

FIRE PERFORMANCE CABLES



**Mineral
Insulated
Cables**

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Cable Construction

Mineral Insulated Wiring Cables have solid copper conductors embedded in Magnesium oxide insulation with a solid copper sheath.

The cable can be supplied with an outer plastic covering of a low smoke zero halogen material, or simply with a bare copper sheath.

Cable Properties

Fireproof

AEI MI Cables will not burn and in bare copper form, will not give off any smoke, acid gas or toxic fumes. MI Cables will not add to the spread of fire and will not provide any fuel for it.



Tough and Versatile

AEI MI Cables have a smaller overall diameter compared with other types of cable which, combined with the fully annealed copper sheath, makes the cable easier to handle and install.



Non Ageing

AEI MI Cables have Magnesium Oxide insulation, copper conductors and a solid copper sheath. These inorganic materials ensure that the cable will not deteriorate with age.



Radiation Resistant

The essentially inorganic construction of AEI MI Cable means that the cable is unaffected by radiation. The solid copper sheath provides an effective screen against electro magnetic pulses (EMPs)



High Operating Temperatures

AEI MI Cables will operate indefinitely at temperatures up to 250° C. At temperatures above this, the life of the cable will be reduced, but the cable will continue to operate at temperatures approaching the melting point of copper, 1083°C.



Flameproof Barrier

The densely compacted Magnesium Oxide insulation will prevent the transmission of explosive gases between equipment without any additional sealing.



Applications and Services

Mineral insulated wiring cables are suitable for all general wiring applications, providing a safe durable, high integrity installation.

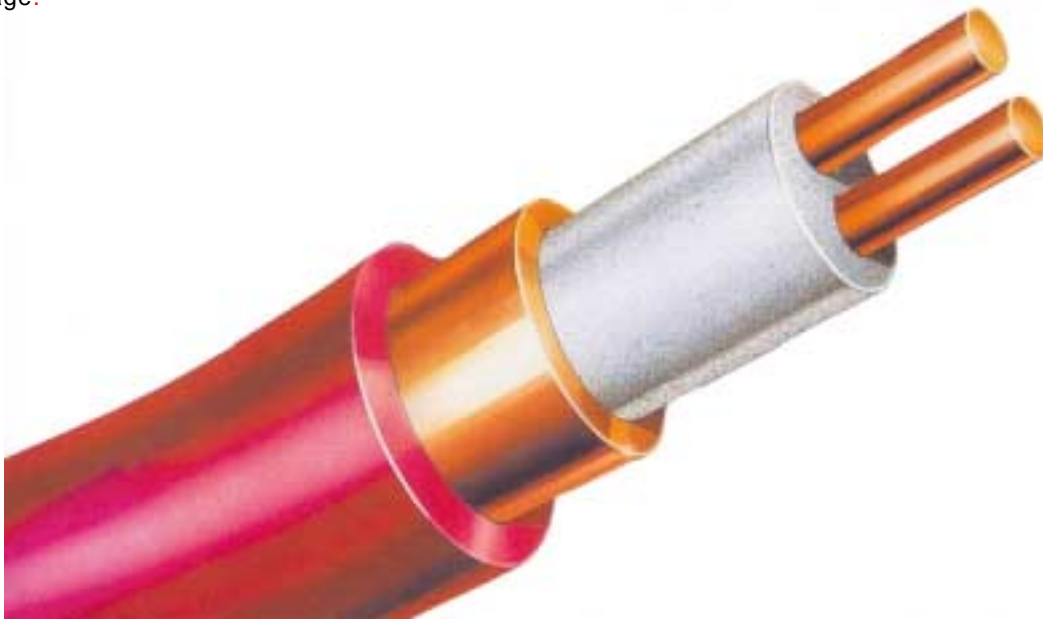
The inorganic construction of MI Cable means that it is a truly fireproof cable, and will continue to operate at temperatures approaching the melting point of copper, 1083°C. This makes MI Cable the ideal choice for critical safety circuits which are required to operate under fire conditions such as smoke extraction fans, fire alarms or emergency lighting

For installations such as historic buildings or churches, for example, the small overall size and pliability means that MI Cables can be installed on the surface, easily following the contours of the stonework, and blending with the structure giving an aesthetically pleasing, safe and durable installation.

On some installations the wiring is repetitive, in hotel rooms, for example, where all socket outlets, lights etc are in the same position. This means that the cable runs in each room are identical. AEI can manufacture 'wiring kits' for installations such as this, where the appropriate sizes of MI Cable are cut to length and terminated at the factory. These are then supplied to site fully tested and ready to install, thus reducing installation time and eliminating wastage.

Training and conference facilities are available at our Bootle factory, where visitors can see at first hand AEI's unique continuous process for the manufacture of MI Cable.

Since the first MI Cable was produced on AEI's automated plant in 1982 many millions of metres have been manufactured and installed throughout the UK and worldwide. Some typical installations are listed on page 15 of this brochure.



Moisture Resistant Insulation

The majority of AEI MI Cables have AEI's unique moisture resistant insulation.

This feature is a major step forward in MI Cable technology, giving the following benefits:



Typical Insulation Resistance reading for traditional MI Cable



Typical Insulation Resistance reading for unsealed AEI Moisture Resistant Insulated Cable, (remains at high level indefinitely)

- No need to leave excess length on exposed cable ends.
- Cables can be tested at any time before or during installation.
- Cables can be tested at any time during the terminating process.
- Low insulation resistance problems due to "leaking" seals are eliminated.

NB. M.I. Cables should be installed by qualified personnel in accordance with the latest edition of the IEE Wiring Regulations (BS 7671).

Fire Performance

AEI MI Cable easily achieves the highest categories, C, W, and Z of BS 6387 (PERFORMANCE REQUIREMENTS OF CABLES REQUIRED TO MAINTAIN CIRCUIT INTEGRITY UNDER FIRE CONDITIONS). There are other types of cable available which will achieve this C, W, and Z category, but generally with these other types the cable sample is changed between the three parts of the test, whereas MI Cable will pass all three parts of this standard on the same cable sample. This, we believe, demonstrates the ultimate performance of MI Cable, capable of maintaining supply to essential equipment under the most adverse conditions.

BS6387

CATEGORY C FIRE ALONE

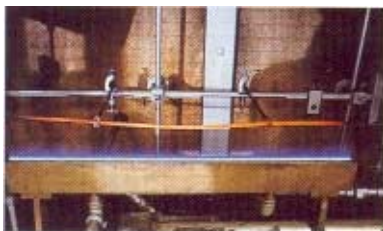
950° C for 3 hours.

CATEGORY W FIRE WITH WATER SPRAY

650° C for 15 mins. followed by water spray for 15 mins.

CATEGORY Z FIRE WITH IMPACT

950° C for 15 mins. with impact.



The full range of AEI MI Cables pass this onerous test

Specifications Approvals and Standards

The Cable

AEI Mineral Insulated Cables are manufactured in accordance with the requirements of British Standard **BS EN 60702** part 1

AEI Mineral Insulated Cables meet the requirement of British Standard BS6387 and IEC Specification IEC331

The Cables meet the requirements of BS6387 at the highest categories of C, W and Z i.e :

Category C

requires the cable to undergo a 3 hour flame test at 950° Centigrade while energised at its rated voltage, without electrical failure.

Category W

requires the energised cable to withstand 15 minutes in a gas flame at 650° Centigrade followed by 15 minutes of water spray while the gas flame is still applied, without electrical failure.

Category Z

requires the cable to withstand 15 minutes in a gas flame at 950° Centigrade while mounted on an artificial wall which is struck repeated blows with a steel bar. The cable is energised at its rated voltage during this test, and no electrical failure may occur.

The Terminations

Cable end seals and glands are manufactured in accordance with the requirements of **BS EN 60702** part 2. Both seals and glands may be used with any cable manufactured to **BS EN 60702** part 1, since dimensions and tolerances are fully specified. Our cable glands conform to the ATEX Directive for equipment for use in Hazardous areas Our Straight through Joint Sleeve is also ATEX Approved.

These Certificates are valid for the dimensional and other relevant requirements of EN50-014 and EN50-018.

Our Increased Safety Seal (type of protection 'e') is also ATEX Approved.

Quality Assurance

Our Quality Assurance System has been assessed independently by the British Approvals Service for Cables (BASEC) and has been certified as complying fully with the requirements of British Standard BSENISO 9001. We hold Certificates Number CS2 - 024 to this effect. This has also been verified by the Loss Prevention Certification Board (LPCB certificate 228) and SIRA(for ATEX)

Product Certification

The full range of Mineral Insulated Cables which we manufacture is covered by Product Certificates issued by BASEC Licence No.036/001 for bare copper sheathed cables, cables with low smoke and fume (LSF) sheaths.

We hold LPCB licence 228a covering the requirements of BS6387 in Categories C, W and Z for the full range of cables.

Cable Selection

Design and Installation Considerations

All AEI MI Cables are available with a bare copper sheath or, alternatively, with a plastic outer covering. Bare copper cables are unobtrusive when installed, and under fire conditions cannot give off corrosive gases or smoke. Plastic covered

AEI MI Cables are recommended when conditions are hostile to bare copper, when circuit identification is required or for aesthetic reasons. The plastic covering is low smoke zero halogen. The table shows the properties of the plastic outer covering.

PROPERTIES OF PLASTIC OUTER COVERINGS						
Type of covering	Order Ref.	Maximum Operating Temp.	Minimum Operating Temp.	HCL Emission	Oxygen Index	Standard Colours Available
Zero Halogen LSF	CCX	80°C	-20°C	Nil	35	Orange White Red

The correct size of cable for a particular application should be selected in accordance with IEE Wiring Regulations (BS7671:2001). The procedure is summarised as follows:

- Determine the minimum acceptable tabulated cable rating I_t . The procedure for calculating I_t is described in Appendix 4 of the IEE Regulations.
- Select the method of installation to be used from the "Schedule of Methods of Installation of Cables" in Table 4A of the IEE Regulations .
- Select a cable having a current rating equal to or greater than the calculated value of I_t from Appendix 4 of the Regulations.
- Carry out the calculation detailed in Appendix 4 to ensure that the volt drop using the selected cable will be less than 4% of the nominal supply voltage (Regulation 525). It should be noted that it may be necessary to include correction factors for conductor temperature, starting currents as per manufacturers recommendations and power factor in this calculation.
- Check the protection against indirect contact constraints to ensure that the maximum earth fault loop impedance (Z_s) for the selected cable when installed will be less than the values stated in Regulation 413 Table 4J1B or 4J2B for the chosen protective device.
($Z_s = Z_e + (R1 + R2)$).
The values of $R1 + R2$ for AEI MI Cables are given on page 8 of this booklet. The value of Z_e must be calculated or obtained from the supply authority.
- Check the size of the circuit protective conductor (the sheath in the case of AEI MI Cables) to ensure that the thermal constraints are satisfied. The requirements are stated in Regulation 543-01-01. AEI MI Cables always satisfy the requirements of Table 54G (Regulation 543-01-04) and no calculation is necessary. Cross sectional areas of cable sheaths are given on page 8 for direct comparison with Table 54G of the Regulations.
- Finally check that the protection against fault current constraints are satisfied (Regulation 434).
- After establishing the cable size see page 8 of this booklet for ordering references.

The Product Range

Light Duty Cable (500v)

Cable ref	Conductors		Cables exposed to touch			Sheath effective c/s area (mm ²)	Earth fault loop impedance (R ₁ +R ₂) (ohm/km)	Maximum conductor resistance (ohm/km at 20°C)
	Number	Size (mm ²)	Current Rating		Volt drop			
			Bare (A)	LSF covered (A)	mV/Amp/m			
2L1.0	2	1.0	16.5	18.5	42.0	5.4	30.7	18.1
2L1.5	2	1.5	21.0	23.0	28.0	6.3	21.2	12.1
2L2.5	2	2.5	28.0	31.0	17.0	8.2	13.3	7.4
2L4.0	2	4.0	36.0	40.0	10.0	10.7	8.6	4.6
3L1.0	3	1.0	13.5	15.0	36.0	6.7	30.0	18.1
3L1.5	3	1.5	17.0	19.0	24.0	7.8	20.6	12.1
3L2.5	3	2.5	23.5	26.0	14.0	9.5	12.9	7.4
4L10	4	1.0	13.5	15.0	36.0	7.7	29.6	18.1
4L1.5	4	1.5	17.5	19.5	24.0	9.1	20.2	12.1
4L2.5	4	2.5	23.5	26.0	14.0	11.3	12.5	7.4
7L1.5	7	1.5	12.0	13.0	28.0	11.8	19.7	12.1
7L2.5	7	2.5	16.0	17.5	17.0	15.4	12.1	7.4

Heavy Duty Cable (750v)

1H6.0	1	6.0	47.0	52.0	6.0	8.0	5.3	3.1
1H10.0	1	10.0	63.0	70.0	3.6	9.0	3.4	1.8
1H16.0	1	16.0	83.0	92.0	2.3	12.0	2.3	1.2
1H25.0	1	25.0	108.0	120.0	1.5	15.0	1.5	0.7
1H35.0	1	35.0	132.0	147.0	1.1	18.0	1.2	0.5
1H50.0	1	50.0	163.0	181.0	0.8	22.0	0.9	0.4
1H70.0	1	70.0	199.0	221.0	0.6	27.0	0.6	0.3
1H95.0	1	95.0	238.0	264.0	0.4	32.0	0.5	0.2
1H120.0	1	120.0	273.0	303.0	0.3	37.0	0.4	0.2
1H150.0	1	150.0	311.0	346.0	0.3	44.0	0.3	0.1
1H185.0	1	185.0	353.0	392.0	0.3	54.0	0.3	0.1
1H240.0	1	240.0	411.0	457.0	0.2	70.0	0.2	0.1
1H300.0	1	300.0	595.0	661.0	0.2	87.0	0.2	0.1
2H1.5	2	1.5	22.5	25.0	28.0	11.0	19.8	12.1
2H2.5	2	2.5	31.0	34.0	17.0	13.0	12.4	7.4
2H4.0	2	4.0	41.0	45.0	10.0	16.0	8.0	4.6
2H6.0	2	6.0	51.0	57.0	7.0	18.0	5.6	3.1
2H10.0	2	10.0	69.0	77.0	4.2	24.0	3.6	1.8
2H16.0	2	16.0	92.0	102.0	2.6	30.0	2.4	1.2
2H25.0	2	25.0	120.0	133.0	1.7	38.0	1.6	0.7
3H1.5	3	1.5	19.0	21.0	24.0	12.0	19.6	12.1
3H2.5	3	2.5	25.0	28.0	14.0	14.0	12.2	7.4
3H4.0	3	4.0	33.0	37.0	9.1	17.0	7.9	4.6
3H6.0	3	6.0	43.0	48.0	6.0	20.0	5.5	3.1
3H10.0	3	10.0	59.0	65.0	3.6	27.0	3.5	1.8
3H16.0	3	16.0	77.0	86.0	2.3	34.0	2.3	1.2
3H25.0	3	25.0	101.0	112.0	1.5	42.0	1.6	0.7
4H1.5	4	1.5	19.0	21.0	24.0	14.0	19.4	12.1
4H2.5	4	2.5	25.0	28.0	14.0	16.0	12.0	7.4
4H4.0	4	4.0	33.0	37.0	9.1	20.0	7.7	4.6
4H6.0	4	6.0	42.0	47.0	6.0	24.0	5.4	3.1
4H10.0	4	10.0	58.0	64.0	3.6	30.0	3.4	1.8
4H16.0	4	16.0	77.0	85.0	2.3	39.0	2.2	1.2
4H25.0	4	25.0	99.0	110.0	1.5	49.0	1.5	0.7
7H1.5	7	1.5	13.0	14.5	28.0	18.0	19.0	12.1
7H2.5	7	2.5	17.5	19.5	17.0	22.0	11.7	7.4
12H2.5	12	2.5	14.5	16.0	17.0	34.0	11.4	7.4
19H1.5	19	1.5	9.0	10.0	28.0	37.0	18.5	12.1

Notes:

Current ratings and volt drops are based on Tables 4J1A and 4J1B of the 16th edition of the IEE Wiring Regulations (BS 7671:2001), using Reference Method 1. The figures for 2, 7, 12 & 19 core cables are for single phase operation. All other figures are for 3 phase operation.

The Complete Termination

Termination Procedure

The illustration shows a complete 105°C termination consisting of a seal, gland and shroud. (The sealing compound used to fill the pot has been omitted for clarity.)

Gland
Ref: RGM

Seal
Ref: RPS plain)
RPSL (earth Tail)

Shroud
Ref: RHG (PVC)
RXG (LSF)

The following procedure shows a standard 105°C termination being



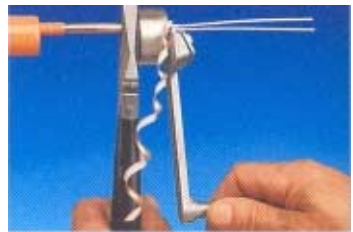
1 . Saw the cable to produce a square end.



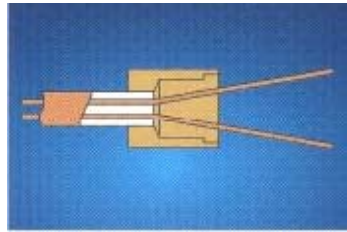
2. Hold the shroud against the cable and cut the taper as shown. Fit the gland shroud.



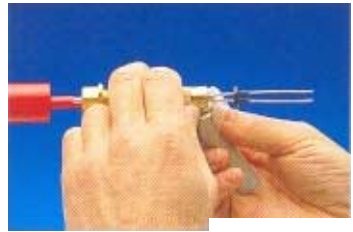
6. For the larger cable sizes or as an alternative to the MIC Stripper the ZSU stripping tool can be used.



6. Finish the stripping operation by gripping the cable sheath with pliers and rotating the tool against the pliers.



9. The pot should be screwed onto the cable sheath to the position shown. Earth tail pots may need screwing on slightly further to correctly position the earth wire.



10. Fill the pot with compound. Push the compound into the pot from one side only until the pot is full. Remove the excess compound



12. For seals using stub caps, cut the sleeving to length and push over the stubs.



13. The other end of the cable should now be terminated in the same way

Terminations.....cont'd

fitted to a 2 core cable. *



3 Strip the plastic outer covering for the required length.



4. Push the MIC Stripper onto the cable using finger and thumb. Rotate clockwise to start cutting. Support the cable by holding as close to the tool as possible.



7. Insert the pot into the Easipot tool as shown. Tighten the Easipot handle to grip the pot.



8. Screw the pot onto the cable. Alternatively, the pot can be screwed on using pliers or grips.

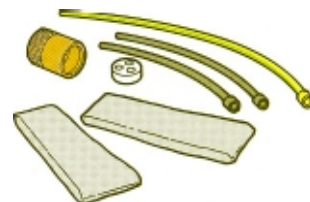


11. Press the stub cap into the pot, feed the conductors into the crimp. Slowly squeeze the crimp until fully closed.

A complete termination for an MI Cable consists of a gland, a seal, and if plastic covered cable is used, a gland shroud. The 105°C Version on a 2 core cable which is the most commonly used seal is illustrated on page 10. The various types of seal available are shown below. The gland and pot are the same for all the different types of seal, the differences being in the sealing compounds,



Standard Seal
Temperature Range -80°C to 105°C
Reference:
RPS for plain seal.
RPSL for earth tail seal



Medium Temperature Seal
Temperature Range 105°C to 150°C
Reference:
RPCD for plain seal.
RPCN for earth tail seal.

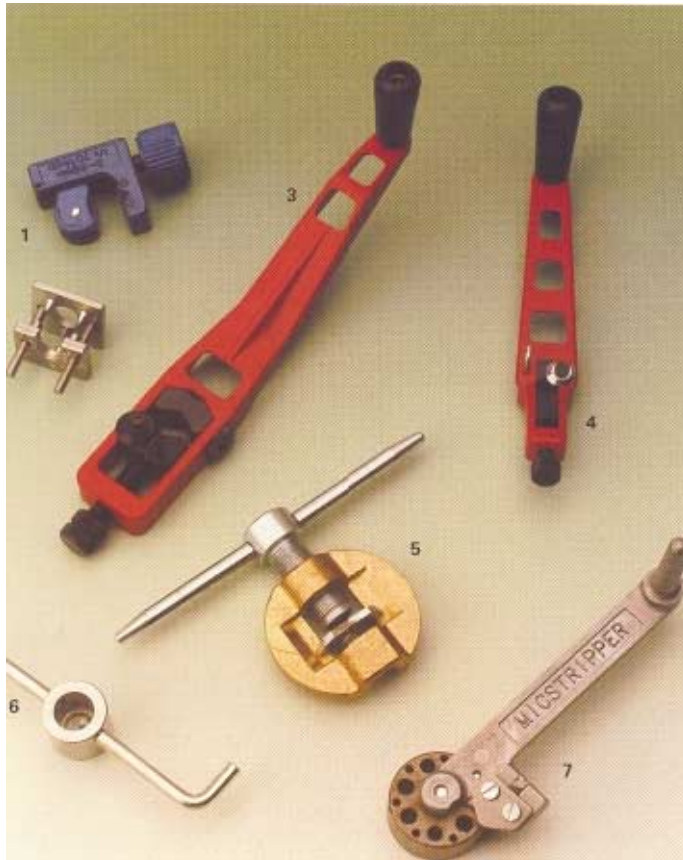


Increased Safety Seal
Temperature Range -20°C to 100°C
Reference:
RPMAA for plain seal
RPMKA for earth tail seal.

Installation Tools

A range of tools is available for stripping the cable sheath, fitting the pot and crimping the pot.

There are also bending levers available to assist in the manipulation of larger cables and a straightening tool for the smaller cables.



1. Ringing Tool

For indenting the sheath circumferentially, to produce a square finish when either sidecutters, or a fork-ended stripper is used for stripping the sheath. Suitable for all cable sizes. Ref: ZR.

2. Plate Type Crimp

An expendable tool for crimping the cap into the pot seal. It is available for all seal sizes. Ref: ZDD followed by 20, 25, 32 or 40.

3. Large Stripper

Suitable for all cable sizes, except 1 H240. Ref: ZSU

4. Small Stripper

Suitable for cable sizes below 9mm in diameter Ref: ZSUS

5. Crimping

As an alternative to the Easicrimp the Handcrimp is available for securing the cap into position. Two sizes are available for 20mm and 25mm pots. Ref ZDC20 or rZDC25.

6. Easipot

This Tool is used to screw the pot on to the cable sheath. Two sizes are available for 20 and 25mm seals Ref: ZPE20,ZPE25

7. MICstripper

A popular tool for stripping the cable sheath on the following sizes of cable: 2L1, 2L1.5, 2L2.5, 3L1, 3L1.5, 4L1 AND 4L1.5 Ref: ZSJ

Clips and Fixings

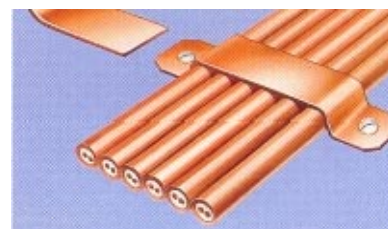
IEE Regulation 522-08-04 states “Where a conductor or cable is not continuously supported it shall be supported by suitable means at intervals in such a manner that the conductor or cable does not suffer damage by its own weight”. A full range of one hole clips and 2 way saddles is available from AEI either in bare copper or plastic covered (Red, Orange or White).

When more than 2 cables are run together a saddle can be formed using copper fixing strip. The strip is available in 2 widths, 12mm and 18mm, in bare copper or plastic coated in 5m coils, and is pre-punched to ease installation.

Fixing to Cable Tray, use either:

1. AEI Fixing Strap
2. Stainless Steel Ties (readily available from a number of suppliers)

NOTE: The plastic covering on all clips saddles and strip supplied by AEI is Low Smoke and Fume (LSF) material.



NOTE: As a general guide for cables run horizontally, fixings should be at a distance of approximately 50 times the cable diameter. For vertical runs a distance of approximately 100 times the cable diameter is usually acceptable. The fixing distance is usually varied to suit local site conditions.

Clip & Saddle Dimensions

Size Reference Bare or Plastic Covered	Fixing Hole Diameter (mm)	Wood Screw Size (mm)	Metric Bolt Size (mm)
20 – 28	4	No. 6	3
30 – 40	5.2	No. 8	5
43 – 63	5.6	No. 10	5
67 – 105	7.2	No. 14	6

Size Reference Bare or Plastic Covered	Fixing Hole Centres (mm)	Fixing Hole Diameter (mm)	Wood Screw Size(mm)	Metric Bolt Size(mm)
202 – 302	26.6	4	No. 6	3
342 – 422	35.6	5.2	No. 8	5
462 – 632	48.3	5.6	No. 10	5
702 – 812	61	7.2	No. 14	6
932 - 1042	73	7.2	No. 14	6

Testing and Commissioning

Cables with Moisture Resistant Insulation

These sizes of cable can be tested at any time before or during installation. The standard electrician's 500 Volt Insulation Resistance tester would normally be used for this testing and should give readings in excess of 100 Megohms on a single isolated length of cable. In some instances, however, where the termination has been fitted in a difficult location for example, the electrician can test the cable with only this one seal fitted correctly before he terminated the cable at the other end.

Low Insulation Resistance Readings

The insulation resistance on an isolated length of AEI MI Cable which has been fitted with standard seals should be in excess of 100 megohms. The larger sizes of cable have standard insulation and may not achieve this reading for up to 24 hours after the terminations have been fitted. If the readings are less than 100 megohms after the 24 hour period has elapsed then it is possible that one of the seals has been incorrectly fitted. Seals which allow moisture into the cable are usually known as "breathing seals". A simple test can be carried out using a standard insulation resistance tester and a match or cigarette lighter. (see example below)

Low Insulation Resistance Readings .. cont'd

After determining which is the faulty seal, remove the seal from the cable by prising out the disc, and unscrewing the pot. Then strip the cable sheath back for a short distance, say 3mm. Fit a completely new seal to the cable and carry out the testing routine as before where this initial reading should be noted, then a second reading taken 24 hours later should give 100 megohms or more. If an immediate high reading is necessary then after the faulty seal has been removed the cable can be dried out using a blow lamp.

Start this heating operation approximately 0.5 metres from the end, slowly moving along to the end. If the cable has a plastic outer covering it will be necessary to strip this back. After the cable has cooled sufficiently the new seal can be fitted.



Reading on insulation resistance tester will fall if there is moisture in the cable, (if seal is faulty).

Packaging

AEI's High Technology Continuous Process has enabled MI Cables to be manufactured in lengths of up to 5km, under rigorous quality controlled conditions

Our cables can be supplied in long factory lengths on wooden drums, thus facilitating handling on site, and reducing the wastage associated with shorter lengths. For availability of long lengths contact AEI Cables Ltd., Birtley.



Health and Safety

Care should be taken when terminating mineral insulated cable to prevent sharp metal edges from cutting the skin, or powdered insulant causing irritation by entering the eyes. Gloves and protective spectacles can be used to prevent this. Detailed information is available from AEI Cables Limited, Birtley.

If you wish to receive more detailed information about our cable range, please contact us by e-mail :

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