

Thermal Fuses for the Protection of Electric Furnaces

As a means of protecting electric furnaces from damage by over-heating, thermal fuses, or excess temperature cut-outs, are very often employed. These generally consist of a length of wire that is inserted in the hot zone of the furnace and connected in the solenoid circuit of the controlling contactor. When the temperature in the furnace reaches a pre-determined value the fuse element melts, cutting off the power supply.

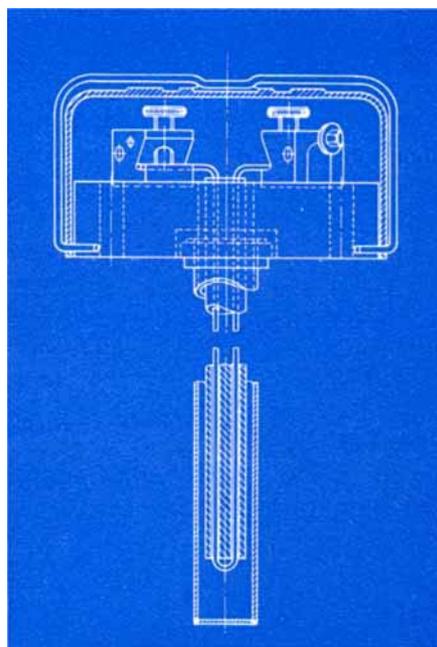
The essential requirements of a thermal fuse material are the shortest possible melting range and the maximum resistance to oxidation and deterioration. Resistance to deterioration is achieved by using silver, gold and palladium and their alloys. For temperatures of 960° and 1063°C pure silver and pure gold naturally give a definite assurance of melting exactly at the required points. In many cases, however, appreciably higher ratings are needed. Here the properties of the palladium-gold alloys are most useful, as this system comprises a continuous series of solid solutions, with the solidus temperatures lying close to the liquidus points throughout. These alloys thus give the required narrow melting range combined with freedom from corrosion or deterioration, and by choosing a number of appropriate points on the equilibrium diagram alloys can be produced to melt at convenient intervals of say 50° between 1100° and 1500°C .

Such fuse elements are commercially available as wire, the diameter usually recommended being about 0.040 inch. On reaching the rated temperature they melt readily, run into beads, and break the circuit.

A few simple precautions are necessary in using these fuse elements. They should not be connected to nickel-chromium leads inside the hot zone of the furnace, as inter-diffusion and subsequent fracture are then

liable to occur. If wire fuses are to be used in a vertical position it is also necessary to support the weight of the electrical insulators, as otherwise the wire may be drawn out, resulting in premature failure due to the reduction of diameter causing over-heating, or simply due to mechanical fracture.

It is nearly always desirable to house the fuse in a closed-end sheath, and if a metal sheath is used contact between the fuse and the sheath must of course be avoided. As a further precaution the fuse sheath should be electrically insulated from earth so that in the event of contact between the fuse and the sheath the leakage current does not cause failure. A suitable fuse housing, designed and used by Wild-Barfield Electric Furnaces Limited is shown in the diagram.



Design of thermal fuse assembly employed by Wild-Barfield Electric Furnaces Ltd.