Fuses

A fuse comprises either a wire fuse element or a metal strip in a small cross-section which are connected to circuit conductors. These units are typically mounted between two electrical terminals and quite often the fuse is cased inside a non-conducting and non-combustible housing. The fuse is arranged in series that could carry all the current passing through the protected circuit. The resistance of the element produces heat due to the current flow. The construction and the size of the element is empirically determined in order to make certain that the heat generated for a regular current does not cause the element to reach a high temperature. In instances where too high of a current flows, the element either melts directly or it rises to a higher temperature and melts a soldered joint in the fuse which opens the circuit.

An electric arc forms between the un-melted ends of the element when the metal conductor parts. The arc grows in length until the voltage required to be able to sustain the arc becomes higher as opposed to the available voltage within the circuit. This is what causes the current flow to become terminated. Where alternating current circuits are concerned, the current naturally reverses direction on each cycle. This method really enhances the fuse interruption speed. When it comes to current-limiting fuses, the voltage required to sustain the arc builds up fast enough to essentially stop the fault current before the first peak of the AC waveform. This particular effect tremendously limits damage to downstream protected units.

Normally, the fuse element is made up of copper, alloys, silver, aluminum or zinc that will offer stable and predictable characteristics. Ideally, the fuse will carry its rated current indefinitely and melt quickly on a small excess. It is important that the element should not become damaged by minor harmless surges of current, and must not oxidize or change its behavior following possible years of service.

To be able to increase heating effect, the fuse elements can be shaped. In large fuses, currents may be separated between multiple metal strips. A dual-element fuse could comprise a metal strip that melts right away on a short circuit. This particular type of fuse may also contain a low-melting solder joint which responds to long-term overload of low values compared to a short circuit. Fuse elements could be supported by nichrome or steel wires. This would make certain that no strain is placed on the element but a spring may be included so as to increase the speed of parting the element fragments.

It is normal for the fuse element to be surrounded by materials that are meant to speed the quenching of the arc. Silica sand, air and non-conducting liquids are some examples.