Technical Data Sheet TD B106

March 2009

Some factors to be considered when specifying bare mineral insulated cables

1) Bare mineral insulated cables on galvanised cable trays.

Normally there is no significant increase in corrosion as a result of galvanized steel being in contact with most common metals in an atmospheric environment.

However, copper and copper containing alloys are the exception to the rule.

PD 6484 'Commentary on Corrosion at Bimetallic Contacts and its Alleviation' grades the severity of any increase in corrosion on a scale of 0-3 (0 = low 3 = high).

When a copper/zinc combination is considered copper has a grading of 0 and is therefore unaffected by its contact with zinc, but zinc has a grading of 0-1 in rural environments and 1-2 in industrial/urban and marine environments. This would imply that when there is a situation where corrosion can take place the copper would be unaffected but there may be some deterioration in the zinc coating of the tray.

Factors to be considered include the fact that for corrosion to take place an electrolyte is required. For cable trays located in dry locations with low humidity the chances of galvanic action are low. If the trays are situated outside, exposed to the weather or in damp tunnels, for instance, it would be prudent to use an MI cable with a plastic outer covering.

Consider also that the contact area between the cable and the tray is relatively small and so any resulting galvanic action will be proportionally small.

In summary, the use of bare MI cable on galvanised trays in a dry, low humidity environment should present no problems. For damp/wet locations a cable with an outer covering is recommended.

2) Bare mineral insulated cables buried in concrete

Concrete is a complex construction material, comprising water, sand, cement and a suitable larger aggregate.

Whilst copper is practically immune from attack by caustic alkalis and may be safely embedded in this basic material, the frequent presence of admixtures in concrete should be taken into consideration.

Chlorides in conjunction with water are corrosive to copper and therefore if the concrete contains foaming or aerating agents containing these salts only plastic sheathed cable should be used.

Bare cables should not be buried in concretes containing anti-freezes and accelerated hardeners containing chloride salts.

Magnesium oxychloride cement and concretes utilising foamed slag fines containing sulfur compounds also require sheathed cables.

As the copper sheath is likely to contain small amounts of phosphorus, sheathed cables must be used if a foaming agent that releases ammonia is used.

In view of the uncertainty attached to the use of bare cables in concrete it is recommended that as a general rule only cable having an outer plastic sheathing be buried.

3) Bare mineral insulated cables and renovation work.

Mineral insulated cables are frequently the preferred cable for use in the renovation of churches, old and listed buildings. The relatively small size and its ability to be fitted neatly around stone–work make it the ideal cable for such structures. Restorers often prefer to use bare cables as this obviously keeps the diameter to a minimum and has the advantage that the copper patina of the bare sheath is not as obtrusive as a coloured plastic outer covering. The use of bare cables with most of the materials used in renovation work should not present a problem. Stone–work, timber, painted surfaces and stucco, for instance, are unlikely to present a problem when using bare MI cable. However, a customer recently asked about the use of these cables when using lime putty.

A Technical Policy Statement issued by English Heritage recommends that 'traditionally made lime putty should be used whenever possible for work on historic buildings because of its superior plasticity and binding properties', and so we detail below the results of our investigation into the use of bare cable with this material.

The patina produced on the surface of the copper consists chiefly of the basic copper sulfate formed by the reaction of sulfur oxides and oxygen in the presence of water with copper oxide. This covering layer protects the metal.

Hydrated lime (calcium hydroxide), present in lime putty and mortars, attacks (or corrodes) metals with 'amphoteric' oxides (i.e. metal oxides that react with <u>both</u> acids and alkalis), These include aluminium, lead, zinc and alloys containing these metals (e.g. brass, which is an alloy of copper and zinc). However, the oxides of iron, copper and most other metals are not amphoteric and are not attacked by alkalis such as calcium hydroxide.

As the copper used for the sheath of our MI cable does not contain significant amounts of any amphoteric metals it will not be attacked by lime putty.

It should also be borne in mind that the calcium hydroxide near the surface of the putty and any that migrates dissolved in water flowing through the putty (efflorescence) rapidly reacts with atmospheric carbon dioxide to produce, initially calcium hydrogen carbonate, which is mildly alkali and subsequently calcium carbonate. Under these conditions lime putty would probably not even attack a susceptible metal such as aluminium to any significant degree.

4) Summary

We have attempted to give some information to users of mineral insulated cable who may wish to install bare cables in preference to plastic covered ones. We must stress, however, that this is guidance only and that the specifier/end user must ensure that such details as local conditions, environmental factors and statutory requirements, for instance, are taken into consideration before making a decision.

5) References and acknowledgements

1) Bare mineral insulated cables on galvanised cable trays

PD 6484 'Commentary on corrosion at bimetallic contacts and it alleviation'
Dr Desmond Makepeace: Galvanizers Association.

2) Bare mineral insulated cables buried in concrete

British Concrete Association data sheet ADS 1 'The action of concrete on various embedded non-ferrous metals'
Edwin A.R.Trout: BCA Centre for Concrete Information

3) Bare mineral insulated cables and renovation work.

Hybrid mortar mixes: English Heritage Technical Policy Statement
Ullman's Encyclopaedia of Industrial Chemistry. 5th edition VCH 1990
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J.A.H. Oates: Limetec Consultancy Services.

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