Pyrosales
Total Sensor Solutions

INSTALLATION INSTRUCTIONS

for MICC Fireproof Wiring Cable

TRM & MICC
Cables for Life

TERMINATING THE CABLE

PREPARING THE CABLE END

Cut the cable to the length required allowing for the appropriate length of conductor tails. Ensure that the cable end is cut off squarely for ease of subsequent stripping. Where PVC over sheathed cable is being used the P.V.C. should be cut back prior to stripping the copper sheath.

Mark the point to which the copper sheath is to be stripped back to expose conductors.

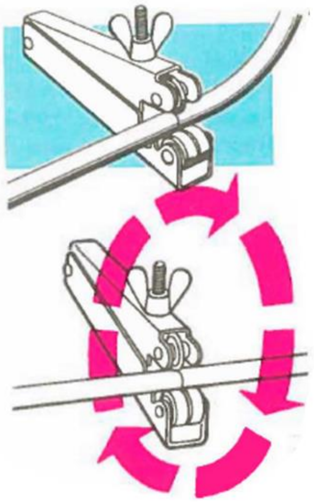
Remove sheath, using one of the three methods described overleaf, but ensure that after stripping the cable end is squared off and clean and free from burrs.

Clean conductors thoroughly, removing all surplus magnesia.

Once the cable end has been prepared it is important to complete the fitting of a termination as quickly as possible so as to exclude the entry of moisture and thus obtain a high insulation resistance reading.

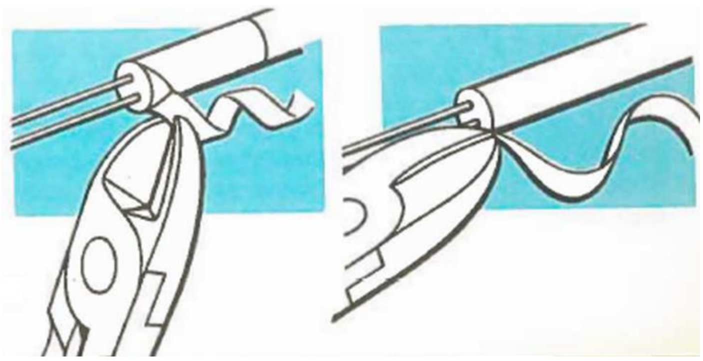
FOUR METHODS OF REMOVING SHEATH

Method* 1 - *Using side-cutting pliers
MARK THE sheath at the point to which the sheath is to be stripped, using the sheath cutter to indent the sheath.
Fit the tool to the cable and tighten the wing nut until the cutting wheel is in contact with the sheath. Turn the wing nut an additional quarter turn.

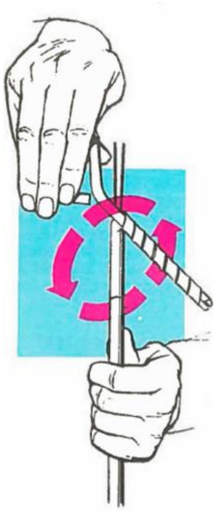


Revolve the sheath cutter around the cable. ·It is important to note that the sheath *must not be cut through* but only indented if a .satisfactory clean cut is to be achieved when stripping. Remove the tool.

Using side-cutting pliers, make a small tear in the end of the sheath. The tear is then firmly gripped with the pliers and by twisting the pliers around the sheath it is easily removed in a spiral. Take care on approaching the indented mark to obtain a clean end to the sheath, free from burrs.

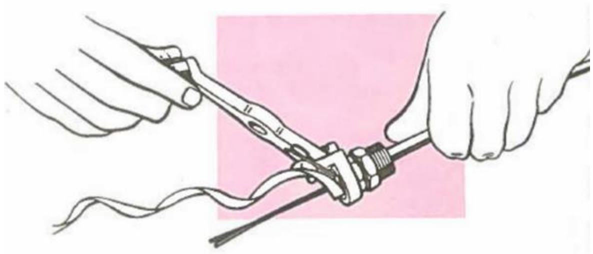


Method 2 - Using fork-ended sheath stripper
PROCEED AS in Method 1 up to the point of making a tear in the sheath with the side cutting pliers.



Fit the fork end of the stripper over the tear and revolve the tool at an angle around the sheath until approaching the indentation when the tool should be positioned alongside and parallel to the cable to ensure a clean break on completion of stripping. Should the amount to be stripped exceed the length of shaft on the tool simply grip the spiral of sheathing already on the shaft and by twisting the tool draw it up the spiral and continue with the stripping operation. If necessary part of the spiral can be cut off with the pliers.

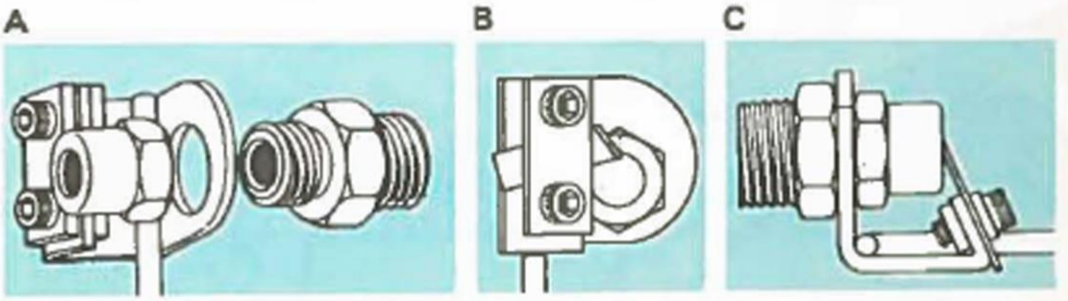
Method 3 - Using rotary stripper / pot wrench tool

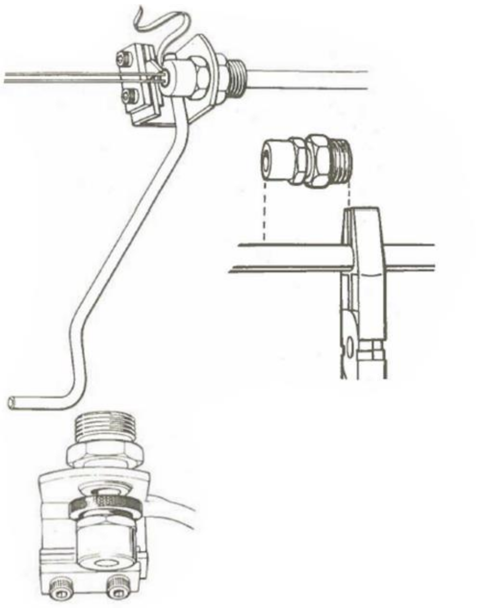


THIS COMPACT TOOL provides the quickest and most efficient means for stripping the cable sheath to fit the popular I inch size gland. To use the tool, first saw the cable to length and straighten the portion to be stripped. Place gland in tool with back end of gland nut in contact with cutting blade. Set blade by slackening off the wing nut and rotating setting wheel until the cutting edge of the blade in use just clears the thickness of the sheath without fouling the conductors. Tighten wing nut; secure gland by means of the locking screw; insert cable end into gland, apply forward pressure and rotate the handle clockwise.

Method 4 - Using rotary stripping tool
THIS TOOL is now available in 1 inch and 11 inch sizes only. It is used like this: Place gland in tool (A) and lock it securely, using spanners. Set cutting blade so that its edge just clears the thickness of the sheath without fouling the conductors; it .should protrude just beyond the half-way mark, which can be pencilled on the gland (B). Ensure blade is in pressure contact with gland (C) and tighten holding down bolts. Insert cable end into gland, apply pressure and rotate tool in clockwise direction so that the blade engages the sheath. Spare cutting blades are obtainable from any MICC Branch Office.

SPACER WASHER FOR USE WITH NEWGLANDASSEMBLIES 'THE REDUCED overall length of the rationalized design of gland necessitates the use of a spacing washer if the earlier type I inch rotary stripping tool is being used. These spacing washers are obtainable free of charge from any MICC Branch Office.





Just clears the thickness of the sheath without fouling the conductors; it .should protrude just beyond the half-way mark, which can be pencilled on the gland (B). Ensure blade is in pressure contact with gland (C) and tighten holding down bolts. Insert cable end into gland, apply pressure and rotate tool in clockwise direction so that the blade engages the sheath. Spare cutting blades are obtainable from any MICC Branch Office.

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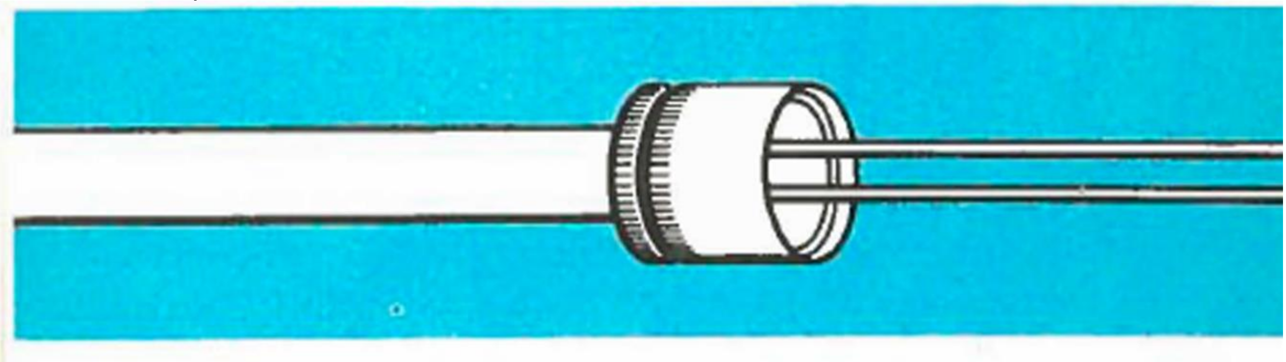
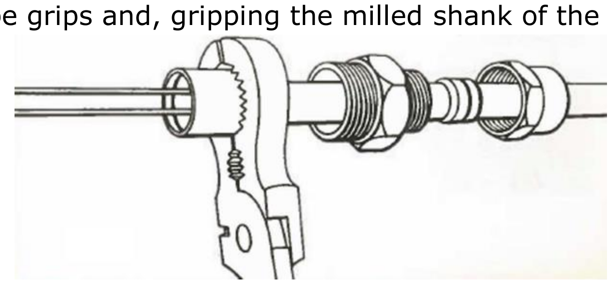
FITTING THE SEAL

BEFORE FITTING commences check (i) whether or not a hood or shroud is to be used, or (ii) whether or not a gland is required - as these should of course be slid on to the cable prior to screwing on the pot. If a pot wrench is to be used for screwing on the pot, the gland is put on the cable at the same time as the pot wrench. Check the pot for cleanliness and remove any loose metallic particles.



Method* 1 - *Screwing on the pot using pipe grips or pliers

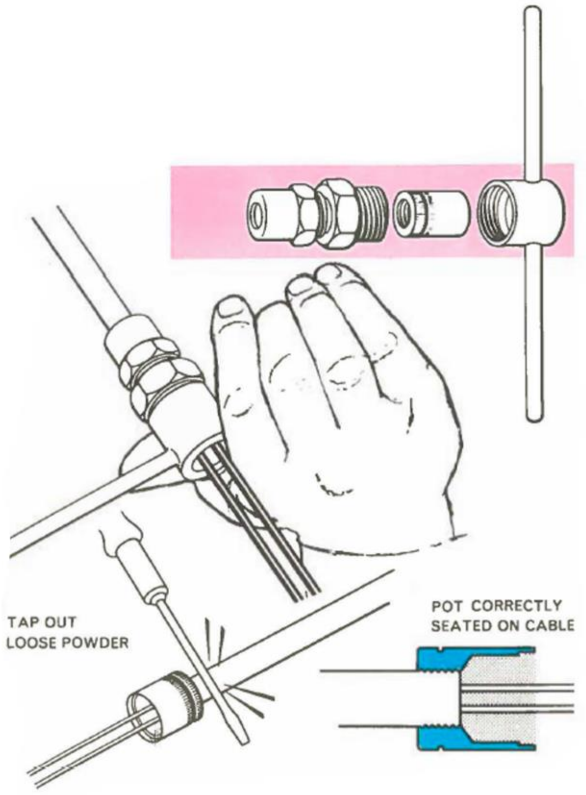
THE POT has self-cutting threads and by pushing the pot squarely on to the cable these can be engaged finger tight. Take a pair of pliers or pipe grips and, gripping the milled shank of the pot, screw the pot down the cable sheath until either the lip of the sheath is level with shoulder inside the pot or alternatively the threads begin to bind. If a gland is being employed check from time to time during the screwing operation that the pot can be housed in its normal position in the gland.

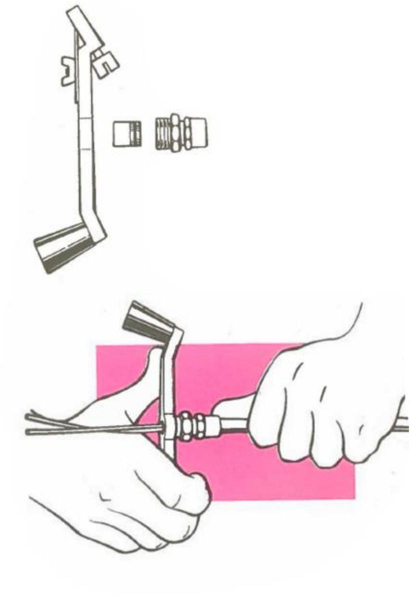


Method 2 Using pot wrench tool

THIS IS a much quicker, easier and more positive method of attaching the pot. Because the pot is housed in its normal position in the gland during the screwing operation, this tool ensures that the pot 'will screw on squarely.

Position the tool, pot and gland as shown. Screw the land into the tool so that the pot is firmly held between them. Push the assembly over the cable sheath, gland first, making sure that the gland compression ring does not foul the cable. Rotate the tool, applying forward pressure, until the pot is properly screwed home. To free the tool simply unscrew the gland.



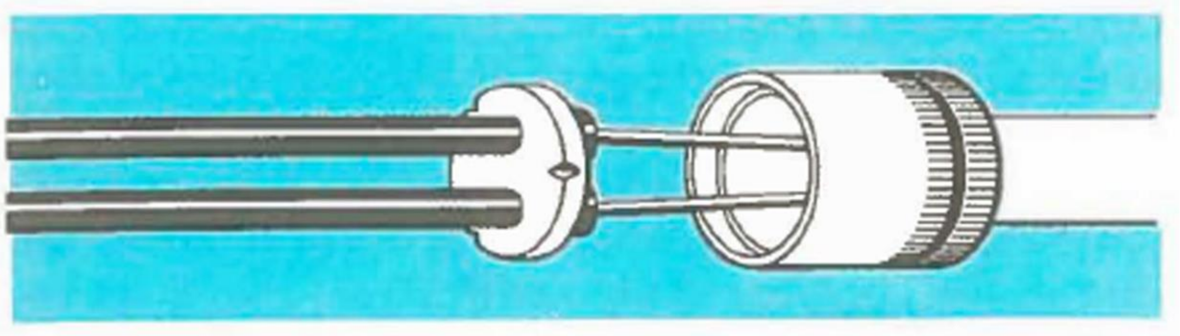


Method 3
Using rotary stripper / pot wrench tool

This combination tool has the same features as the pot wrench tool described on Page 59. To use, position the gland, pot and tool as shown. Screw up the gland finger tight. Push the assembly, gland first, over the cable sheath. Applying forward pressure, rotate the tool until the pot is properly screwed home. To free the tool unscrew the gland. In all cases, after the pot has been screwed on, it is vitally important to remove all loose powder by tapping the sheath or shaking the end of the cable.

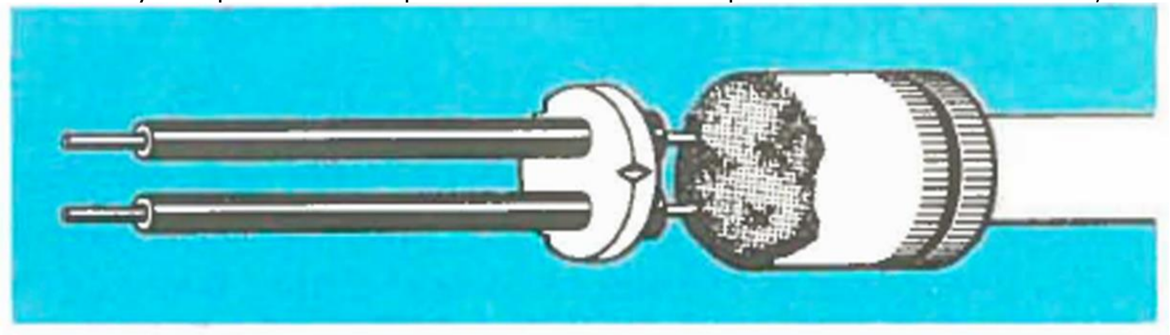
FITTING DISCS AND SLEEVES

CUT THE headed sleeves to the required length and thread these through the holes in the disc; pull the moulded head up tightly against the disc. Next, thread the sleeves over the conductors with the moulded heads nearest the pot. Slide the assembly down to the mouth of the pot and check the fit. Position the assembly part way along the conductors so that the compound can be put into the pot.



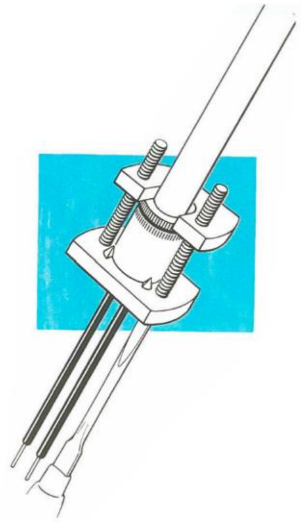
FILLING WITH COMPOUND

Press the compound firmly into the pot from one side only to avoid air pockets forming. Use an adequate amount of compound so that a small mound is created beyond the mouth of the pot. Hands should be clean to avoid any extraneous matter being introduced with the compound. Protect any compound that is put aside so that it is kept clean and free from dust, etc.



CRIMPING THE SEAL

PRESS THE disc and sleeve assembly down with finger and thumb into the mouth of the pot and remove any surplus compound that oozes out from between disc and pot. There should be sufficient compound to prevent full seating of the disc in the pot with finger pressure- note that crimping tool will achieve this during the final operation.



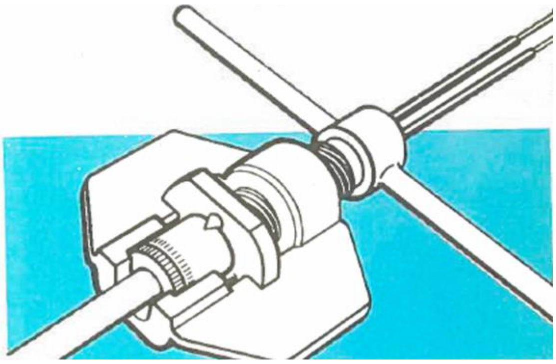
Always check that the heads of the sleeves have been pulled up tightly behind the disc. In order to seat and ~ retain the disc in position, the mouth of the pot is crimped at three points around the circumference. Depending upon the material the di sc may be notched on the outer edge, these notches being lined up with the crimping pins on the tool. This will ease the crimping operation, although this can, in fact, be done fairly easily at any point on the circumference.
Two types of crimping tool are available and are used in the manner described below.

Method* 1 – *Pyro X Crimp
THIS SIMPLE tool will perform up to 100 crimping operations, but immediately any wear on the tool becomes apparent it should be scrapped. To use the tool, slacken the bolts and thread the conductors through the hole in the top plate, slipping the bottom plate into position below the pot. Screw down each of the bolts a little at a time bringing the crimping pins into contact with the edge of the pot.
When the top plate lies flush with the mouth of the pot the crimping operation is complete. Unscrew the bolts and withdraw the tool.

Method* 2 – *Pyro Crimp
This excellent tool is simple to use and will give many thousands of effortless crimping operations not only speedily but also accurately. Simple insert the conductors up through the handle of the tool which should be unscrewed so that the pot can be positioned in the nest. On screwing down the handle the crimping plate is brought swiftly and surely into contact with the pot.

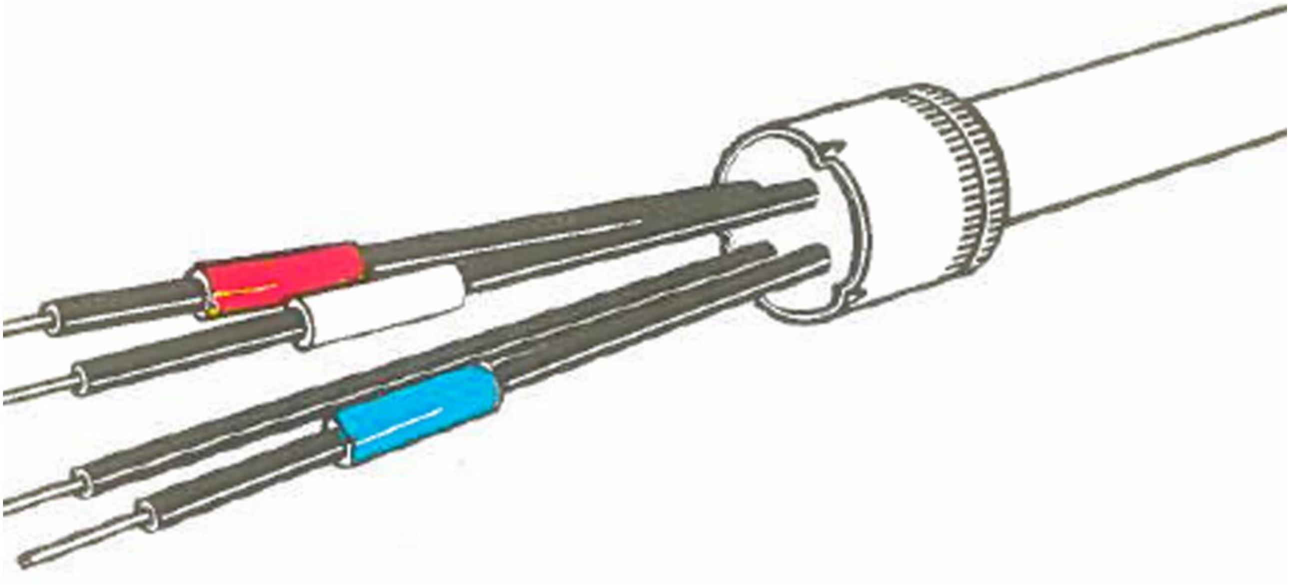
After crimping, the sealing operation is now complete. However, always wipe away and surplus compound that has been forced out of the pot as a result of the pressure built up during the crimping.

This pressure ensures that the compound has been forced down on to the face of the insulation of the cable as well as up the insulating sleeves. Inspect the seal to see that the disc has been seated properly, that the sleeve have not been pushed down into the pot, and that a satisfactory crimp has been achieved.

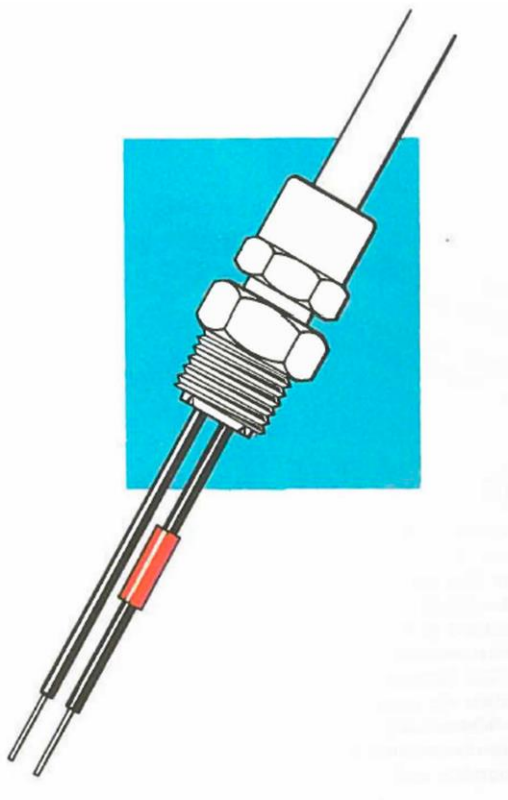


This method of making off the seal is exactly the same for either the standard of the medium temperature seal.

IDENTIFYING CONDUCTORS
Identification of conductors is normally done on completion of the sealing operation. This may be carried out by using PVC extension sleeving, which is available in a range of colours and is a sliding fit over the seal sleeves.
Alternatively PVC adhesive tape can be supplied either half inch of 5/8 inch width and in eight colours.
We recommend that you make a practice of following the colour combination laid down in IEE Regulations 14th Edition, Table B4.



TESTING THE INSTALLATION



The insulation resistance of each length of MI cable may now be tested and as the normal insulation tester is used for this operation it can be combined with the job of identifying conductors, thus dispensing with the often used bell and battery. An infinity reading on a 500 or 1000 volt instrument should be obtained.

The terminating procedure is now completed and the cables are ready for connecting up.

Where a gland is used this may now be brought into position to house the pot seal and the termination is complete and ready to connect to the box or apparatus.

For a screwed entry, pass the conductors into the box and screw the gland firmly into the box entry. Only after this has been locked into position should the back nut of the gland be tightened to sink the compression ring on to the sheath of the cable.

For a plain hole entry push the gland through the hole and secure inside the box by means of a locknut or locking ring. Again after connection to the box lock up the back nut of the gland.

The same procedure is adopted for either standard or flameproof type glands but, of course, with an E.S. gland instead of locking up the back nut on the compression ring it is necessary to tighten the two earthing screws on to the sheath.

Although reducers and increasers are available and are described in the Accessories Section of this booklet these should rarely be necessary with the MICC standard range of glands with entry threads matching present-day boxes.

CONDUCTOR CONNECTIONS

SECTION FOR section a solid conductor (as in an M.1. cable) has a smaller diameter than a conventional stranded conductor. Since M.I. cable~ also have a higher current carrying capacity than other cables you can at times use a smaller conductor size than is possible with rubber or thermoplastic cables. You might therefore find that the connectors on meters and fuse boards are too large for the M.I. cable conductors. Do not be misled by the mistaken theory that it is then necessary to increase the conductor size by binding it with fine wire and tinning or soldering on a brass ferrule. This procedure is suspect because it may increase the contact resistance. Certainly where possible double back the conductor, particularly on the smaller sizes, otherwise ensure that the connector screws are bearing directly on the conductor. You should use lugs for conductors of 0·007 square inch and larger where possible.

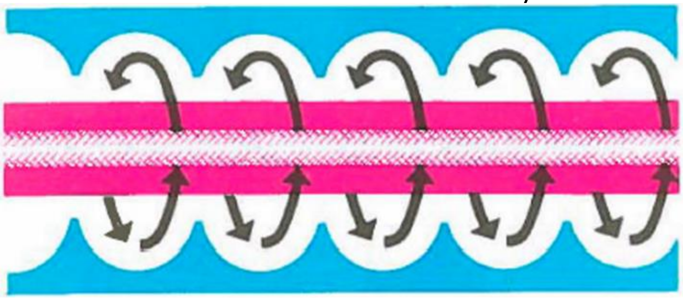
Two types of lug as described on pages 3 I and 127 are recommended. In addition MICC BURNDY provide a comprehensive range of crimped connectors especially for M.I. cables and details are given on page 36.

PARTICULAR TYPES OF INSTALLATION

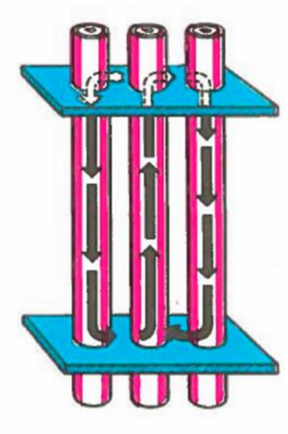
We have so far dealt with a standard and straightforward job of installing and connecting M.I. cable. We now turn to particular aspects of installation which may crop up from time to time.

RUNNING LARGE SINGLE CONDUCTOR CABLES

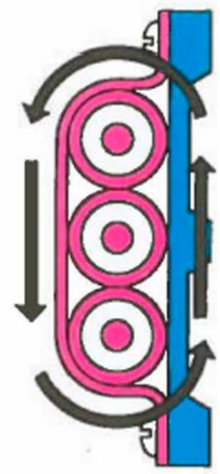
BY AND LARGE there is no problem about running large single conductor cables but it is necessary to recognise that sheath losses will occur on a.c. systems in two ways:



Eddy currents which circulate around the sheath (see illustration above).
Circulating currents which travel through the cable sheath in a longitudinal direction (See illustration below).



On a 50 cycle supply the losses from eddy currents are very small and can be ignored. In the case of circulating currents these also may be unimportant but the following points should be borne in mind.



If large single conductor cables are required to pass through ferrous plates at each end, as found in switchgear, bus bar chambers and the like, it may be found that as the cables come under load, these plates will become warm or, in exceptional circumstances, quite hot. This may not create any problem unless they are too hot for the cable terminations or adjacent fittings. If the cables are carrying only moderate currents, say around 100 amps, it will probably be sufficient to overcome the difficulty by simply putting a slot in the plate through the centre line of the cable. If such plates exist at both ends of the run then both should be slotted. Should the cables be carrying heavy loads and there are dangers of overheating then the ferrous end plates of the switchgear should be replaced with brass or aluminium plates, or alternatively (provided earthing arrangements are satisfactory) insulating plates of Tufnol or teak may be used.

When running large single conductor cables they should not be spaced apart but should be in trefoil formation or certainly in very close proximity to one another. Circulation of air around the cables will obviously be beneficial and this can be improved by the use of standoff or spacer bar saddles, as shown above.

FLAMEPROOF WIRING

WHERE A FLAMEPROOF system is required M.I. cables must be a first choice by reason of their fireproof qualities. This system, which has technical and economic advantages, is extensively used for a variety of flameproof applications ranging from small motors to complete industrial flame proof installations.

MICC flameproof glands, which incorporate a longer threaded body, are approved by the Ministry of Power for use with certified enclosures in atmospheres containing Groups II and III gases as defined in B.S.229 : 1957.

Straight through joints for flameproof use (see page 128) incorporate a brass sleeve. Two flameproof glands joined by the brass sleeve constitute a flameproof straight joint. Since M.I. cable is itself fireproof, there is obviously no necessity to install it in conduit. The ease of installation resulting from the elimination of heavy conduit makes the work lighter, simpler, quicker and therefore less costly.

In the event of a fire, it is desirable that the alarm and other circuits should continue to operate, however extreme the conditions, and M.I. cables are of course ideal, as they will continue to operate in temperatures up to l000°C.

Whilst the system of M.I. cable and flameproof terminations is ideal it must be remembered that all other fittings and boxes must also be of the flameproof type and meet the appropriate regulations.

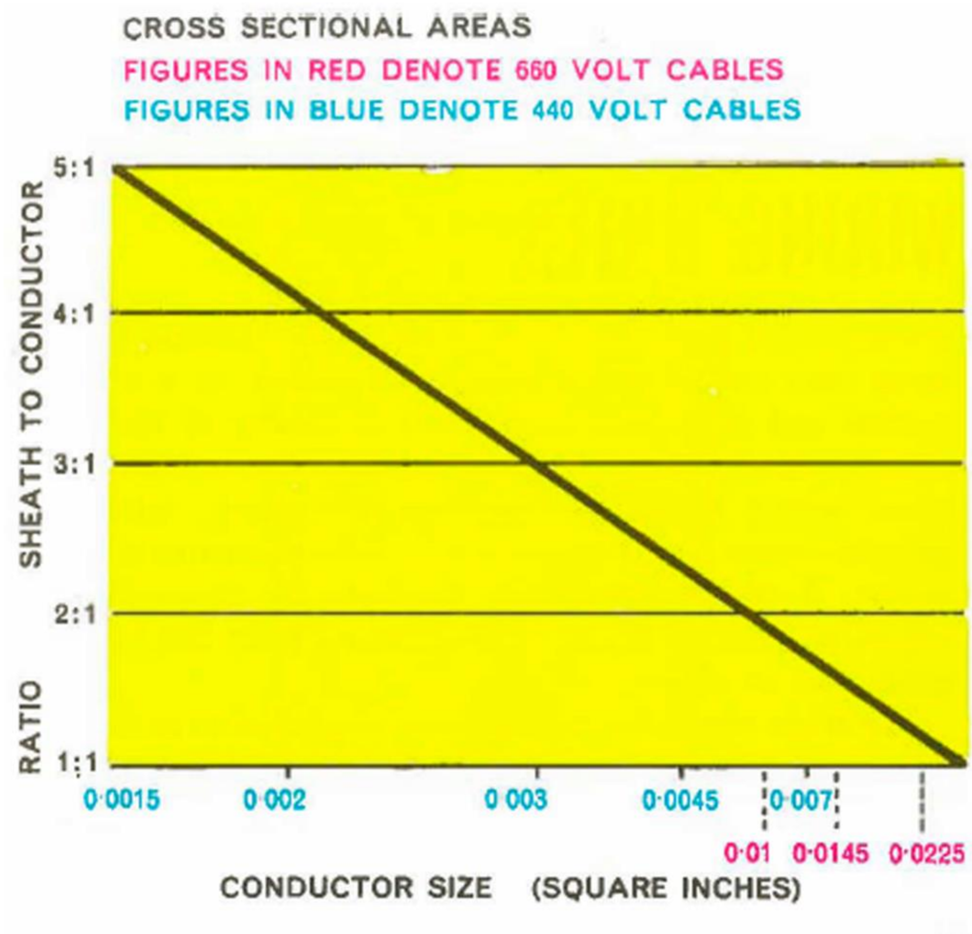
In the case of inductive circuits it is important to suppress any surges which may be generated.

CONCENTRIC WIRING

BARE OR P.V.C. copper sheathed M.I. cables are eminently suitable for use on concentric or earthed concentric wiring systems, both of which utilize the copper sheath of the cable as the return lead.

It will be appreciated that a single-conductor cable can be used in place of the conventional twin, and on three-phase circuits a three conductor cable would be used to convey a three phase and neutral supply.

Cost is reduced not only because of the absence of one conductor but also from the reduction in the overall diameter of the cable. Particularly with the smaller cables, the conductivity of the sheath is so high that practically all the voltage drop takes place in the conductor. This means that the length of run for a given voltage drop is considerably higher than that of a corresponding system using two conductors. This applies to a lesser degree to the larger cables, although as the cable size is increased the resistance of the sheath approaches that of the conductor until, at a conductor size of 0·0225 square inch, they are approximately equal (at W°C). This is the size of the largest single-conductor cable that can be used as a concentric cable.



Multi-conductor cables can, however, be used no matter what their size, since in all cases their sheaths are more conductive than anyone conductor.

Regulation number BI24 of the 14th Edition of the I.E.E. Regulations states "At every joint in the external conductor and at terminations, the continuity of that conductor shall be ensured by a bonding conductor additional to the means used for sealing and clamping the external conductor. The resistance of the bonding conductor shall not exceed that specified in Regulation BI22 for the external conductor".

A convenient method of achieving this bonding is to fit the earth-tail type of sealing pot in place of the standard type, when terminating the cable. The ratings for mineral insulated cables used in this way are shown in Table 5. Concentric or earthed concentric wiring systems when used on a public supply network are subject to a number of conditions. These special conditions are laid down by the I.E.E. and are covered by Regulations Bl19-B124 (14th Edition).

WIRING UNITS

MODERN MASS PRODUCTION methods, in the building trades, mean that buildings are often constructed on a module system and certain projects such as blocks of flats and offices, schools, hotels and housing estates contain electrical wiring which is repetitive in nature. Similarly, manufacturers of equipment may require repetitive internal wiring. A multi-storey block may contain many flats or offices of identical layout which means power and lighting cable runs of identical length.

For these repetitive installations considerable savings in time, and therefore cost, can be made by the use of prefabricated wiring units. These can be made up in a contractor's own workshop or supplied direct from the MICC works. Details can be taken from plans or elevation drawings and the cables, bare or PVC over sheathed, are cut to exact measurements terminated with seals, glands and any other accessories such as earth-tail pots. Before dispatch the units are tested to check performance and insulation resistance and both the unit and the individual conductors can be colour coded for identification. The units can be prepared in kit form and packaged accordingly, so that on arrival on site a complete kit can be placed in each dwelling or suite of rooms. A trial kit is supplied initially and any adjustments in length are corrected for the bulk production. Following this stage, all that has to be done when the units arrive is to fit them in position.

This ensures that installation work can be carried out at a fast rate thus avoiding delay to other trades.

The method of fitting the cables naturally depends on the local conditions. Very often the cables may be laid, without further protection, directly on the shuttering prior to the pouring of the concrete floors. This method is used extensively and shows significant savings in installation costs.

The 13 amp ring main circuits may be fitted at a later stage of the contract, and here it is customary to run the cables around the walls either at floor level or at a height of, approximately 15.inches. Subsequently the cables are either plastered over or covered by the floor screed and the small diameters of M.1. Cables are easily accommodated in modern thicknesses of plaster.

Box manufacturers now offer a range of competitively priced boxes (see page 35). These boxes obviate the need for cable glands, and being of plaster depth, eliminate the expensive cutting of wall surfaces. Any pattern or system of wiring can be accommodated in this manner for all forms of repetitive installation. Apart from building work, prefabricated wiring units are used in many types of machine production as, for instance, petrol pumps which require integral wiring. Obviously, where this system is used there will be a significant saving in time and labour costs and wastage on site will be eliminated. Experience has shown that, compared with a conduit system, a substantial reduction in wiring costs can be achieved by using M.I. cable wiring units.

A price list and special order form for wiring units is available on demand. The order form is designed to make it easy for you to make out an order and also greatly assists us in executing the order at the factory so we particularly request that your orders be submitted in this way.

Extensive use of M.I. cable has resulted from the competitive position of this type of wiring using the standard range and quality of cables.

With the introduction of 250 volt grade cables for domestic installations the cost savings are even more substantial. We have had extensive experience in the use of M.I. cable prefabricated wiring units in all types of buildings and will gladly advise on current wiring practices, modern trends, fixing methods, new materials, etc.

PROTECTION AGAINST VOLTAGE SURGE

THE QUESTION of surge voltage has been discussed in the section dealing with cable characteristics (see page 13). Whenever you consider the hazard of over voltage is likely to arise this can be adequately catered for by fitting our small surge diverters across any offending coil or across the terminals of equipment. Protection against induced surges from indirect Lightning which affects overhead line supplies may be provided by connecting the diverter between conductor and earth at the incoming supply terminals.

These simple and inexpensive devices are a type of nonlinear resistor. The material used has the unusual property of being almost non-conductive at normal (mains) voltage but becoming increasingly and rapidly more conductive as the voltage rises. The surge diverter therefore provides a shunt path for any surge voltage.

The standard diverter is suitable for use on 250 volt and 440 volt circuits. It may be connected across any coil taking up to 120 milliamps r.m.s. (160 milliamps d.c.) and operating at a rate of not more than once per second. The steady leakage current is about 0·2 milliamps at 250 volts or 1·5 milliamp's at 440 volts.

Do remember to disconnect the diverter when testing the circuit for insulation resistance.

CONSTRUCTIVE SUGGESTIONS

AFTER INSTALLATION
HAVING JUST completed the installation you will naturally carry out tests before connecting up the supply and the tests will include insulation resistance. Mineral insulated cables are covered by the same regulations and requirements on test values as for other types of cable.

An M.I. cable when sealed has an extremely high insulation resistance value and will therefore meet the most stringent requirements specified in any country of the world and under any climatic conditions.

Generally speaking, in the United Kingdom insulation tests are carried out with a 500 volt instrument and with the British climatic conditions no difficulty should arise in achieving an infinity reading. In some parts of the world, where very high humidity values are experienced, the same test figures can be expected on the cable itself but in testing a complete installation due note must be taken of surface moisture on insulators, terminal blocks, and switches which may affect the overall reading.

It should be remembered than an M.L cable must be sealed before testing and that a slight film of moisture across the end face of the cable will be sufficient to give a low reading. Provided the seal is made off in the approved manner this small amount of moisture will be absorbed by the cable and in a very short space of time an infinity reading should be achieved.

If however you are not satisfied with the I.R. value after sealing then by carrying out the following simple checks you will be able to determine whether the cable has been satisfactorily sealed.

LOW INSULATION RESISTANCE
THE MOST probable reason will be a leaking or breathing seal and provided these are readily accessible you should inspect for looseness of the pot seal or for obvious damage.

If you are not satisfied by a visual inspection it is possible to apply a simple test to locate a breathing seal.

Connect the insulation tester to the cable in the normal manner, and either switch on or turn the handle until a steady reading is obtained. Note the reading. With the tester still operating apply a match or cigarette lighter flame to the cable sheath immediately adjacent to each seal in turn.

The heat need only be applied for a few seconds and if the reading on the tester remains constant then the seal is satisfactory.

If, however, the seal is breathing, moisture will have entered the cable and the brief application of heat will result in an immediate fall in the reading.

This simple test is, of course, quickly and easily carried out on a surface installation or at a fuse board or distribution board where all the seals are in close proximity.

Where the seals are not readily accessible it may be necessary to isolate individual cable runs, and if a naked flame is not permissible (such as in a flameproof area) then the test may be carried out by using alternative sources of heat such as boiling water, a soldering iron, electric heating tongs or even by running a piece of string around the sheath for a couple of turns and pulling backwards and forwards vigorously to provide heat by friction.

Having located a breathing seal the following procedure should be adopted.

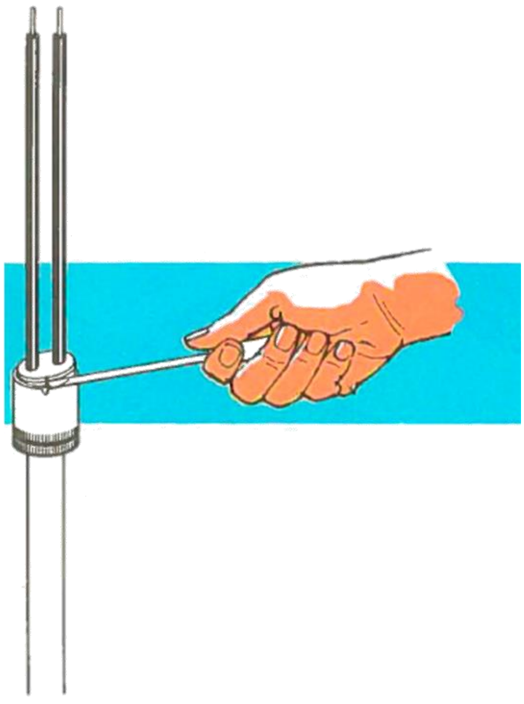
REMAKING A FAULTY SEAL

PRISE OUT and remove the disc and sleeves and as much of the compound as you can. Next, unscrew the pot and scrape the remaining compound off the face of the insulant. Keep the face of the insulant clean and remember to wipe off the compound with a clean rag.
Alternatively the seal can be quickly dismantled by using the sheath cutter to cut through the wall of the pot, when the top portion of the pot together with the disc and sleeves can be drawn off.

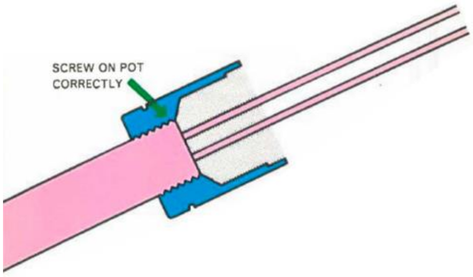
If the insulation resistance of the cable is very low and the cable is required for immediate service, the damp insulation should be dried out.

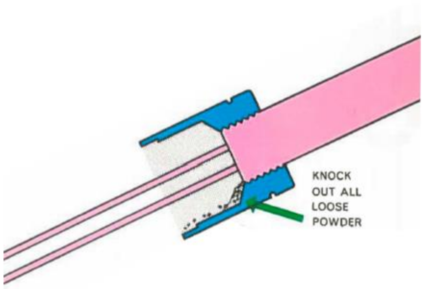
Apply the flame of a blowlamp to the cable, about 18 inches from the end of the sheath. Heat the cable to a cherry red, holding the blowlamp steady, then move the flame toward the end of the cable so that the moisture is driven in front of it and out of the cable.

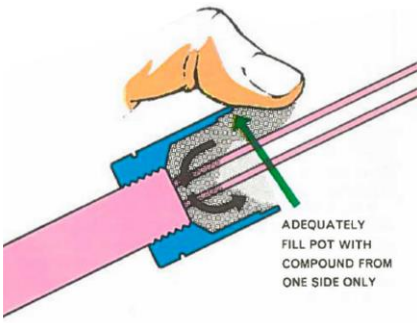
If the reading is reasonable, it is not necessary to dry out the insulation but simply to remove the seal. Clean the cable end and re-seal. Given time a properly sealed M.I cable will, under test, always show an infinity reading as any small amount of absorbed moisture will disperse along the cable and will no longer be of consequence.

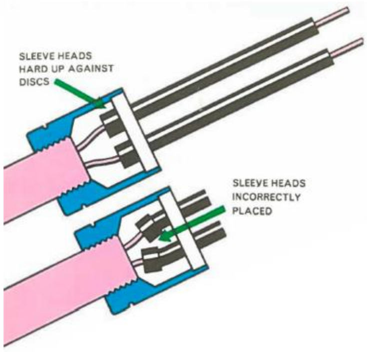


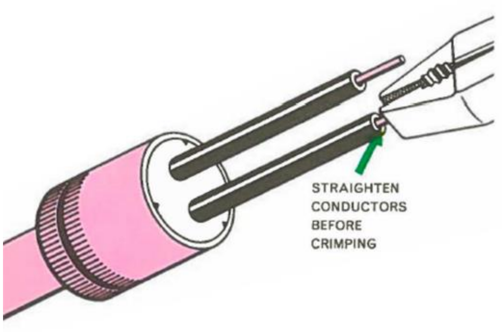
AVOIDING FAULTY SEALS

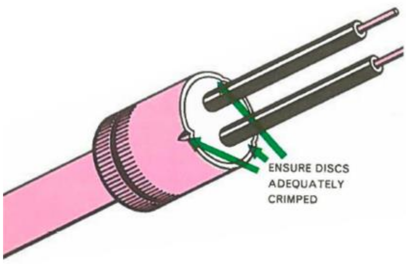












SHEATH DAMAGE

HAVING CHECKED all the seals and found them satisfactory we must seek other causes for low insulation values and the next step will be to look for damage to the sheath. The test described for locating a breathing seal can equally well be used to locate a penetration of the sheath. Again moisture has entered the cable and if heat is applied at this point the insulation resistance of the cable will immediately fall.

It may be convenient here to use either a candle or blowlamp and this should be moved slowly along the cable whilst the reading is carefully watched. Immediately any fall in the reading occurs, you will find the sheath has been penetrated at the point reached by the heat source.

REPAIRS TO SHEATH

HAVING LOCATED damage to the sheath it will be necessary to cut and joint unless the damage is of a superficial nature when a repair can be achieved simply by tinning or soldering. If you decide to cut and joint the cable this may be done using either a straight-through conduit box or the straight through joint shown on page 32. The cable is cut at the point of damage, the two ends are stripped as for normal terminating, and this will generally remove both the damaged portion of the sheath and also any damp insulation. The ends may then be terminated following the standard procedure.

If such a joint is made in a naturally damp situation such as in a cable buried in the ground, then the connection used can be filled with a bituminous compound or an epoxy resin. When the bituminous compound is poured hot the box should be warmed before filling commences.

Concluding this section on installation, the following are a selection of questions we have been asked in recent times and the answers may be of interest to a wider audience.

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