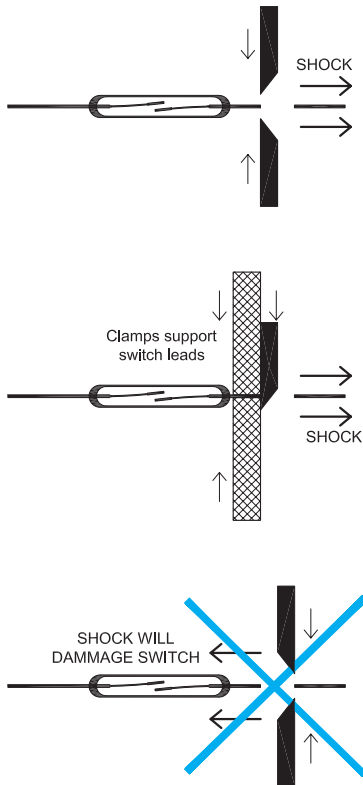
Reed Switch modifications can be very dangerous to the Reed Switch if not done properly. Primarily, this is because the reed lead is large by comparison to the glass seal. Here a balance is achieved in Reed Switch sensitivity and mechanical strength. If the lead of the Reed Switch was much smaller than the glass, seal stress and glass breakage would not be an issue. However, to achieve the sensitivity and power requirements in the Reed Switch, a larger lead blade is necessary. With that in mind, it cannot be emphasized enough, any forming or cutting of the Reed Switch leads must be done with extreme caution. Any cracking or chipping of the glass are signs that damage has occurred. Internal damage can occur with no visible signs on the seal. In these instances, seal stress has occurred, leaving a torsional, lateral, or translational stress in the seal. This produces a net force on the contact area that can affect the operate characteristics (Pull-In and Drop-Out), contact resistance, and life characteristics.

Most Reed Switch suppliers can perform value added cutting and shaping of the leads in a stress free environment using proper tooling and fixtures. Often times this is the most economical approach for users, although it may not seem so at the time. Many times the user will often choose to make their own modifications, and only after manufacturing and quality problems with the product, do they go back and choose the approach of letting the Reed Switch manufacturer perform the value added

requirements. Below, in Figure #41 & Figure #42, is the proper approach for cutting and/or bending the Reed Switch. The effect on the Pull-In and Drop-Out characteristics of cutting and bending the Reed Switch will be explained later in more detail.



(Figure #41. Presentation of the proper and improper way of bending a Reed Switch. Supporting the switch lead while bending is a must.)

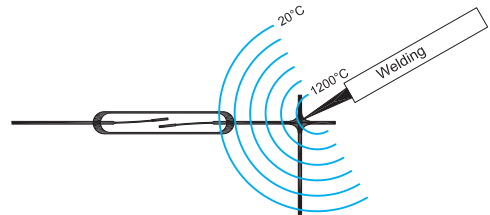


(Figure #42. Properly supported the switch lead while cutting is required, otherwise damage can occur to the Reed Switch.)

Soldering and Welding

Many times soldering or welding of the Reed Switch is required. Reed Switches are usually plated with a suitable solderable plating. Welding is also easily carried out on the nickel/iron leads of the Reed Switch as well. However, in both processes, if not done properly, stress, cracking, chipping or breaking of the Reed Switch can occur. When soldering or welding, the farther one is away from the glass seal the better. Many times, this may not be possible. Welding can be the most dangerous if one is welding very close to the seal. Here a heat front of up to 1000 0C can conduct its way to the seal. Since it arrives on one end of the seal first, the other end of the seal may be at 20 0C. This causes a dramatic thermal gradient to exist across the seal which

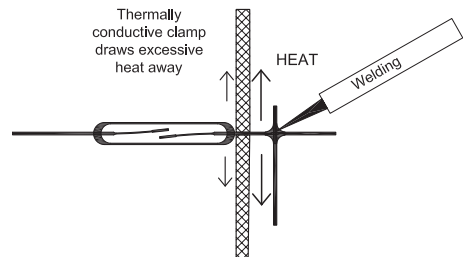
can disrupt the seal in many ways, all of which, will give rise to faulty Reed Switch operation. (see Figure #43)



(Figure #43. Soldering and welding can generate a heat front to the glass to metal seal of the Reed Switch causing potential damage.)

Soldering, in a similar manner, close to the seal can have the same effect to a lesser extent because of the lower solder temperatures involved (200 0C to 300 0C).

Two ways to improve the likelihood of success are by heat sinking the lead of the Reed Switch (see Figure #44) or by preheating the Reed Switch and/or assembly.



(Figure #44. Use of Heat Sinking or preheating Reed Switches for soldering or welding can prevent heat stress damage.)

Most commercial wave soldering machines have a preheating section before the PCB or assembly is immersed into the solder wave. Here the thermal shock is reduced by the existing higher ambient temperature preexisting before the solder wave, thereby reducing the thermal gradient to the reed switch seal.

Printed Circuit Board (PCB) Mounting

Reed products mounted on PCBs can sometimes be a problem. If the PCBs have a flex to them after wave soldering, removing this flex may be required when mounting the board to a fixed position. When the flex is removed, the hole distance, where a Reed Switch for instance may be mounted, can change by a small amount. If there is no provision in the mounting to take this small movement into consideration, the Reed Switch seal will end up absorbing the movement, which leads to seal stress, glass chipping or cracking. Care should be taken in this area, particularly when very thin PCBs are used and flexing or board distortion is common.

Using Ultrasonics

Another approach to making a connection to a Reed Switch is ultrasonic welding. Reed Switch Sensors and Reed Relays may also be sealed in plastic housings where the sealing process uses ultrasonic welding. In addition, cleaning stations use ultrasonic welding. In all these areas the Reed Switch can be damaged by the ultrasonic frequency. Ultrasonic frequencies range from 10kHz to 250kHz, and in some cases even higher. One does not only have to be concerned with the resonant frequency of the Reed Switch and its harmonics, but also of the resonant frequency of the assembly in which the Reed Switch resides. Given the right frequency and the exact conditions severe damage can occur to the contacts. If using ultrasonics in any of the above conditions, be very cautious and perform exhaustive testing to insure there is no interaction or reaction with the Reed Switch.

Dropping Reed Switch Products

Dropping the Reed Switch, a Reed Sensor, or a Reed Relay on a hard object, typically on the floor of a manu-

facturing facility, can induce a damaging shock to the Reed Switch. Shocks above 200 Gs should be avoided at all costs. (See Figure #45.) Dropping any of the above on a hard floor from 20 cm or more (greater than one foot) can and will often destroy a Reed Switch where G forces greater than 1000 Gs are not uncommon. Not only can the glass seal crack under these circumstances, but the reed blades may be dramatically altered. Here the gaps may have been drastically increased or the gaps may be closed, due to these high G forces. Simple precautions of placing rubber mats at assembly stations can eliminate these problems. Also, instructing operators that if a reed product is dropped it can not be used until it is re-tested.

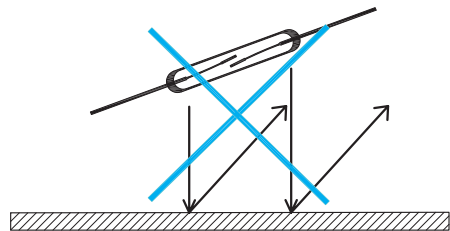


Figure #45. Dropping the Reed Switch on a hard surface can induce several 100 Gs to the contacts many times altering the switch characteristics.

Encapsulating Reed Switch Products

Further damage can occur to a Reed Switch when one attempts to package the Reed Switch by sealing, potting, or encapsulating. Whether this is done by a one or two part epoxy, thermoplastic encapsulation, thermoset encapsulation, or other approaches, damage to the glass seal can occur. Without any buffer, the encapsulants crack, chip or stress the glass seal. Using a buffer compound between the Reed Switch and the encapsulant that absorbs any induced stress is a good approach to eliminate this problem. Another approach would be to match the linear coefficient of thermal expansion with that of the Reed Switch, thereby reducing stress as the temperature fluctuates. However, keep in mind, this approach does not take into consideration the shrinkage that occurs in most epoxies and encapsulants during the curing stage.

Sometimes a combination of both approaches may be the best way to seal a product with a Reed Switch.

Temperature Effects and Mechanical Shock

Temperature cycling and temperature shock if naturally occurring in a Reed Switch application must be taken into consideration. Again, temperature changes

creating movement with various materials due to their linear coefficients of thermal expansion will induce stress to the Reed Switch if not properly dealt with. All MEDER's Reed Sensors and Reed Relays have been designed to handle temperature changes and mechanical shock. Through rigorous qualification testing by exposure to temperature cycling, temperature shock and mechanical shock, potential design defects have been eliminated from our products.