

**DC Power Arc Control & Barriers**

Grade: **EM42**

**Information Sheet**

Issue: **2004-01**

**DESCRIPTION**

Electric traction motors used for railway passenger transport commonly use a DC supply which may arrive at the vehicle via an under-car shoe collector or via an above-car pantograph system. Dependent on the precise nature of the electrical system it is common that there is no electrical protection on the supply which is useful in the sense of personnel protection, other than the remote substation, ahead of the High Speed Circuit Breaker. In the event of a fault to earth occurring in this "unprotected" part of the supply it is possible that the resistance in the circuit can lead to extended duration power arcing events due to the limiting effect on the current drawn. Such incidents can lead to local power dissipation in the MW range and with very high power densities such that steel is a mobile liquid.

London Underground Ltd. have pioneered the study and use of DC power arc barriers as well as the use of the so-called "arc snuffing tubes". The function of a barrier is simply to protect vulnerable and/or critical areas, (such as the metallic floor of the vehicle), from direct arc strike. The "arc snuffing tubes" are actually active devices and are required to confine an arc to a defined area and to extinguish it within this area.

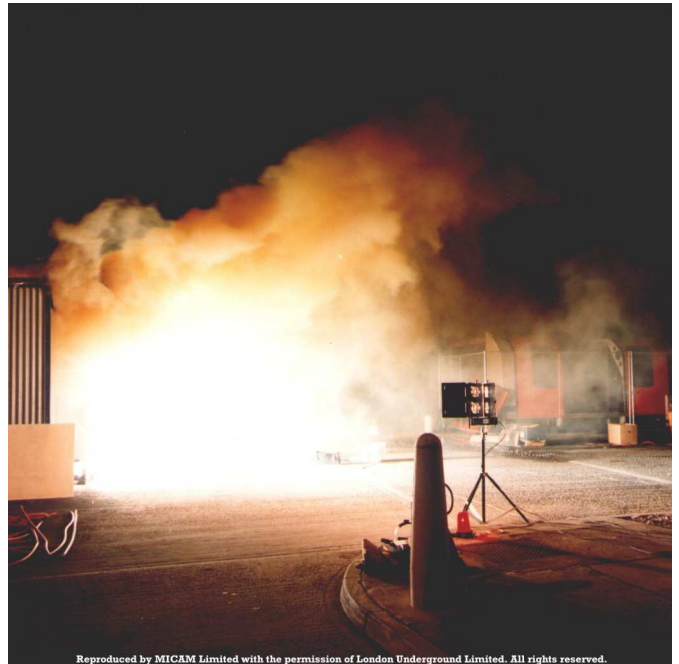
**DC ARC EVENT**

A DC power arc is a hazardous event in its own right with significant amounts of smoke and toxic fume arising simply from the metals and air involved in the event. It is also a powerful ignition source and will promote adverse reaction from most materials which are within its sphere of influence.

The before and during photographs of a DC power arc test, (reproduced by permission of London Underground Ltd.), illustrate the scale of the event which is being considered.



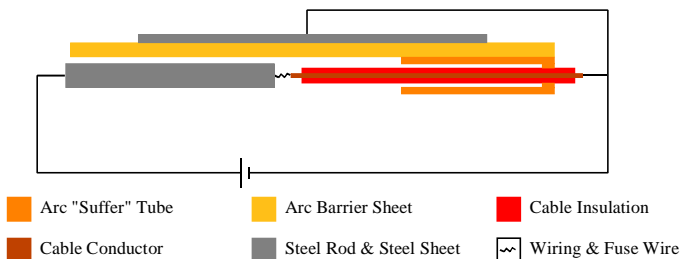
DC Arc Rig Prior To Test - View From The Front



DC Arc Rig During Test - View From The Side

**DC ARC TEST CONDITIONS**

The test arrangement and the relevant parameters are shown in the test schematic below.

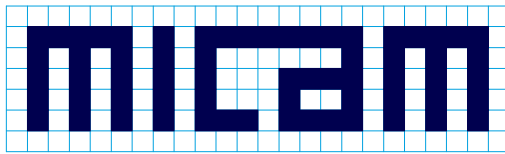


Schematic Arrangement Of Items & Circuit

The arc is initiated by the fuse wire and the cable burns back into the arc snuffing tube. If any current flows in the steel sheet electrode behind the arc barrier sheet this is a failure of the arc barrier sheet. If the arc does not extinguish naturally before the cable burns out of the back of the tube this is a failure of the arc "snuffer" tube. The spacing between the cable and the barrier is known as the stand-off. The smaller the stand-off the more severe is the attack on the barrier. Generally the stand-off is greater than 50mm in which case 12mm of EM42 is required for the barrier. If the stand-off approaches 20mm then 16mm of EM42 is required. The arc "snuffer" tubes use EM42 at 12mm. Arc "suffer" tubes may be used alone or in combination with an arc barrier.

Test Pass/Fail Criteria

The information contained in this leaflet has been prepared with care and is accurate to the knowledge of MICAM Ltd. The Company does not accept any liability either in respect of the contents or arising from the use of this information. Typical properties are given in this brochure and these must not be taken as minimum standard values.

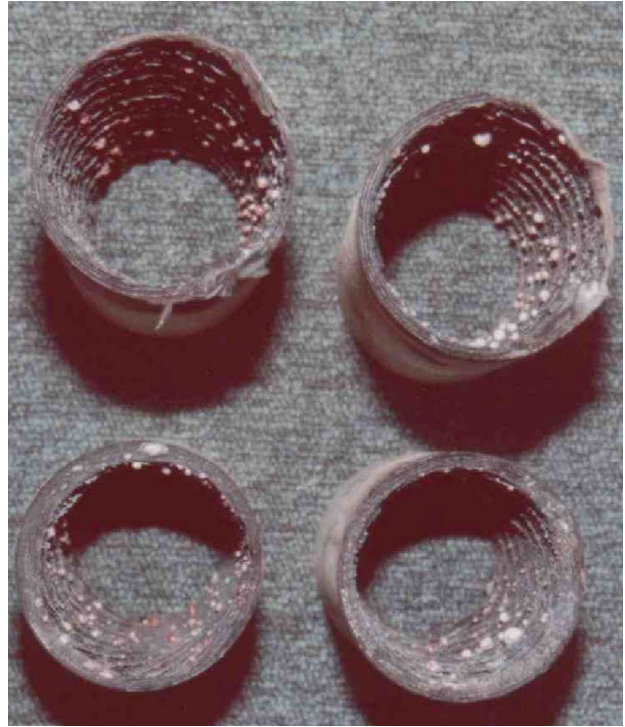


**PERFORMANCE OF EM42**

EM42 was one material which passed the London Underground Ltd. preselection criteria for entry into the large scale DC arc testing programme. During this programme EM42 was subjected to DC power arc testing and resulting from this it received approval for use. Specifically of interest was its use in the active arc snuffing tubes where commonly a 12mm thickness is used. The success of the arc snuffing tube concept has resulted in these devices being used without being associated with formal arc barriers so that the arc can be extinguished earlier and closer to the power collectors and away from the most vulnerable and/or critical areas. The before and after pictures of EM42 show the success achieved by arc snuffing tubes composed of EM42. The leading edge of the tubes is intact and the erosion of the arc has not penetrated the tube. (The rear seal on the tubes has been removed).



EM42 Arc Snuffing Tubes (& Threaded Connectors)



EM42 Arc Snuffing Tubes After Test

**ASSOCIATED USES OF EM42**

EM42 is a high performance electrical insulator and hence can be used to make insulating arc resisting boxes for DC power connections amongst others. One critical issue for such boxes as compared to earthed metallic boxes is that should a connection begin to fail within the box there is no propensity for an earth fault to develop as the air dielectric breaks down. Some typical EM42 constructions are shown.



The information contained in this leaflet has been prepared with care and is accurate to the knowledge of MICAM Ltd. The Company does not accept any liability either in respect of the contents or arising from the use of this information. Typical properties are given in this brochure and these must not be taken as minimum standard values.