

Company Directive

STANDARD TECHNIQUE: CA3C/2

Relating to General Requirements for 33kV Cable Jointing

Policy Summary

This ST document contains all the General Requirements for 33kV cable jointing. These General Requirements detail the separate techniques, which collectively form a Jointing Procedure.

This ST has not been written as a training document. It is not intended to be exhaustive in content and you must refer to your supervisor if you require training or instruction.

You shall work safely and skilfully, utilising the training/instruction you have already received, relating to the contents of this document and its cross-references.

You must make sure that you understand your job instructions and that you have the necessary tools and equipment for the job.

Author: Peter White

Implementation Date: March 2017

Approved by



Policy Manager

Date:

14 March 2017

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IMPLEMENTATION PLAN

Introduction

This ST document contains all the General Requirements for 33kV cable jointing. These General Requirements detail the separate techniques, which collectively form a Jointing Procedure.

Main Changes

Document has been modified to take into account the WPD losses strategy and the harmonization of the 33kV cables within the company.

General requirement 44 modified additional copper stocking added to take into account the extended outer shells.

General requirement 45 modified addition of water blocking tape to the end of the MDPE to take into account sheath testing.

Minor changes to remove SHOPS and replace with E5.

Impact of Changes

None.

Implementation Actions

Team managers to disseminate the information to their respective 33kV Joints.

Implementation Timetable

This Standard Technique can be implemented with immediate effect.

Document Revision & Review Table		
Date	Comments	Author
March 2017	This is a new document.	Peter White

ST: CA3C/2 GENERAL REQUIREMENTS FOR 33kV CABLE JOINTING.

INTRODUCTION

This ST document contains all the General Requirements for 33kV jointing. These General Requirements detail the separate techniques, which collectively form a Jointing Procedure.

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GENERAL REQUIREMENT 1

GENERAL CLEANLINESS AND ACCIDENT PREVENTION

1.1 SITE SAFETY

The majority of accidents can be avoided by taking reasonable care and precautions when performing normal duties associated with any work. Fortunately most of these accidents which do occur are of a minor nature, but there is always the risk of them developing into something more serious, with a consequent increase in the pain and suffering of the victim. Any accidents that do occur must be reported as soon as possible after the event.

Western Power Distribution spends many thousands of pounds each year to create the safest possible working conditions for its employees and take particular care in the selection and provision of tools and equipment which will improve safety in the working environment. Strict safety rules and procedures have been laid down with the sole purpose of safeguarding all who work on the distribution system and these must be observed at all times.

Despite all the efforts that have been made to provide safe appliances such as safety stands for gas torches, compound gloves, etc., accidents still occur. Most of these could be avoided if a little more care and forethought were to be exercised, e.g. gas furnaces should be sited conveniently near to the job but in such a position that they cannot be overturned, and also where they will not cause damage. Items of kit should not be left where they could be tripped over either by persons engaged on jointing work or by the general public. Gloves of the approved type should always be worn when handling hot or cold pour compound or when cutting or handling armour and cleaning cables.

Care should be taken to remove all oversheaths, scrap paper and hessian etc., resulting from cable stripping operations from joint pits as it occurs, to prevent the accumulation of inflammable material and reduce the fire risk in confined places.

When working on the highway appropriate warning notices must be displayed. These warning notices, barriers etc. shall comply with ST: HS14D. All barriers shall be erected and traffic cones positioned before commencement of work. By night obstructions and excavations must be marked by continuously lit yellow danger lamps.

Joint holes must be adequately fenced at all times and the fences must be substantial – not just token fences.

Note: -(a) A pile of earth is not a suitable barrier.

(b) The Company's obligation to safeguard members of the public extends to all users including blind and infirm persons. To discharge this obligation the fencing must be such that it readily detectable by such persons. Approved barriers should therefore be erected around all excavations.

(c) Where a footpath is substantially obstructed, then fencing must provide a passageway on the carriageway for pedestrians, protecting them from moving vehicles.

- (d) Where positive traffic control is necessary at small obstructions of short duration it must be by means of a manually operated stop and go boards. Flags must not be used for traffic control.

Paving stones must be removed and replaced with great care to avoid breakage.

When re-laying paving stones it is essential that they should lie on an even bed, to prevent any rocking, and should be level with the surrounding stones.

When working on private premises care must be exercised to avoid accidental damage to consumers' property or internal decorations. Damage of this nature can often be avoided with a little forethought and particular attention should be paid to the removal of potential fire risks before a blow torch is used.

1.2 RISK ASSESSMENT

The risks when conducting the jointing of cables are principally those of electric shock and burns. Jointing of cables can be achieved without exposure to significant risk but only following appropriate control measures identified in various risk assessments.

A checklist and an on-site risk assessment pad have been produced to assist the process of on-site risk assessment.

1.3 IDENTIFICATION OF LV CABLES

When excavating around cables in the ground all cables must be assumed to be alive. In normal circumstances Jointers will be provided with service forms showing details of both the cable to be worked on and information concerning the position of other HV and LV cables in proximity to the working area, based on drawing office records. See Policy document POL: OS 4A, Location, Identification and Proving Dead of Underground Cables and Standard Technique ST: OS 4A, Location, Identification and Proving Dead of Underground Cables.

Where service forms are not issued a drawing giving similar information should be provided showing clearly what action is required. In cases of emergency or when it is expeditious the Jointers should alternatively be immediately supervised.

It is essential that strict compliance with the Company's Safety Rules, Policy Documents and Standard Techniques are maintained at all times and if any time doubt arises in the Jointer's mind he should cease work immediately and contact the Supervisor who will take appropriate action to positively identify the cable.

1.4 HYGIENE

General

During any tinning or sweating operation involving resins or fluxes, fumes are given off. To certain people these fumes are obnoxious and can cause respiratory irritation. In other people, skin irritation and rash can occur, but this is equally possible with people handling De-Solvit, oil, and other similar substances.

Where the majority of people are concerned these effects can be completely eliminated by taking a few simple precautions.

Avoidance of Fumes

Care must be taken not to char or burn any PVC material as this will cause toxic gases to be given off.

During the tinning or sweating operation care should be taken to avoid the inhalation of large volumes of the fume given off, and tent flaps should be raised to permit the flow of clean air through the tent. At the same time the Jointer should position himself in such a way that the clean air flow carries the fumes away from his face.

Care of the Skin

Before commencing work, hands and forearms should be thoroughly washed in cold water, using soap or a skin cleanser and then well dried.

A barrier cream should be applied to the hands taking particular care to rub sufficient in between the fingers and round the nails. Although approved gloves shall be worn while degreasing a cable, if inadvertent contact is made with the hands and the approved degreasing material then the hands must be washed and dried using the routine described above and a further application of barrier cream made.

As an additional precaution approved plastic coated gloves of a distinctive colour are available to Jointers for use during the fluxing, tinning and sweating operations. Care should be taken to prevent these gloves from becoming contaminated and they should be washed off with soap and water each time after use. Jointers are encouraged to use these gloves despite the slight restriction in movement that may be experienced as this can be overcome with practice.

Note: -These gloves are not electrically tested and are not safe for live working.

If work is to be carried out on live LV conductors the normal approved Safety Rubber Gloves should be worn when necessary, care being taken to wash the gloves off after use and to completely dry them using French Chalk.

1.5 FIRST AID

All Jointers should be in possession of a small first-aid kit and items used should be replaced as soon as possible.

Details of the approved methods of artificial respiration are given in the Company's Safety Rules and every employee should familiarise himself with the procedures to be adopted. A knowledge of these methods could be of inestimable value at any time and may assist in saving life. Remember it could be YOURS.

1.6 USE OF PROPANE GAS

General

Gas containers should be stored at a temperature with the range of 13°C (55°F), to 30°C (85°F), and should never be exposed to a temperature higher than 43°C (110°F).

Always keep the gas valve on the container turned off except when the gas is being used.

It is possible when turning on the gas to turn the handle several revolutions, this is unnecessary, one revolution being ample. This has the advantage that shutting the valve can be done quickly in an emergency.

Always keep the container upright and fastened securely in its carrying rack or cage during transit.

Containers, whilst in use, should be placed in position where there is good ventilation and never in a confined and unventilated place or joint pit. If the appliance will not reach the job when the container is in safe position, a longer flexible hose should be used.

For normal jointing work a length of 4m (3 metres minimum) of hose should cover the majority of circumstances without creating hazards of escaping gas or tipped appliance that might result from persons tripping over surplus hose.

Remember that the gas used is heavier than air and will therefore accumulate in pits and trenches in which it may travel along some distance from the point of release.

When the gas is no longer required for use it should be turned off at the valve on the container first, the gas allowed to burn itself out and the burner taps turned off last.

If the flame is accidentally extinguished do not attempt to relight the gas and do not allow any naked flame near, until the accumulated gas has been dispersed by opening ventilators, tent flaps or doors.

Do not meddle with any part of the gas apparatus.

A very small amount of gas can create an explosive mixture with air and small leakages of gas, therefore, are dangerous unless proper precautions are taken.

In Case of Fire

If it is safe to approach the gas cylinder, turn off the main valve and remove the cylinder to a place of safety. If this cannot be done, call the Fire Brigade. In the meantime keep the cylinder as cool as possible by hosing it down from behind cover and keep the public well away.

1.7 USE OF HOT METALS

Hot metals are no longer used in WPD, other than lifting the aluminium sheath on a Consac cable.

The use of gloves and a face visor is important when handling hot metals.

1.8 USE OF CLEANING/DEGREASING SOLVENTS

The use of solvents for both cleaning bitumized coated cable sheaths and the removal of grease etc. to provide a good bond and seal for resin encapsulated joints is common to most jointing procedures and practices. It is therefore in the interests of health and safety that adequate precautions are taken when undertaking these processes which are common to both.

Your attention is drawn to the level of PPE required as the matrix given in General Requirement 3 whilst undertaking this operation.

Handling/Storage

Solvents should only be dispensed from small containers; lids are to be tightly sealed whilst not in use and containers are stored secure in the upright position and away from sources of ignition.

Dispense only sufficient solvent onto the dry wipe, it is unnecessary, wasteful and potentially harmful to pour out large quantities which merely splash onto the ground.

Do not smoke whilst using solvents.

Contact of solvents with naked flames and red hot surfaces should be avoided.

Skin Contact

Skin sensitisation or irritation is very infrequent, should contact occur with the de-greaser, then immediately wash the area with soap and water. Unless the area to be washed, is the hands, **PVC gloves shall be worn** when carrying out this operation.

Remove any contaminated clothing and shoes; do not allow saturated clothing to remain in contact with skin for prolonged periods.

Splashes in the Eye

Flush with water as needed, the use of eye protection may be worn.

Breathing of Vapour

Ensure good ventilation particularly if working in confined areas.

Fire Hazard

Solvents are flammable and should a fire occur the use of water fog, CO₂, dry chemicals or foam are to be used to extinguish.

Avoid breathing the smoke and in and in confined areas suitable respiratory equipment is to be used.

Spillage

Absorb small spills with dry sand or oil absorbent dispose as dry oil absorbent.

Disposal of empty containers

Before disposal of the container the Jointer shall apply the Waste Disposal Label, available via the hyper link given below: -

<\\avodcs01\data\Purchase\Buyer Folders\David Barker\Purchasing Catalogue 2011\RT Test Pages\Business Services\Corporate Print\000. MASTER WPD ORDER FORM.xls>

Select option 2, WPD print order form; then Product code WPD/W400121.

These labels **shall** be used cover ALL the orange and black hazardous Dangerous Substances Directive (DSD) or the new red diamond of the Classification, Labelling and Packaging Regulations (CLP) labels, once the product in the respective container has been used or neutralised, thus allowing the re-labelled empty container to be placed in the normal waste bin.

1.9 GENERAL SAFETY PRECAUTIONS

Attention is drawn to the other General Requirements in this Section which all have safety implications, but in particular to: -

- 19. Moisture Testing of Paper Insulated Cable
- 35. Degreasing Operation
- 37. Mixing and Pouring 3-Part Polyurethane Resin

GENERAL REQUIREMENT 2

JOINT BAY PREPARATION

General

It is the responsibility of the jointer to ensure that the execution of his work does not endanger the public in any way. The joint bay must be properly fenced and if it obstructs the pavement, an alternative walkway must be provided. All signing and guarding shall be in strict accordance with ST: HS14D.

The jointer must also ensure that there is a safe ingress and egress to the joint bay for person's and materials. He must ensure that adequate provision is made against adverse weather conditions including, if necessary, providing drainage for storm water and the provision of water pumps.

The jointer must also ensure that the joint bay is large enough for him to complete his work safely and satisfactorily. Ensure that there is no danger of subsidence due to looseness of soil or the movement of traffic adjacent to the joint bay. There should be at least 300mm below the cable to enable jointing work to be completed.

Note: - The Construction (Health, Safety and Welfare) Regulations 1996.

Clause 12(1) states "All practical steps shall be taken, where necessary to prevent danger to any person, to ensure that any new or existing excavation or any part of such excavation which may be in a temporary state of weakness or instability due to the carrying out of construction work (including other excavation work) does not collapse accidentally".

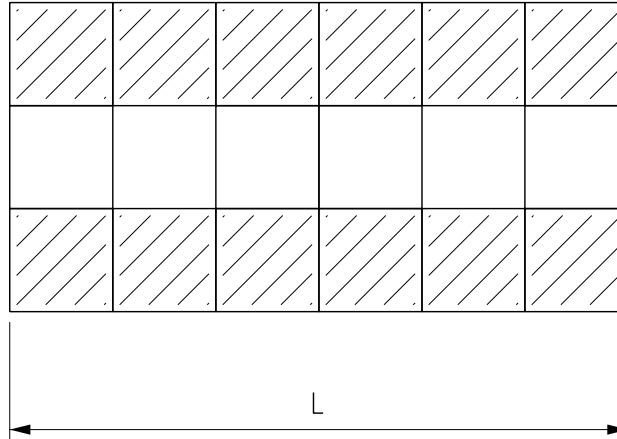
- (2) Suitable and sufficient steps shall be taken to prevent, so far as is reasonably practicable, any person from being buried or trapped by a fall or dislodgement of any material.
- (3) Without prejudice to the generality of paragraph (2), where it is necessary for the purpose of preventing any danger to any person from a fall or dislodgement of any material from a side or the roof of or adjacent to any excavation, that excavation shall as early as practicable in the course of the work be sufficiently supported so as to prevent, so far as is reasonably practicable, the fall or dislodgement of such material.
- (4) Suitable and sufficient equipment for supporting an excavation shall be provided to ensure that the requirements of paragraphs (1) to (3) may be complied with.
- (5) The installation, alteration or dismantling of any support for an excavation pursuant to paragraphs (1), (2) or (3) shall be carried out only under the supervision of a competent person.

- (6) Where necessary to prevent danger to any person, suitable and sufficient steps shall be taken to prevent any person, vehicle or plant and equipment, or any accumulation of earth or other material, from falling into any excavation.
- (7) Where a collapse of an excavation would endanger any person, no material, vehicle or plant and equipment shall be placed or moved near any excavation where it is likely to cause such collapse.
- (8) No excavation work shall be carried out unless suitable and sufficient steps have been taken to identify and, so far as is reasonably practicable, prevent any risk of injury arising from any underground cable or other underground service.

Joint Bay Layout

Drawings GR3D 6.2.1 and GR3D 6.2.2 show a typical joint bay layout (straight/stop end) to allow the work to be completed safely and to a satisfactory standard.

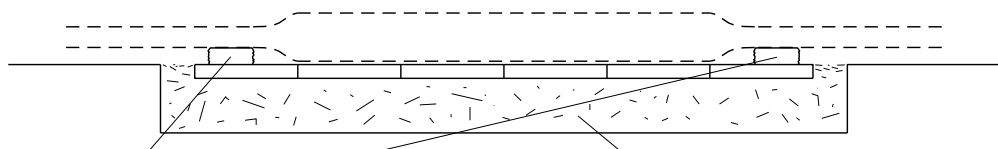
Drawing GR3D 6.2.3 gives the minimum joint bay sizes required by the “dig and lay” contract, these are minimum sizes and further enlargement may be required depending on circumstances.



450x450 slabs

L is dependent upon joint being made


Shaded slabs may be removed upon completion of jointing



Cables supported by
sand bags at end of joint

Granular bedding to assist
levelling of slabs and to
increase drainage in wet conditions

Note shoring requirements
for deep excavations

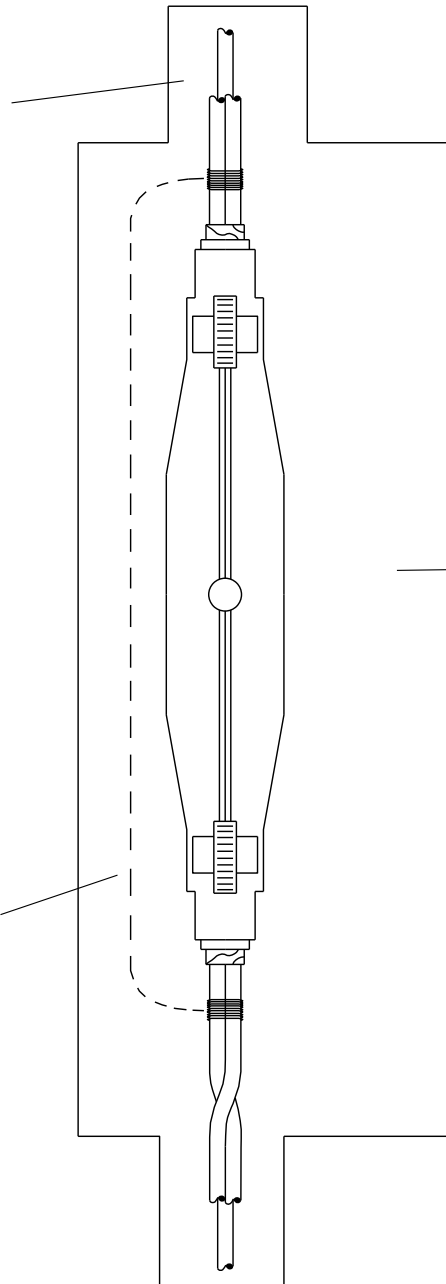
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Drawn	RJB	11/16			
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Approved					
SCALE		N.T.S.		Title	
				JOINT BAY BASE FOR 33kV JOINTS	
				Drg. No. GR3D 6.2.1	
				Rev No	

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All dimensions in mm

Approximate 1 Metre Of Trench
Left Open At Either End To Allow Core
Set-up (Not Required For PILC/ H Cable
/ HSL Cable Or 3 Core XLPE)


Temporary Earth Continuity
Bond Removed On Completion Of Jointing



Joint Offset Within Joint Bay
To Allow Ease Of Working

PLAN VIEW

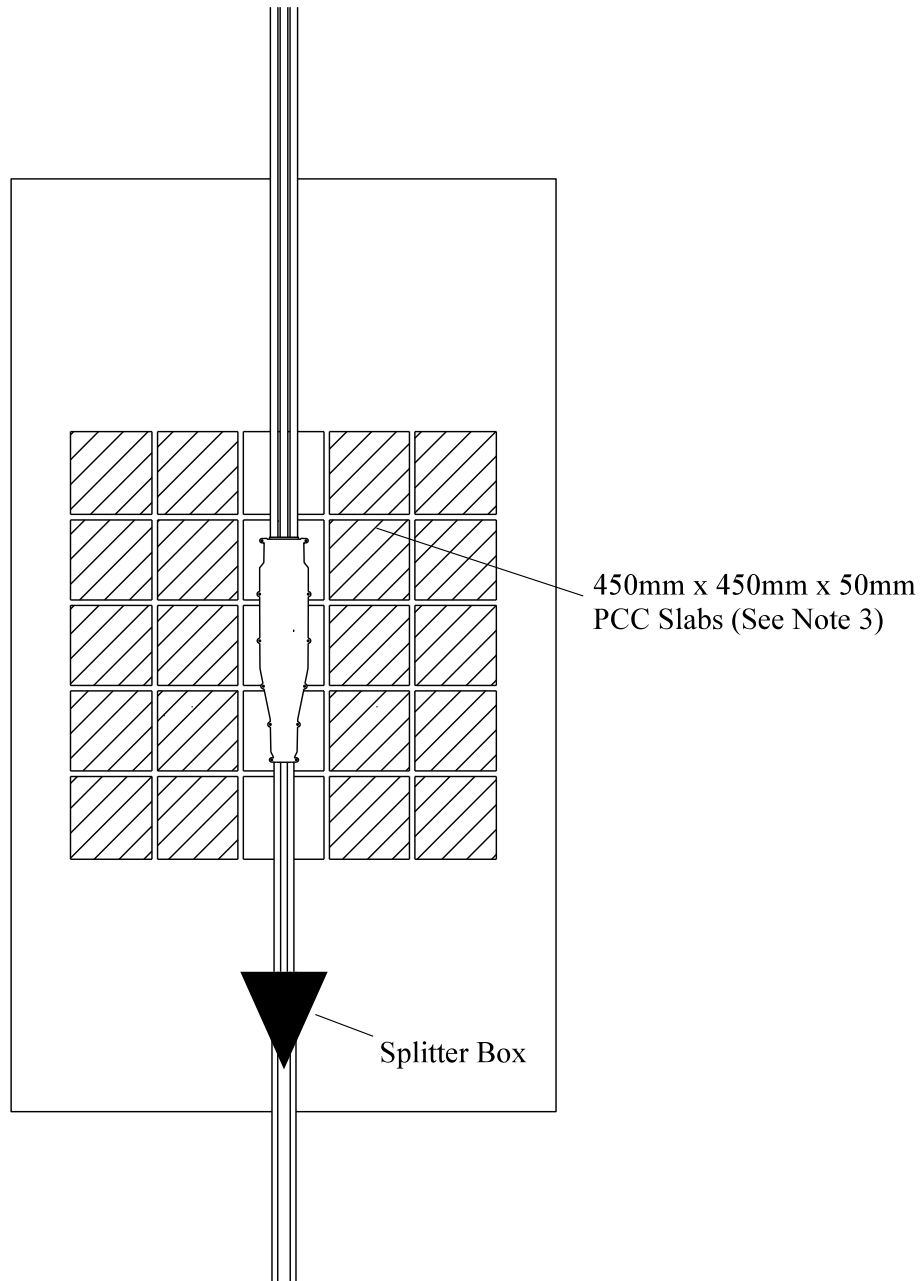
Note:- For A Stop End Joint The Open Trench At The Opposite End Of The Cable
And The Temporary Earth Continuity Bond Are To Be Omitted.


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Note :-

- 1 All Dimensions Are In mm
- 2 Sandbag Support To Be Used As Shown In WPD
Technical Standard CA6A/4 (Page 22) For Details
- 3 Hatched Slabs May Be Removed Upon Completion Of
Jointing



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SCALE		N.T.S.			
Title				Drg. No. GR3D 6.2.3	
LAYOUT OF 33kV HSL AND 3 CORE XLPE CABLE JOINTS				Rev No	

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GENERAL REQUIREMENT 3

GENERAL JOINTING PROCEDURE – DEAD CABLES

The provisions detailed in General Requirement 1 are to be applied when jointing 33kV cables.

The following points shall be observed for electrical safety: -

1. All 33kV cables shall be assumed to be live unless proved dead with an approved indicator, any work carried out prior to the 33kV cables being proved dead shall be done using live working techniques to protect the Jointer from inadvertent generation or possible back-feeds.
2. When working on 33kV cables all criteria of the Distribution Safety Rules shall be adhered to.
3. Any person receiving instructions to work on 33kV cables shall be certain that he clearly understands the instructions and shall report any objections he may have regarding carrying out such instructions to the person issuing them. This person shall then have the matter investigated and if necessary refer it to the Line Manager.
4. The required level of personal protective equipment and additional safety equipment whilst jointing on 33kV cables is shown in Matrix 1 overleaf.
5. Jointers shall comply with ST: HS8H, if using flame retardant longs and shirt then the shirt shall be tucked into the long trousers and the sleeves shall be down to the level of the wrists. If coveralls are being used then only flame retardant coveralls (one piece boiler suit) E 5 No 41865 with sleeves down to the level of the wrists shall be worn when working on live low voltage cables. Reflective jackets shall be worn as required by the New Roads and Street Works Act.
6. The work and work area shall be kept dry as far as is practicable.
7. Only approved tools and methods of working shall be used when jointing.
8. Tools used whilst jointing shall be kept clean and dry. On PILC or aluminium sheathed cables the metallic sheath shall be bonded across the joint using a temporary earth continuity bond before removal of the metallic sheath and this connection shall be maintained until the permanent continuity bond of the metallic sheath is completed. This shall be done in accordance with General Requirement 10.
9. The jointer must ensure that there is full and safe access and egress to the work site and there is a minimum of inconvenience and no danger to the general public. The Jointer must also ensure, where necessary, that full protection is given against adverse weather conditions.

Single core EPR/XLPE, 3 Core XLPE, H cable, HSL cable and PILC cables should be examined for signs of damage. If damage is limited to the MDPE/PVC oversheath in the single core EPR/XLPE, 3 Core XLPE, H cable or PILC, repairs should be carried out in accordance with Jointing Procedures. Any cases of doubt should be referred to the relevant Supervisor.

Cables shall be examined for visible signs of damage. With paper cables where damage is noted and moisture ingress suspected, samples of the filler and the papers from the screen or belt and the outer and inner layers of each core should be tested as specified in General Requirement 8. If moisture is found to be present and it is possible to cut a short length from the end of the cable, this should be done and a further test carried out to determine if moisture has penetrated beyond the surplus length. When a satisfactory result cannot be obtained the matter should be reported to the Supervisor in charge before commencing the joint. The cables should be tested with a 1000V Megger applied between cores and sheath, see General Requirement 7.

Before commencing work, it is incumbent on the Jointer should satisfy himself that all jointing materials supplied are suitable for the work to be carried out, and that they are in a sound condition.

Matrix 1 Minimum PPE Required when carrying out 33kV Jointing Work

Task	Comply with ST: HS8H.	Totectors	Gloves (GP)	Gloves (Kevlar)	Gloves (PVC)	Gloves Electrical Class 1	Gloves (Disp.)	Gloves (Comp)	Visor	Goggles	Ear Defenders	Approved dielectric footwear
Jointing in General (All)	X	X										
Handling cables moving/lifting objects etc.	X	X	X									
Cutting a length of EPR/XLPE of the cable drum	X	X	X									
Removing PVC or MDPE oversheaths on polymeric cables	X				X							X
Removing servings, armour & PVC oversheath on PILC cables	X	X			X				Visor or Eye Prot.			
Temporary Equipotential Bonding whilst Jointing	X					X			X			X
Using Solvents/degreasers	X	X			X				Visor or Eye Prot.			
Removal of Lead Sheaths	X								X			X
Handling Individual Copper Screen Wires	X									X		X
Removing insulation on or near Conductors	X			X								X
Application of silicon grease	X						X					X
Dead Conductors – System Fully Isolated	X											X
Setting/Forming of screen wires	X								X			X
Mixing/Pouring Cold Pour Polyurethane Resin	X	X					X		Visor or Eye Prot.			
Mixing/Pouring Cold Pour LoviFit Resin	X	X					X		Visor or Eye Prot.			
Pouring Cold Pour Lovisil Resin	X	X					X		Visor or Eye Prot.			
Handling/Pouring Hot Bituminous or Resin Oil Comp	X	X						X	Visor or Eye Prot.			
Handling Paraffin Wax / Damp Testing Papers	X	X						X	Visor or Eye Prot.			
Installing mechanical earth bonds / roll springs.	X	X		X								
Operation of the “Izumi” Shear Bolt Tool	X	X									X	
Spiking Gun Application	X		X						X			X
Spiking Gun Use	X		X						X		X	X
Spiking Gun Removal	X					X			X			X
Spiking Gun Maintenance	X	X					X			X		

The Matrix details the minimum use of PPE for General Jointing Applications. Where site conditions dictate the use of additional PPE will be required e.g. safety helmet, high-visibility jackets etc.

GENERAL REQUIREMENT 4

EPR/XLPE CABLE INSTALLATION DATA

General

All current standard size 33kV EPR/XLPE cables the are purchased in single core configuration, where the cable is laid it is to be placed into a touching trefoil L1, L2 and L3 formation and two complete turns of Gorilla gaffer tape applied at intervals of not more than 2 metres (1 metre on bends), for cables laid to single phase the cable is to be laid in touching trefoil and Gorilla duct/gaffer taped as previously stated.

All cable circuits/feeders must be kept within its designed configuration i.e. trefoil throughout its complete length and as close to joints/terminations as possible so as not to infringe the 12% rule.

The 12% rule being applied from a point to which the cable is removed from its trefoil configuration into flat spacing. The distance of flat spacing, within a trefoil route must not be more than 12% of its total route length.

e.g. Total route length = 250 metres minus 12% (30 metres) = 220 metres. Therefore 220 metres must remain in trefoil to prevent affecting the electrical characteristics of the circuit /feeder.

Should the 12% rule be broken contact the Company Cable Engineer, Avonbank or the Policy Manager at Avonbank urgently for special procedures.

Method of Installation

The table overleaf gives all the installation data required for all the standard sizes of single core EPR / XLPE cable used within WPD.

The pulling of the cable shall be undertaken using a suitable stockings then each core shall have a separate stocking and swivel.

Single core EPR / XLPE cable should not be laid if the cable temperature is -5°C or below, otherwise damage will occur.

Capping shall be undertaken to General Requirement 63, the use of PVC tape **does not** constitute capping the cable.

Cable: - Single core, Cu., EPR, Cu-w, MDPE, 33kV.	Std. Length	Drum Size	Weight (kg)		Max Pulling Tension	Minimum Bending Radius (mm)	
	Metres	Metres	Cable	Drum	Kg	Normal	Terminations
185mm ² Cu. EPR	500	2.0 x 1.02	1530	570	1110	900	650
300mm ² Cu. EPR	250	2.0 x 1.02	1840	560	1440	950	700
400mm ² Cu. EPR	250	2.2 x 1.02	2605	695	2000	1100	800
630mm ² Cu. EPR	250	2.4 x 1.38	3960	1040	2000	1200	900
800mm ² Cu. EPR	250	2.4 x 1.31	2555	802	2000	1300	1000

Note: - 150mm² will be treated as 185mm² EPR/XLPE and 240mm² EPR/XLPE will be treated as 300mm² for the purposes of laying i.e. pulling tension and bending.

GENERAL REQUIREMENT 5

CUTTING 33kV EPR/XLPE SINGLE CORE CABLES

Before commencing the level of PPE required for this operation shall be as the matrix given in General Requirement 3.

General

In order to overcome the nuisance value of receiving a slight electric shock similar to that received when getting out of a car, those persons who cut 33kV EPR / XLPE single core cable shall adopt the procedures set out in this General Requirement.

The person shall wear the following Totectors, flame retardant one piece coveralls and red PVC General-purpose gloves.

Using the Company Approved insulated hacksaw the cable shall be cut at the relevant position, once the cable has been cut the person shall then cap both ends of the recently cut cable using the relevant cold/heat shrink caps provided.

The cable end, which is left on the drum, should then be firmly attached to the drum to prevent damage to the cable, at some future date.

GENERAL REQUIREMENT 6

SETTING UP AND MARKING CABLES

Before commencing the level of PPE required for this operation shall be as the matrix given in General Requirement 3.

General

Joints: – before commencement of jointing sufficient room all around the cable (minimum of 300mm) including the underside of the intended joint position must be available to carry out jointing operations safely and effectively. This requirement is particularly important due to the need to provide clearance for specialised tooling and prevent the ingress of detritus into the various joints.

Prior to commencement of a joint or termination the phasing is to be identified and should any crossing or rolling of the cores be required, then this shall only be undertaken on the single core EPR / XLPE side of the accessory and clear of the joint outer sleeve.

6.1 All Joints

- 1.1 Check phasing, any crossing or rolling of cores is to be undertaken clear of the joints outer sleeve.
- 1.2 Set cables into position straight and level correctly aligned without undue stress.
- 1.3 With the H/HSL/3core XLPE cable trifurcating transition joint the three single core polymeric cables have to enter the joint in an expanded trefoil configuration to aid this a spacer is available from E 5 to facilitate this configuration the first of these spacers should be fitted some 800mm from the final position of the outer shell with a second spacer some 900mm further back along the cable. On completion of the jointing work the furthestmost spacer from the joint maybe removed and kept for further 33kV jointing work. The spacer closest to the joint shall be left in situ and suitable cable tied into place. See below.



- 1.4 Mark the centre / reference line on both cables, allowing a 150mm minimum beyond, cut the cables at this position.

- 1.5 Proceed with the appropriate Jointing Procedure.

6.2 Pole Termination

ALL POLE TERMINATIONS ARE TO BE COMPLETED AT THEIR FINAL ERECTED POSITION.

Refer to Drawing GR3D 6.6.1, 6.6.2 and 6.6.3 whilst undertaking this General Requirement.

- 3.1 Construct the crucifix as General Requirement 49 and fix to the final position on the pole.
- 3.2 Ensure the cable is positioned correctly at the pole base directly under in its final erection position.
- 3.3 Check phasing any crossing or rolling of cores is to be undertaken below the cable cleat.
- 3.5 Position the cable in line with the crucifix clamp the cable into the cleat.
- 3.6 Straighten and position each core to its correct connection point.
- 3.7 Proceed with the appropriate Jointing Procedure.

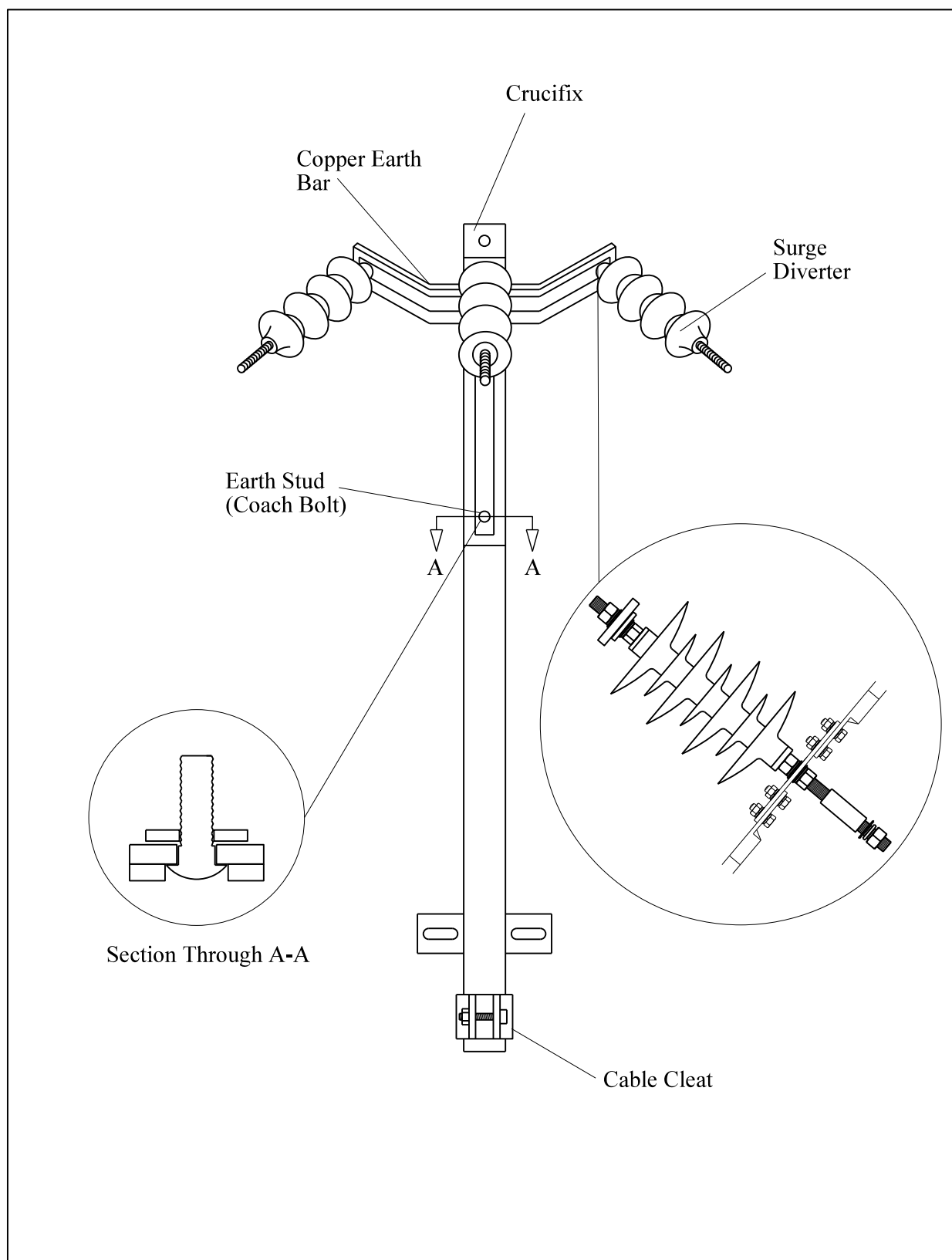
6.3 Cable Box Terminations


- 4.1 Prepare the cable box as General Requirement 46.
- 4.2 Ensure the cable is straight and positioned in line with the centre connection point.
- 4.3 Check phasing, any crossing or rolling of cores is to be undertaken below the cable gland.
- 4.4 At the centre phase connection point place a white PVC tape marker around the cable, at a further 300mm beyond place a second marker and cut the cable at this point.
- 4.5 Straighten and position each core to its correct connection point.
- 4.6 Proceed with the appropriate Jointing Procedure.

6.4 “Dead break” Separable Connectors

- 6.1 Refer to the relevant General Requirement for the separable connector being used.
- 6.2 Ensure the cable is straight and positioned in line with the centre connection point.
- 6.3 Check phasing, any crossing or rolling of cores is to be undertaken well below the cleats and the equipment bushing interface.

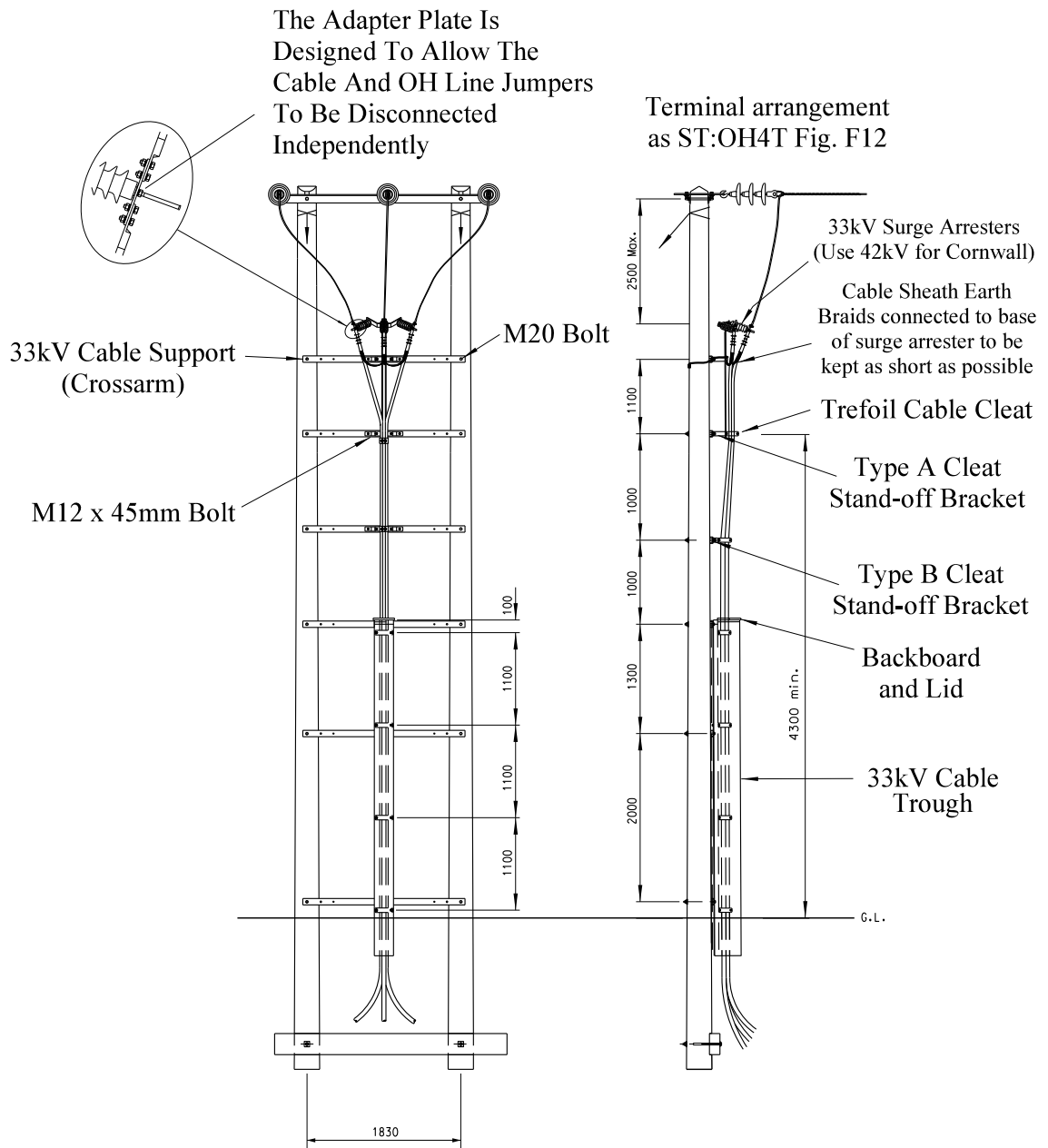
- 6.4 At the centre phase connection point place a white PVC tape marker around the cable, at a further 500mm beyond place a second marker and cut the cable at this point.
- 6.5 Straighten and position each core to its correct connection point.
- 6.6 Proceed with the appropriate Jointing Procedure.




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ORIGINAL ISSUE		DATE		<div>WESTERN POWER DISTRIBUTION</div> <div>Design Department.</div> <div>Avonbank,Feeder Road,Bristol BS2 0TB</div> <div>Tel: 0117 933 2000</div> <div>Fax: 0117 933 2001.</div> <div>WESTERN POWER DISTRIBUTION</div> <div></div>	
Drawn	RJB	11/16			
Checked					
Approved				Title	
SCALE		N.T.S.		ASSEMBLY OF SURGE DIVERTER COMPONENTS TO CRUCIFIX	
				Drg. No.	
				GR3D 6.6.1	
				Rev No	

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All dimensions in mm



Note: Anti-climbing device as detailed in ST:OH4M required.

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ORIGINAL ISSUE	DATE	WESTERN POWER DISTRIBUTION Design Department. Avonbank, Feeder Road, Bristol BS2 0TB Tel: 0117 933 2000 Fax: 0117 933 2001.			
Drawn	RJB	11/16	Title 33kV CABLE TERMINATION 'H' POLE ARRANGEMENT (3 x SINGLE CORE EPR CABLES)		
Checked					
Approved			Title 33kV CABLE TERMINATION 'H' POLE ARRANGEMENT (3 x SINGLE CORE EPR CABLES)		
SCALE	N.T.S.				
					
			Drg. No. GR3D 6.6.2 Rev No		

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All dimensions in mm

The Adapter Plate Is
Designed To Allow The
Cable And OH Line Jumpers
To Be Disconnected
Independently

Surge Arrester
Support Bracket

Terminal arrangement as
ST:OH4T Fig. F5 or F13

Cable Sheath Earth
Braids connected to base
of surge arrester to be
kept as short as possible

Stay Assembly
to ST:OH4L

33kV Surge Arresters
(Use 42kV for Cornwall)

Twin Bolt Hole Lug

Trefoil Cable Cleat

M20 Bolt

Detail of Stabilizing
Bracket

Lid

33kV Cable Trough

Brace Block 1.3m

Note: Anti-climbing device as detailed in ST:OH4M required.

Rev No	Drawn	Chk'd	App'd	Date	Revision		
ORIGINAL ISSUE					WESTERN POWER DISTRIBUTION Design Department. Avonbank, Feeder Road, Bristol BS2 0TB Tel: 0117 933 2000 Fax: 0117 933 2001.		
Drawn	RJB	11/16					
Checked							
Approved							
SCALE	N.T.S.			Title 33kV CABLE TERMINATION SINGLE POLE ARRANGEMENT (3 x SINGLE CORE EPR CABLES)			WESTERN POWER DISTRIBUTION Drg. No. GR3D 6.6.3 Rev No

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GENERAL REQUIREMENT 7

INSULATION AND CONTINUITY CABLE TESTS

General

The insulation resistance and continuity of all cables that are to be part of the HV (6.6/33kV) system including previously disconnected and new cables shall be tested before jointing.

These tests will require preparation of the cable ends; any cable end that is undergoing test shall be protected and supervised to prevent accidental contact with a member of the general public or WPD staff.

The “Megger” or insulation resistance test instrument shall be used on the 1000V range and shall be tested for serviceability before use.

Method of Testing

- 7.1 Continuity** – having opened and prepared the cable ends, the remote end of the conductor shall be connected to the earth screen.

With the instrument connected to the conductor and earth screen at the test end a very low reading zero should be obtained, each core being tested in turn.

- 7.2 Insulation Resistance** – having opened and prepared the cable ends the instrument shall be connected to the conductor and earth screen the reading should show the insulation resistance greater than 1000 megohms ($M\Omega$) for lengths up to a drum length.

Where cables have been jointed the cores shall be tested between each in turn, a reading of 1000 megohms ($M\Omega$) should be achieved.

If the test shows an insulation resistance below 1000 megohms ($M\Omega$), the Supervisor shall be advised before carrying out any jointing work.

- 7.3 Phasing Identification** – prior to jointing work being carried out it will be necessary to obtain the phasing of the circuit to which the single core EPR / XLPE cables are to be connected. The test shall be carried out as the continuity test and as each core is identified it shall be marked with the appropriate PVC phase colour tape.

GENERAL REQUIREMENT 8

HEAT STRAIGHTENING OF CABLES

Before commencing the level of PPE required for this operation shall be as the matrix given in General Requirement 3.

General

With dry designs of polymeric cable after the removal of the oversheath and metallic sheath, the polymeric cable has a tendency to bend. This can give rise to problems associated with the fitting of the terminations or straight joints. Because of this there is a need for a heat treatment process to be applied to each core to relieve the mechanical stresses that are locked into the cable insulation.

With the wet designs of polymeric cable the polymeric cable has a tendency to bend, even after being set into their final position. This can give rise to problems associated with the fitting of the terminations or straight joints. Because of this there is a need for the heat treatment process to be applied to the core to relieve the mechanical stress that is locked into the cable insulation.

Apply the tube, fitted with the heater tape and thermocouple, over the cable end and onto the PVC packing. Ensure that the thermocouple is not directly under the heater tape. Wrap the complete assembly with a thermal blanket.

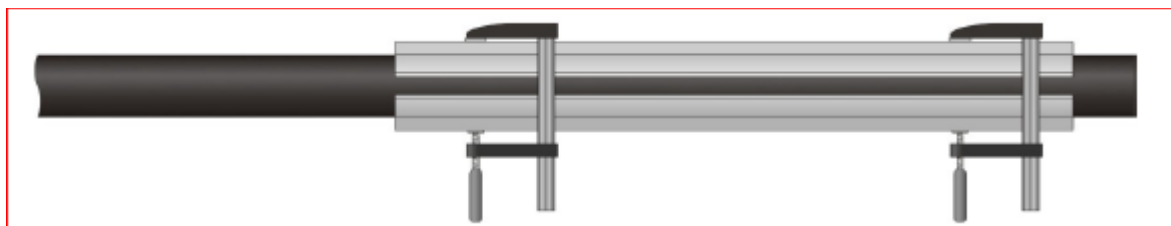


Switch on the controller and bring the temperature of the cable up to 90°C, once the cable has reached the required temperature the heating time is determined by the cable size. Given below: -

4 hours for conductor sizes up to and including 500mm².

6 hours for conductor cross sections above 630 mm² and up to 1600 mm².

After the requisite time, switch off. Remove the blanket, heater tube complete with heater tape, thermocouple and PVC packing. Wearing appropriate gloves carefully straighten the cable into the correct position by hand.



Clamp the cable in to position on a V shaped angle irons or channel irons and allow the cable to cool for a minimum of two hours, insuring the angle iron or channel irons stay in the correct position during the cooling process.

GENERAL REQUIREMENT 9

MOISTURE TESTING

Before commencing the level of PPE required for this operation shall be as the matrix given in General Requirement 3.

General

Moisture if it penetrates into a cable will travel along the cable and may be detected many metres from the point of entry.

The moisture can travel along the screen papers, belt papers, wormings, core papers or between the strands of the conductor. It is essential; therefore, when carrying out moisture tests that samples from each part of the cable are tested, the samples must not be touched by hand as the test is so sensitive that the moisture transferred from the hand to the sample will be detected.

The simple on-site method of testing cable papers using hot paraffin wax can be conveniently used for this purpose.

The paraffin wax is heated to a temperature of **140°C** and providing the wax shows no signs of frothing around the dipped items then the items can be assumed to be “**dry**”.

9.1 Safety Precautions

Skin Contact

When the wax is in the motion state at elevated temperatures there is a risk of thermal burns, therefore contact with the skin should be avoided and precautions taken against accidental splashes. Skin sensitization or irritation is very infrequent.

Molten wax on the skin should be cooled rapidly by cold water and removed carefully from the skin in not less than 30 minutes to avoid blistering, preferably under medical supervision to avoid tissue damage.

Splashes in the Eye

In the event of wax entering the eyes these should be flushed immediately with water from 15 minutes and medical attention obtained.

Breathing of Vapour

Paraffin wax poses virtually no hazard to health when used in normal industrial practice. There is no hazard from inhalation of the vapour nor is ingestion considered to be a normal industrial hazard. Wax fumes may cause eye and respiratory tract irritation if present in sufficiently high concentration, in such circumstances adequate ventilation is to be provided to prevent high concentration building up in the work area.

Fire Hazard

Although stable at the usage temperature paraffin wax may catch fire at temperatures above 175°C and in the event of a small fire, foam, carbon dioxide, dry chemical powder, sand or earth may be employed to extinguish the flames.

For larger fires where a high concentration of wax is stored use foam or water fog, anyone tackling the fire must wear suitable respiratory equipment.

9.2 Method of Testing

Heat the paraffin wax to the required temperature **140°C**, monitoring the thermometer to keep the temperature constant throughout the test.

Take samples of the belt paper, outer and inner core papers, wormings and finally the core strands. These samples should be taken using dry knives and pliers.

A foamy bubbling of the compound around the samples will indicate the presence of moisture.

The samples should all be tested singly to avoid air trapped between layers causing bubbles in the compound.

Care must be taken to keep the compound temperature within the temperature range as higher temperatures will cause spurious bubbling and lower temperatures cannot be relied on to give an indication when moisture is present.

If the test shows moisture is present in the cable further tests should be made at 300mm intervals along the cable until it is proved dry in two consecutive tests.

GENERAL REQUIREMENT 10

REMOVAL OF WATER FROM EPR/XLPE CABLES WHILST JOINTING

Before commencing the level of PPE required for this operation shall be as the matrix given in General Requirement 3, also your attention is drawn to the Use of Solvents given in General Requirement 1.

General

Due to the MDPE oversheath of EPR / XLPE cables being loosely extruded and the absence of any water blocking between the sheath inner and the copper wires, water travels easily through the cable.

This becomes evident at times when the MDPE oversheath has become punctured and allowed the ingress of water to travel some distance along the cable from the point of damage.

It is of the utmost importance for reliability of the completed joint that resin encapsulation is undertaken whilst the cable is dry; otherwise the resin will not cure and becomes porous, with subsequent failure of the joint.

Having opened the cable at the joint position ascertain from which end the water is draining and adopt the following method, there may be a need to vent both sides of the joint position.

Method

Refer to Drawing GR3D 6.10.1 whilst undertaking this General Requirement.

1. Clean and degrease the MDPE oversheath using an approved degreaser.
2. At a suitable distance (i.e. position of temporary earth continuity bond) from the proposed end of the outer joint sleeve remove a 30mm length of MDPE oversheath – Fig 1.
3. Allow water to drain, dry the interior of the cable at the joint position and complete to the relevant Jointing Procedure.
4. Park a mastic lined heat shrink tube on the cable.
5. Replace the MDPE oversheath and apply two half lapped layers of '3M' 5313 tape the tension of the 5313 tape shall be such to cause the width of the tape to reduce to $\frac{3}{4}$ of its normal width, the tape shall then overlap onto the oversheath by 25mm – Fig 2.
6. Apply two half lapped layers, under tension of '88' black PVC tape over the previously applied '3M' 5313 tape, overlapping onto the MDPE oversheath. – Fig 2.
7. Shrink down the mastic lined heat shrink tube over the '88' tape. – Fig 3.

All dimensions in mm

Mastic Lined
Heatshrink Tube

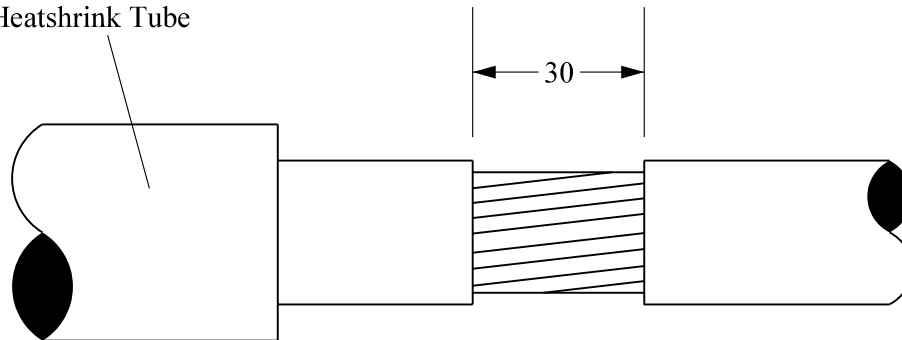


Fig 1.

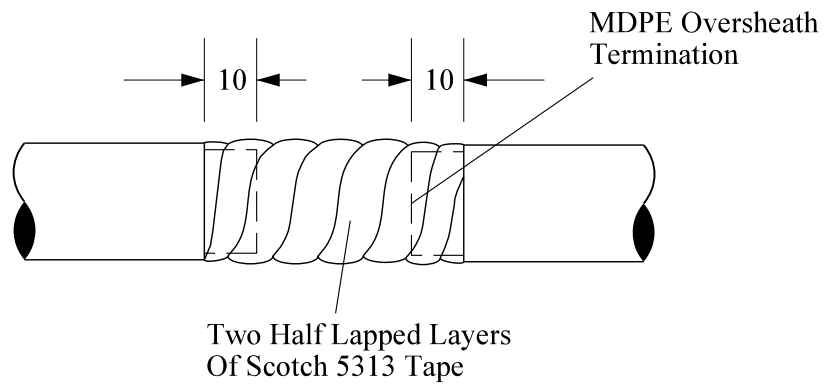


Fig 2.

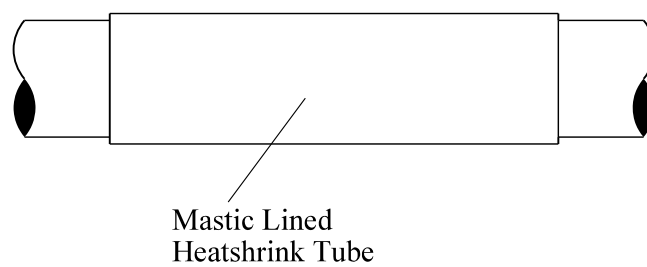



Fig 3.

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Drawn	RJB	11/16				
Checked						
Approved						
SCALE	N.T.S.		Title REMOVAL OF WATER FROM EPR CABLES WHILST JOINTING			Drg. No. GR3D 6.10.1
						Rev No

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GENERAL REQUIREMENT 11

EQUIPOTENTIAL BONDING DURING JOINTING

Before commencing the level of PPE required for this operation shall be as the matrix 1 given in General Requirement 3.

General

The procedure is designed to provide protection for personnel by maintaining electrical continuity across breaks in the sheathing and or armour during jointing or repair operations on underground cables. This will ensure that the earthing of connected equipment is not impaired; in addition it will bring all exposed metallic cable sheaths/armours to the same potential.

This general requirement applies to straight, branch, loop joints and terminations on LV, 11kV, 33kV, 66kV and Pilot/Scada/Multicore underground cables whether these cables are connected to WPD's electrical network or any other private network. It applies equally to cables having a continuous metallic sheath and those where earth continuity is provided via the armouring of the cable.

High voltage faults resulting in an earth fault on the network can occur at any time. In the short period of time during which the earth fault current is flowing, it is possible for the high voltages to be impressed onto conducting parts of a power cable which may create a hazard to people and equipment.

There are two effects that can cause high voltages to appear on the conductive parts of a power cable.

- 1) Induced Voltage: - is a direct result of the proportion of earth fault current returning through the soil. This longitudinal voltage is proportional to the value of earth fault current and the distance that the two circuits run in parallel.
- 2) Rise Of Earth Potential (ROEP) at the site feeding the faulted circuit. When an earth fault occurs, the entire area of a site where the fault current flows to earth may momentarily rise in potential with respect to the general mass of earth. This rise in potential is due to the fault current flowing through earth system impedance.

During an earth fault and the subsequent ROEP, circuits can import true earth potential into a Hot Site. In a similar way a Hot Site can transfer the ROEP to the remote end of the circuit. In each case the potential difference between the cable and the local earth potential may create a hazard to people and equipment.

Approved Equipment

The temporary continuity connectors consist of cross bonds of flexible tinned copper braid, which are connected to the armour or sheath by special clamps. The braid has a primary insulation of clear polythene tubing.

Class one electrical gloves complete with outer leather protector.

Application of Bonds

The temporary continuity connectors or “Bonds” are used in the following way: -

Examine the Hepbonds to ensure the insulation and connection clamps are clean and serviceable.

After the spiking gun has been released from the cable the cable is then cut using the insulated hacksaw and the class 1 electrical gloves, this cut then becomes the reference line for the new joint. Once the one cable end has been shrouded work on the exposed length of cable can now progress: -

11.1 Straight Through Joints

11.1.1 Single Core EPR/XLPE

Working on one end of the trefoil and with the second end shrouded with either a 1000 gauge pole top bag or by using the LV shrouding, the non-shrouded end of the trefoil is then opened out thus separating the cores thus allowing the installation of the various components required to complete the joint.

Where the cores have been cut becomes the reference mark for the joint, wearing the red Mappa gloves the oversheath is cleaned down using the approved degreaser for a distance of 1.5m. Using the reference line and a Chinagraph pencil mark where the oversheath termination will be, add an additional mark some 300mm clear of the oversheath termination mark this second mark will be for the earth continuity bond. Park up a medium walled mastic lined tube over each of the cores.

Using the correct size of PG pliers for the cable carefully open a window in the oversheath as per Figure 1 of GR3D 6.11.1, a clean temporary continuity connector shall be applied and properly tightened to the copper screen wires.

Remove the 1000 gauge pole top bag or LV shrouding from the second end of trefoil, apply the shrouding to end which has been prepared and follow the above procedure for the second end. The application and removal of the earth continuity bond requires the use of class 1 electrical gloves as detailed in the matrix of GR 3. **The bond shall not be removed until the permanent earth conductor has been re-established across the joint**, or the normal earth path is restored by the joint sleeve, or by a permanent armour bond in the case of cables where the armour is the only continuity conductor.

11.1.2 H Cable/HSL/3 core XLPE

Working on one end of the H Cable/HSL/3 core XLPE and with the second end shrouded with either a 1000 gauge pole top bag or by using the LV shrouding, the non-shrouded end of the H Cable/HSL/3 core XLPE is then set into position.

Where the cable has been cut becomes the reference mark for the joint, wearing the red Mappa gloves the oversheath is cleaned down using the approved degreaser for a distance of 1.5m. Using the reference line and a Chinagraph pencil mark where the oversheath termination will be, after the aluminium sheath, has been exposed during the early stages of making a straight joint and before the aluminium sheath, has been cut to the required length, as dictated by the relevant Jointing Procedure, a clean temporary continuity connector shall be applied, see Figure 4 of GR3D 6.11.2 and properly tightened to the cleaned aluminium sheath, at a position where it will not interfere with the jointing procedure. With an H Cable/HSL/3 core XLPE cable this will be in the location of where the water blocking shall be applied. The application and removal of the earth continuity bond requires the use of class 1 electrical gloves as detailed in the matrix of GR 3. **The bond shall not be removed until the permanent earth conductor has been re-established across the joint**, or the normal earth path is restored by the joint sleeve, or by a permanent armour bond in the case of cables where the armour is the only continuity conductor.

11.1.3 PILC

Working on one end of the PILC and with the second end shrouded with either a 1000 gauge pole top bag or by using the LV shrouding, the non-shrouded end of the PILC is then set into position.

Where the cable has been cut becomes the reference mark for the joint, wearing the red Mappa gloves the oversheath is cleaned down using the approved degreaser for a distance of 1.5m. Using the reference line and a Chinagraph pencil mark where the armour termination will be, after the armours have been cut and the lead sheath, has been exposed, cleaned and the armours tied down to the lead sheath during the early stages of making a straight joint and before the lead sheath, has been cut to the required length, as dictated by the relevant Jointing Procedure, a clean temporary continuity connector shall be applied, see Figure 5 of GR3D 6.11.2 and properly tightened to the cleaned lead sheath, at a position where it will not interfere with the jointing procedure. With a PILC cable this will be in the location of where the water blocking shall be applied. The application and removal of the earth continuity bond requires the use of class 1 electrical gloves as detailed in the matrix of GR 3. **The bond shall not be removed until the permanent earth conductor has been re-established across the joint**, or the normal earth path is restored by the joint sleeve, or by a permanent armour bond in the case of cables where the armour is the only continuity conductor.

In the case of the cables that are disconnected from one another, then all work involving the cable sheath / armour carried out prior to the temporary continuity connector being fitted, shall be undertaken using the approved personal protective equipment (PPE) as detailed in the matrix given in ST: CA3C/2 – General Requirement No. 3. Once the temporary continuity connector has restored the earth continuity then the jointing can proceed in accordance with the relevant jointing procedure.

The third or free end of the temporary continuity connector should be placed safely out of the way, e.g. by putting it around some clean part of the cable.

Once the cable(s) have been cut the Jointer shall park the relevant number of heat shrink mastic lined tubes over the cable(s), so that once the bond has been removed the oversheath can then be sealed using the mastic lined heat shrink tubes, see Figures 2 and 3 of GR3D 6.11.1.

11.2 Terminations

After the cable sheath, or armour, as the case maybe, has been exposed during the early stages of terminating the cable and before the sheath / armour is cut, a clean temporary continuity connector shall be applied to the sheath / armour of the cable and a suitable earth of the switchgear/transformer. The temporary continuity connector shall be properly tightened and at a position where it will not interfere with the jointing procedure. **It shall not be removed until the permanent earth conductor has been established on to the termination** or by a permanent armour bond in the case of cables where the armour is the only continuity conductor.

All work associated with the removal of the PVC oversheath / serving carried out prior to the temporary continuity connector being fitted to the sheath / armour of the cables to be terminated, should be undertaken using the approved PPE as detailed in the matrix given ST: CA3C/2 – General Requirement No. 3. Once the temporary continuity connector has established the earth continuity between the main cable and the switchgear / transformer, then the jointing can proceed in the normal manner.

The third or free end of the temporary continuity connector should be placed safely out of the way, e.g. by putting it around some clean part of the cable.

11.3 Removal of Bonds

Once the jointer reaches the stage where the mechanical earth connection or earth cage has been correctly fitted to the sheaths/armours of all cables within the joint or termination, wearing class 1 gloves the temporary continuity connector can be removed. The class 1 gloves are not needed for the application of the Scotch 5313 tape or shrinking down the previously parked heat shrink tube can then be centralised and then shrunk down over the opened oversheath position.

All dimensions in mm

Mastic Lined
Heatshrink Tube

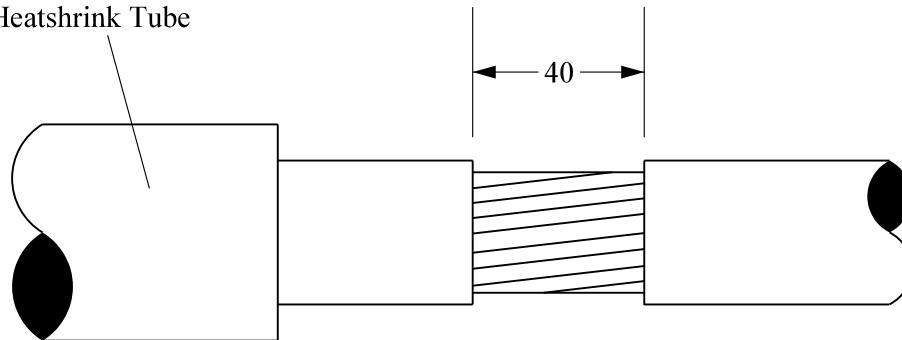


Fig 1.

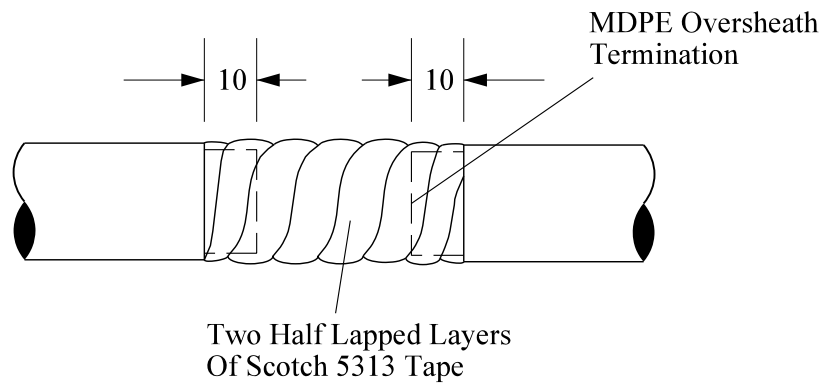


Fig 2.

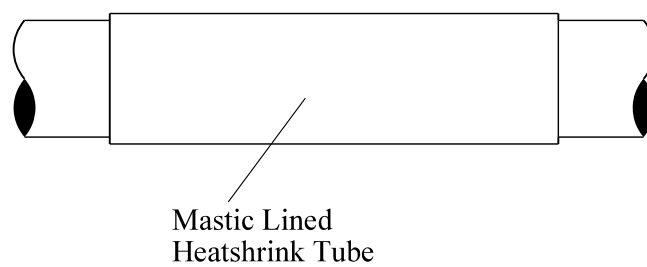


Fig 3.

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SCALE	N.T.S.		Title APPLICATION OF EARTH EQUIPOTENTIAL BONDS - TRIPLEX			Drg. No. GR3D 6.11.1
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All dimensions in mm

PILC

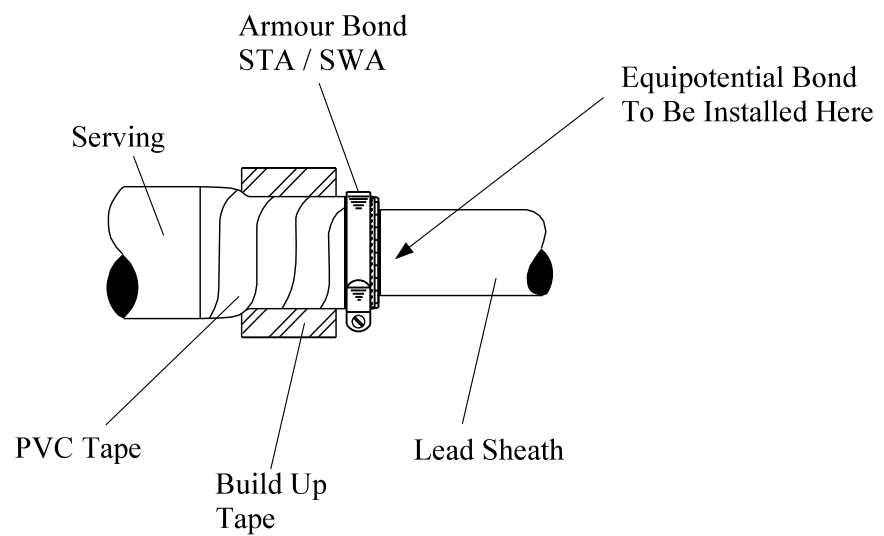



Fig 4.

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GENERAL REQUIREMENT 12

REMOVAL OF SERVING, ARMOUR AND BEDDING

Before commencing the level of PPE required for this operation shall be as the matrix given in General Requirement 3, also your attention is drawn to the Use of Solvents General Requirement 1.

General

Removal of cable servings and protective steel tape or wire armour must be undertaken with care, tape and wire armour are to be terminated using a depth guarded hacksaw.

Bedding tapes require removal with knives and heat (gas torch), careless use of the knife can cause lead sheath damage, whilst excessive localised heat will produce burning and melting of the lead sheath.

Damage to the lead sheath will weaken the sheath of its current carrying capacity or if severed will allow the ingress of moisture.

Method of Removal

12.1 Steel Tape Armour

Refer to the relevant Jointing Procedure for stripping dimensions

- 1.1 At the armour termination position apply a 16 swg wire binder around the serving. Cut around the serving at the binder with a hook knife (E 5 No. 32264) using sufficient force to cut the serving but not to damage the armour.
- 1.2 Remove the serving to the cut position.
- 1.3 At the armour termination position apply a 16 swg wire binder around the armour tapes, cut through the outer armour tape with a hacksaw fitted with a depth guard and remove.
- 1.4 Repeat the operation for the inner armour tape, taking extreme care to ensure that the lead sheath is not damaged.
- 1.5 At the bedding termination position apply a 16 swg wire binder around the bedding. Cut around the bedding at the binder taking care not to damage the lead sheath.
- 1.6 Remove the hessian bedding by cutting with a hook knife along the side of the cable, which will allow the bedding to be unwrapped. Warming the bedding with a gas torch may help this operation.
- 1.7 Warm the paper bedding over the lead sheath and remove.

- 1.8 Warm the bitumastic coating over the lead sheath and the armour tapes until it just begins to melt, with a gas torch. Remove the bitumastic coating and clean the lead sheath and armour tapes with a wipe moistened with an approved degreaser.
- 1.9 Finally clean with a dry wipe.
- 1.10 Before any further work on the lead sheath is undertaken, the sheath should be degreased with an approved degreaser.

12.2 Steel Wire Armour

Refer to the relevant Jointing Procedure for stripping dimensions.

- 2.1 At the serving termination position, apply a 16 swg wire binder around the serving. Cut around the serving at the binder with a hook knife using sufficient force to cut the serving but not to damage the armour.
- 2.2 Remove the serving to the cut position.
- 2.3 At the armour termination position, apply a 16 swg wire binder around the armour wires, partly cut through the armour wires with a hacksaw fitted with a depth guard.
- 2.4 Unwrap and remove the armour a few wires at a time, by bending backwards and forwards to break them away.
- 2.5 Remove the wire binder applied in 2.3, lift and turn the armour wires back at 90° to the lead sheath bedding.
- 2.6 At the bedding termination position apply a 16 swg wire binder around the bedding. Cut around the bedding at the binder taking care not to damage the lead sheath.
- 2.7 Remove the hessian bedding to the armour by cutting with a hook knife along the side of the cable, which will allow the bedding to be unwrapped. Warming the bedding with a gas torch may help this operation.
- 2.8 Warm the paper bedding over the lead sheath and remove.
- 2.9 Warm the bitumastic coating over the lead sheath and the armour wires until it just begins to melt, with a gas torch. Remove the bitumastic coating and clean the lead sheath and armour wires with a wipe moistened with an approved degreaser.
- 2.10 Finally clean with a dry wipe.
- 2.11 Before any further work on the lead sheath is undertaken, the sheath should be degreased with an approved degreaser.

GENERAL REQUIREMENT 13

BONDING OF STEEL TAPE OR STEEL WIRE ARMOUR (PAPER CABLES)

Before commencing the level of PPE required for the operation shall be as the matrix given in General Requirement 3, in addition your attention is drawn to the Use of Solvents given in General Requirement 1.

General

When jointing on PILC cables that are served with steel tape or steel wire armour the armour and lead sheath must be bonded to prevent potential difference between the two, failure to bond between will lead to erosion of the lead at the armour termination point.

Method of Installation

Refer to Drawing GR3D 6.13.1 whilst undertaking this General Requirement.

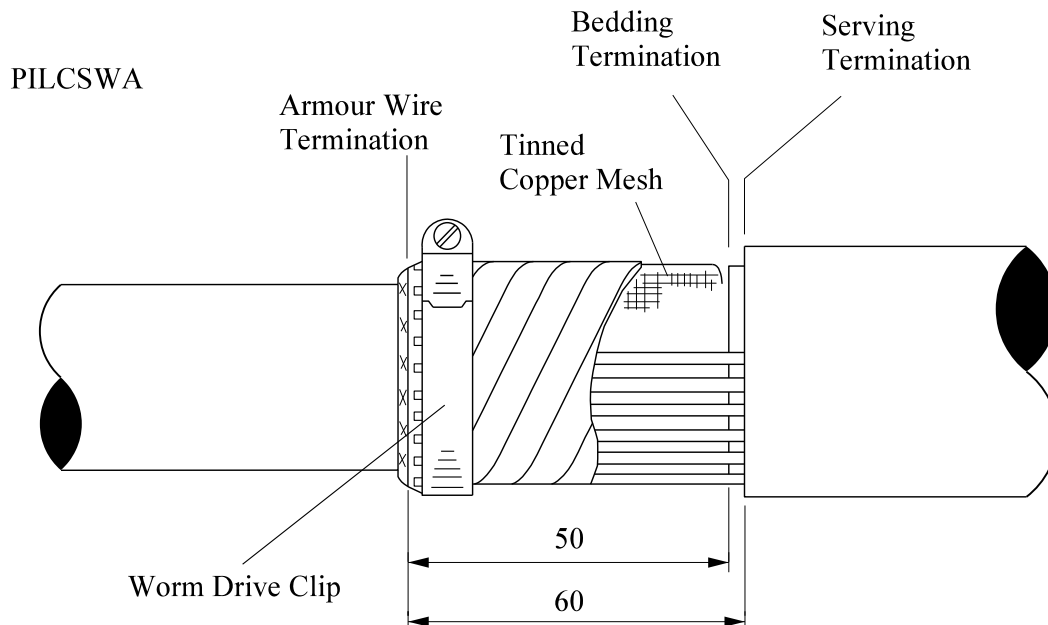
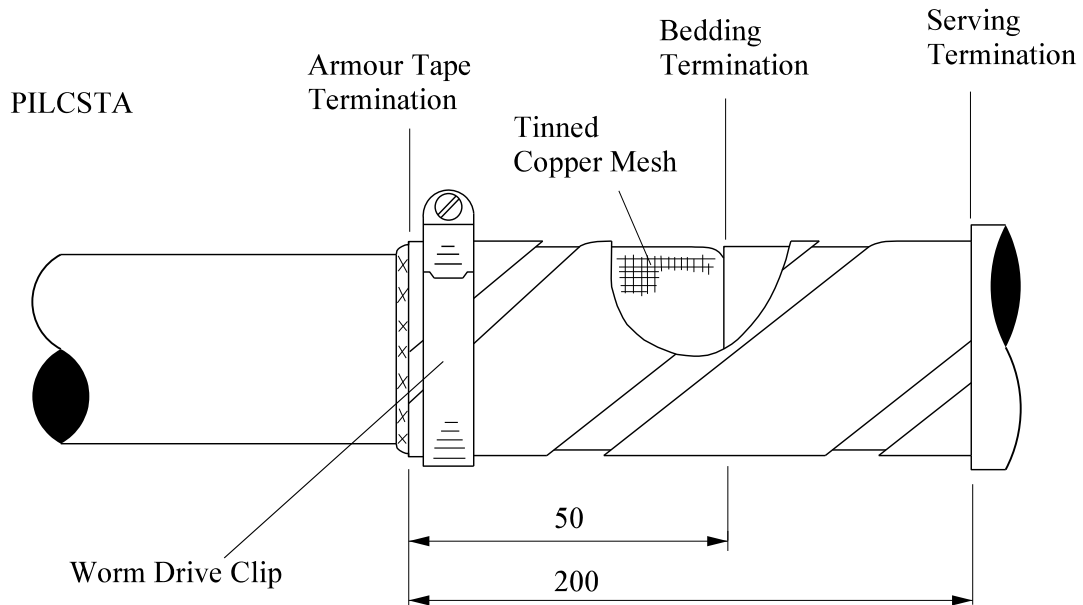
13.1 Steel Tape Armour

- 1.1 Prepare the cable to General Requirement 12 using the stripping dimensions given in the relevant Jointing Procedure.
- 1.2 Thoroughly degrease and abrade the lead sheath giving a final clean after abrading with an approved degreaser.
- 1.3 Wrap tinned copper mesh around the lead sheath so that the leading edge protrudes just beyond the tape armour when laid back onto the lead sheath.
- 1.4 Re-lay the tape armour over the tinned copper mesh securing with a worm drive clip, tighten with a torque driver set at 5Nm.
- 1.5 Starting on the outer serving cover the exposed tape armour with two half lapped layers of Scotch 88 black PVC tape up to the worm drive clip.

13.2 Steel Wire Armour

- 2.1 Prepare the cable to General Requirement 12 using the stripping dimensions given in the relevant Jointing Procedure.
- 2.2 Thoroughly degrease and abrade the lead sheath giving a final clean after abrading with an approved degreaser.
- 2.3 Wrap tinned copper mesh around the lead sheath so that the leading edge protrudes just beyond the wire armour when laid back onto the lead sheath.

- 2.4 Re-lay the armour wires over the tinned copper mesh and secure with a worm drive clip, tighten with a torque driver set at 5Nm.
- 2.5 Starting on the outer serving cover the exposed armour wires with two half lapped layers, applied under tension of Scotch 88 black PVC tape up to the worm drive clip.



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				BONDING OF STA/SWA ARMOUR		GR3D 6.13.1	

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GENERAL REQUIREMENT 14

REMOVAL OF STEEL WIRE ARMOUR OF 3 CORE SWA XLPE CABLES

Before commencing the level of PPE required for this operation shall be as the matrix given in General Requirement 3, also your attention is drawn to the Use of Solvents General Requirement 1.

General

Removal of the cable oversheath or wire armour must be undertaken with care, the wire armour are to be terminated using a depth guarded hacksaw.

When jointing on 3 core SWA XLPE cables that are served with steel wire armour the armour and three individual copper tape screens of the cores must be bonded to prevent potential difference between the two, failure to bond between will lead to damage of the copper tape screens if a trough fault were to be carried by the cable as the steel wire armours are designed to carry the fault current.

Method of Removal

Refer to Drawing GR3D 6.14.1 whilst undertaking this General Requirement.

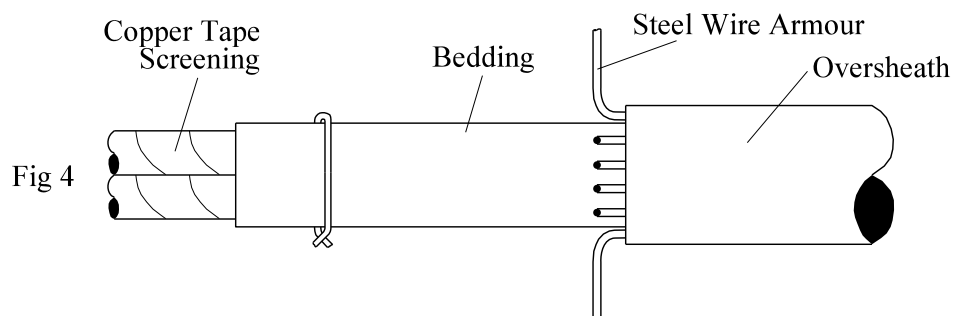
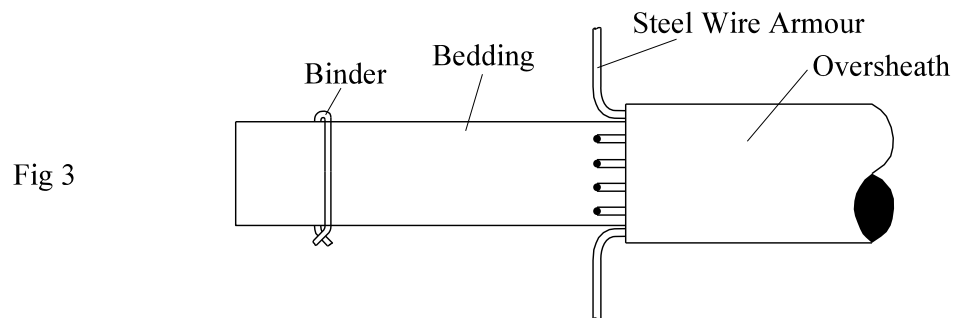
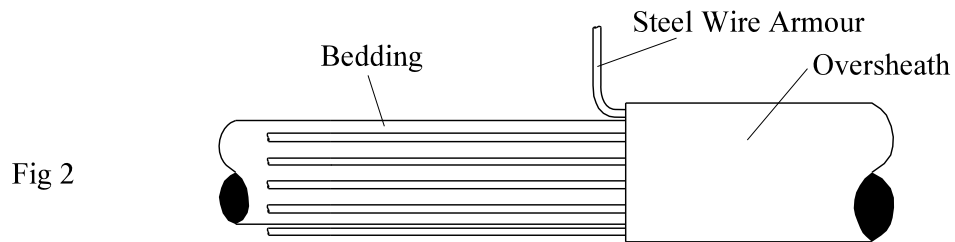
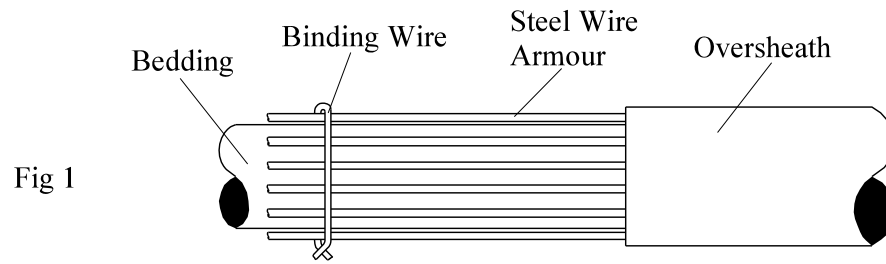
14.1 Steel Wire Armour

Refer to the relevant Jointing Procedure for stripping dimensions.

- 1.1 At the oversheath termination position, apply a circumferential cut to the PVC to cut the oversheath but not to damage the armour.
- 1.2 Remove the oversheath to the cut position.
- 1.3 At the armour termination position, apply a 20 swg wire binder around the armour wires, partly cut through the armour wires with a hacksaw fitted with a depth guard. See Fig 1.
- 1.4 Unwrap and remove the armour a few wires at a time, by bending backwards and forwards to break them away. See Fig 2.
- 1.5 Remove the wire binder applied in 1.3, lift and turn the armour wires back at 90° to expose the PVC bedding.
- 1.6 At the bedding termination position apply a 20 swg wire binder around the bedding. Cut around the bedding at the binder taking care not to damage the copper tape screens on each of the phases. See Fig 3.
- 1.7 Remove the PVC bedding up to the binding wire applied in 1.6, by cutting with a hook knife along the side of the cable, which will allow the bedding to be removed. See Fig 4.

- 1.8 Thoroughly degrease the copper tape screens of the cores and the bedding with an approved degreaser.

All dimensions in mm



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				REMOVAL OF STEEL WIRE ARMOUR ON 3 CORE SWA XLPE CABLE	
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GENERAL REQUIREMENT 15

BONDING OF STEEL WIRE ARMOUR (3 Core SWA XLPE CABLES)

Before commencing the level of PPE required for the operation shall be as the matrix given in General Requirement 3, in addition your attention is drawn to the Use of Solvents given in General Requirement 1.

General

When jointing on 3 core XLPE SWA cables that are served with steel wire armour the armour and copper tape screens must be bonded to prevent potential difference between the two, failure to bond between the SWA and the copper tape screens will result in a failure of the copper tape screens under through fault conditions as the copper tape screens can only carry about 3% of the fault current the steel wire armours are designed to carry the fault current.

Method of Installation

Refer to Drawing GR3D 6.15.1 whilst undertaking this General Requirement.

15.1 Steel Wire Armour

- 1.1 Prepare the cable to General Requirement 14 using the stripping dimensions given in the relevant Jointing Procedure.
- 1.2 Thoroughly degrease the PVC bedding layer.
- 1.3 Wrap the stainless steel support ring around the bedding and clip into the required position. As the support ring is range taking, the ring should be clipped into position in such a way that there a snug fit between the ring and the PVC bedding.
- 1.4 Covering the complete support ring apply two layers of copper knit mesh applied under moderate tension.
- 1.5 Lay the steel wire armours onto the stainless steel support ring.
- 1.6 Taking the copper braid from Lovink base module, cut off the copper ferrule.
- 1.7 Splay the end of the copper braid to the diameter of the steel wire armours of the cable.
- 1.8 Lay the copper braid onto the steel wire armours, ensuring all the armours are covered by the braid.
- 1.9 Apply the jubilee clip to the copper braid.
- 1.10 Once the jubilee clip has been applied, torque to 5Nm.

- 1.11 Starting on the oversheath cover the exposed armour wires, braid and roll spring with two half lapped layers, applied under tension of Scotch 88 black PVC tape.

Fig 1

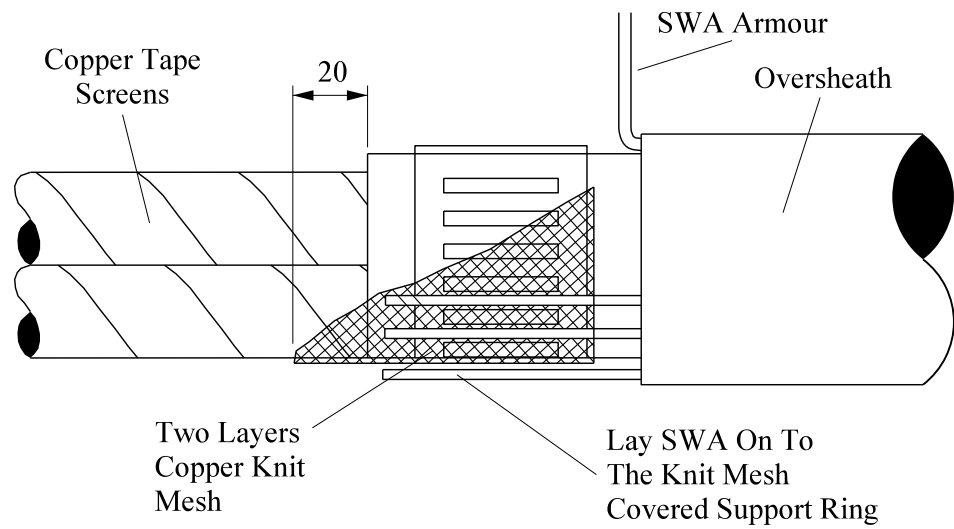


Fig 2

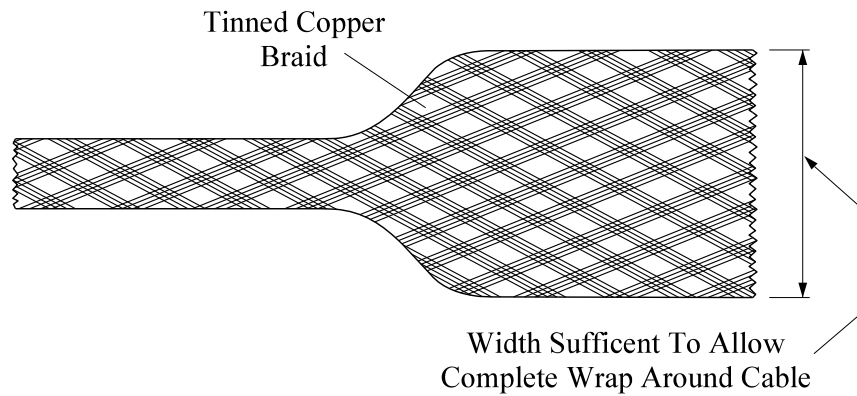
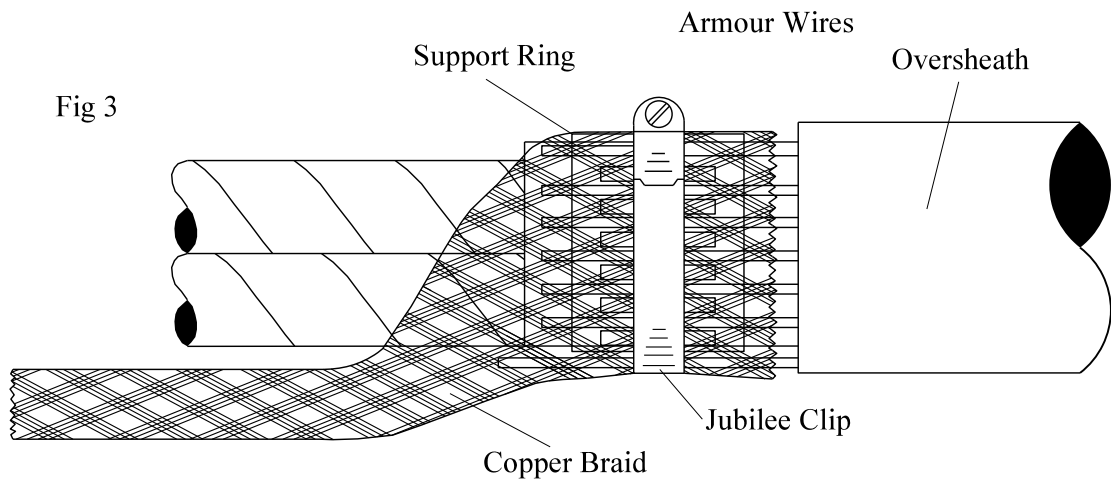



Fig 3



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GENERAL REQUIREMENT 16

REMOVAL OF PVC OVERSHEATHS ON PAPER CABLES

Before commencing the level of PPE required for this operation shall be as the matrix given in General Requirement 3, also your attention is drawn to the Use of Solvents General Requirement 1.

General

PVC oversheaths are sometimes found on SWA PILC and PILC single core cables. Removal should be undertaken with care to prevent damage to underlying metallic sheaths and steel wire armour; use of correct depth guarded tooling will prevent accidental damage.

Where heat is required to aid the removal of PVC oversheaths care must be taken whilst heating with a gas torch flame, excessive heat will cause burning of the PVC which in turn will result in the giving off of toxic fumes.

Method of Removal

16.1 PVC Oversheaths of PILC SWA Cable

- 3.1 Make a circumferential cut at its termination point using the aluminium sheath-cutting tool and cutting partially through the PVC oversheath.

Note: - If the Consac tool is unavailable then there are two methods of making the cut the first being with Kevlar string at the relevant position or the second is a circumferential cut shall be made with a depth guarded hacksaw.

- 3.2 Carefully warm the length of oversheath to be removed and hook knife blade.
- 3.3 At the cable end and to the cable side hook the knife between the oversheath and lead sheath, draw the knife along the length of oversheath to be removed with the blade kept flat to the underlying lead sheath.
- 3.4 Using a hook wedge lift the oversheath away from the cable along the length of the straight cut, remove the oversheath by unwrapping from the cable.

16.2 PVC Oversheaths of PILC Unarmoured Cable

- 2.1 Make a circumferential cut at its termination point using the aluminium sheath-cutting tool and cutting partially through the PVC oversheath.

Note: - If the Consac tool is unavailable then there are two methods of making the cut the first being with Kevlar string at the relevant position or the second is a circumferential cut shall be made with a depth guarded hacksaw.

- 2.2 Carefully warm the length of oversheath to be removed and hook knife blade.

- 2.3 At the cable end and to the cable side hook the knife between the oversheath and lead sheath, draw the knife along the length of oversheath to be removed with the blade kept flat to the underlying lead sheath.
- 2.4 Using a hook wedge lift the oversheath away from the cable along the length of the straight cut, remove the oversheath by unwrapping from the cable.

GENERAL REQUIREMENT 17

REMOVAL OF MDPE OVERSHEATH

Before commencing the level of PPE required for this operation shall be as the matrix given in General Requirement 3.

General

Medium Density Polyethylene (MDPE) oversheaths must be removed with care using depth guarded tooling, incorrect use of tooling may cause damage to the underlying copper screen wires thus reducing the cross sectional area of the screen and its ability to carry fault current to which its designed.

Thickness of the oversheath should be of equal thickness at any point within the sheath. This may not always be the case and the use of specialised tooling may cause damage to the underlying copper screen wires, it is therefore, advisable to test on a scrap length of cable before jointing commences.

Should this be the case or where the work area is restricted, an alternative method for making the circumferential cut is the use of Kevlar string (or whipping thread).

Method of Removal

17.1 Removal using the correct size of Alroc PG Pliers

- 1.1 Pick the correct size of Alroc PG pliers for the cross sectional area of the cable.
- 1.2 Adjust the depth of blade in accordance with the thickness of the oversheath, there is a depth variation of 1, 2 or 3; try the depth of cut on the end of the cable or on some spare core.
- 1.3 Hold the Alroc PG pliers at 90° to the cable and place on the oversheath termination mark is, apply a **slight pressure** to the plier handle and rotate the pliers through 90°. This will create a full 360° circumferential cut in the oversheath.

Note: -Excessive hand pressure on the handles of the pliers will result in copper wire screen damage. This will place a 360° circumferential cut in the oversheath. Only use replacement blades from the WPD E 5 system.

- 1.4 Remove and turn the pliers so as they are parallel to the cable fit the cable between the support roller and cutting wheel.
- 1.5 Ensure the cutting wheel is placed to the waste side of the circumferential cut, apply a good pressure to the plier handle and pull the pliers longitudinally towards the cable end.

- 1.6 Using the claw blades at 90° to the cable, place the top blade into the cut line, apply pressure and pull down and away from the cut line, this will open the oversheath.

17.2 Alternative Method (Kevlar String)

- 2.1 The Kevlar string is used in the form of a “garrotte” around the cable oversheath, with a sawing action the Kevlar will penetrate through the MDPE oversheath without causing damage to the underlying copper screen wires.
- 2.2 The longitudinal cut may be made using a hook knife held and drawn along the cable side, to ease removal a gentle warming of the MDPE oversheath and knife blade with a gas torch will be of benefit.

GENERAL REQUIREMENT 18

RASP ABRADING PVC and FLAME ABRADING MDPE OVERSHEATHS

Before commencing the level of PPE required for this operation shall be as the matrix given in General Requirement 3, also your attention is drawn to the Use of Solvents given in General Requirement 1.

General

The abrading of PVC and the flame abrading of the MDPE oversheaths must be carried out diligently as the adherence of the resin depends upon it. It must be remembered that this produces the primary moisture seal and if this is not effective the joint will surely fail.

Method of Abrading

18.1 Rasp Abrading of PVC Oversheaths

- 1.1 At the position at which the abrading is to be carried out thoroughly clean the oversheath with an approved degreaser.
- 1.2 Thoroughly and circumferentially abrade the cleaned surface of the oversheath with a rasp to produce a matt finish, all embossing must be removed. Check the underside with a mirror.
- 1.3 Clean the abraded area with an approved degreaser to remove all loose particles.

18.2 Flame Abrading of MDPE Oversheaths

Polyethylene has a non-polar, nonporous and inert surface. For this reason, adhesives cannot link chemically or mechanically to untreated polyethylene surfaces. For bonding to other materials a suitable surface preparation must be used. This improves the wetting properties and hence the adhesion of the polyethylene oversheath.

Flame treatment is fast and provides a high bond strength; however it requires very careful control to prevent heat damage to the oversheath.

- 2.1 Thoroughly clean the surface of the sheath, for a length of 200mm.
- 2.2 Using the gas torch with a soft blue flame, which is passed over the sheath until the oversheath appears glossy.
- 2.3 Check the underside of the oversheath with a mirror, to check for the glossy surface.

GENERAL REQUIREMENT 19

REMOVAL OF LEAD SHEATHS

Before commencing the level of PPE required for this operation shall be as the matrix given in General Requirement 3, also your attention is drawn to the Use of Solvents given in General Requirement 1.

General

Removal of lead sheaths on 33kV cables (as with any voltage) must be undertaken with care and control, failure at the lead sheath termination point will result, should the lead sheath be severed whilst cutting, damage will occur to the belt or screen papers.

All PILC cables within Lovink 33kV joints will have the lead sheath removed from the cable end only.

19.1 Method of Removal

1.1 At the lead cut mark, make a circumferential cut no more than halfway into the sheath using: -

- (i) a curved knife for cables of diameter over the lead, less than 40mm.
- (ii) an **insulated hack knife** and hammer for cables of diameter over the lead, greater than 40mm.

Use a mirror to check that the cut has been correctly made underneath the cable.

1.2 Make two “tramlines” spaced 6mm apart, cutting partially through and along the top surface of the lead sheath from the open cable and to its termination point.

1.3 Using pliers pick up the 6mm wide strip at the cable end and pull towards its termination point, thus removing the strip.

1.4 Using a hook wedge lift the oversheath away from the cable along the length of the straight cut, remove the lead sheath by unwrapping from the cable. Check the edges of the lead cut are raised clear of the belt papers.

1.5 Once the lead sheath has been removed an insulated belling tool shall be used to slightly bell the mouth of the lead sheath, to not more than 10mm of the overall lead sheath diameter, care being taken so as not too damage the belt papers with the belling tool.

GENERAL REQUIREMENT 20

TERMINATION OF COPPER WOVEN COTTON TAPES ON SCREENED CABLES

Before commencing the level of PPE required for the operation shall be as the matrix given in General Requirement 3.

General

Modern three-core screened cables have the three cores are laid up and then a metalized cotton binder tape around the three cores; this applies to all 33kV lead sheathed designs of cables.

Removal of the metalized cotton binder tape must be carried out with care, damage to the metalized screen papers in the form of splits or cuts during the jointing process will cause electrical stress at this critical point, which may result in failure.

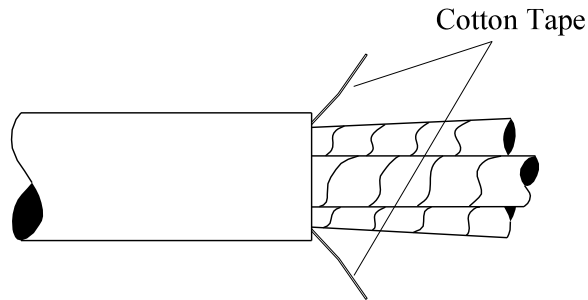
20.1 Method of Removal

Refer to Drawing GR3D 6.20.1 whilst undertaking this General Requirement.

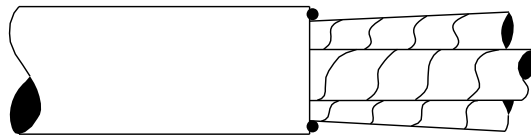
- 1.1 Unwind the copper woven fabric tape, fold the tape to half its original width. Wrap two full turns close to the lead sheath termination, tie off the ends with a half hitch close to the bell mouth of the lead sheath, then push into the bell mouth of the lead sheath, pull tight and cut off excess tape at the termination of the metallic sheath.
- 1.2 Pull out and cut off the outer and centre core fillers close to the copper woven fabric tape.
- 1.3 Apply the 3M Scotch 70 silicon self-fusing rubber electrical tape for a distance of 10mm on the metallic sheath and 20mm from the metallic sheath, see GR3D 6.20.1, on to the metalized screens of the three cores thus forming a seal at the crotch position as detailed in General Requirement 20.

Note: - The only reason this Scotch 70 tape is applied to the metallic sheath is to prevent the Lovisil draining out of the joints inner sleeve and into the cable.

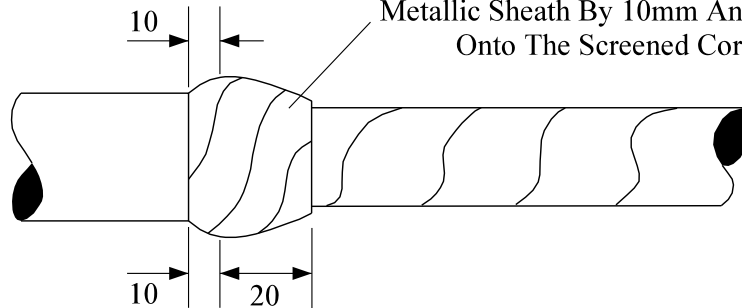
All dimensions in mm




'H' Cable Or Single Core PILC



On Single Core PILC
Scotch 70 Sealing Tape Over Lapped Onto
Metallic Sheath By 10mm And 20mm
Onto The Screened Cores



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SCALE		N.T.S.		Title TERMINATION OF COPPER WOVEN COTTON TAPES ON SCREENED CABLES	
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GENERAL REQUIREMENT 21

SEALING OF METALLIC SHEATHS WITHIN JOINTS (Lovink)

Before commencing the level of PPE required for this operation shall be as the matrix given in General Requirement 3, also your attention is drawn to the Use of Solvents General Requirement 1.

General

To prevent the possible migration of silicon compound (Lovisil) within Lovink joints, a seal is to be placed at the termination point of the metallic sheath.

3M Scotch 70 Self-Fusing Silicone Rubber Electrical Tape is to be used, the tape being compatible with the silicon compound and has the added advantage of providing a support to the cotton woven fabric tape (CWFT) during and after jointing, and to prevent the Lovisil draining out of the joints inner sleeve and into the cable. **No other tape is to be used in this critical area.**

All cable types with a metallic sheath of either lead or aluminium will require this seal.

When applying this tape DO NOT over tension the tape, when over tensioned it will fail.

21.1 Method of Application – Single core PILC

Refer to Drawing GR3D 6.21.1 whilst undertaking this General Requirement.

- 1.1 Ensure the metallic sheath is grease free cleaning with an approved degreaser, dry wipe the CWFT.
- 1.2 Start with the sealing tape butted to the metallic sheath and with the lay of the CWFT apply the tape with a moderate tension – Fig 1.
- 1.3 Apply sufficient lapped turns to form a tapered profile, from the outer diameter of the metallic sheath to the CWFT termination – Fig 2.
- 1.4 Overlap the metallic sheath by 10mm ensuring a minimum of two layers coverage – Fig 3.
- 1.5 Finish on the CWFT area applying the last turn with zero stretch, press down and hold to avoid lifting, fusing will then take place, cut and trim tape.

21.2 Method of Application – H Cable

Refer to Drawing GR3D 6.21.2, GR3D 6.21.3 and GR3D 6.21.4 whilst undertaking this General Requirement.

- 2.1 Ensure the metallic sheath is grease free cleaning with an approved degreaser, dry wipe the CWFT.
- 2.2 Tie off the CWFT 20mm ahead of the lead sheath termination, see Drawing GR3D 6.20.2 figure 1.
- 2.3 Park two foam rings on the lead sheath of the H cable, see Drawing GR3D 6.20.2 figure 1.
- 2.4 Offer up the cold shrink three fingered boot to the prepared H cable, see Drawing GR3D 6.20.2 figure 2
- 2.5 Starting on the fingers, remove the hold outs spirals, once the fingers are finished remove the hold spiral of the cold shrink boot body, see Drawing GR3D 6.20.2 figure 2.
- 2.6 Carefully slide the foam ring closest to the body of the cold shrink boot over the skirt so that the whole foam ring is positioned approximately one third of the way up the skirt of the foam ring. See Drawing GR3D 6.21.3 figure 3.
- 2.7 Apply a medium width plastic cable tie around the skirt of the cold shrink boot and securely tighten the cable tie, see Drawing GR3D 6.21.3 figure 3.
- 2.8 Using a sharp knife carefully trim along the edge of the cable to remove the excess cold shrink skirt, see Drawing GR3D 6.21.3 figure 3.
- 2.9 Slide the second foam ring up into position adjacent the recently installed first foam ring, see Drawing GR3D 6.21.3 figure 4.
- 2.10 This will provide space for the earth continuity bond to be applied as per GR 10.
- 2.11 Once the connectors are through and the bolts have been sheared the earth continuity bond can be removed as per GR 10.
- 2.12 The second foam ring can be slid into its final position so that it fits into the correct location of the inner shell, see Drawing GR3D 6.21.3 figure 4.
- 2.13 Using the new Lovink calliper and as detailed in GR 30 build up the foam ring with two to three layers of foam tape, so as to provide a good seal to the inner shell, see Drawing GR3D 6.21.4 figure 5. The foam tape build up is to be positioned as shown in Drawing GR3D 6.21.4 figure 5, the foam rings in figure 5 are shown fitted in their final position.

All dimensions in mm

Fig 1

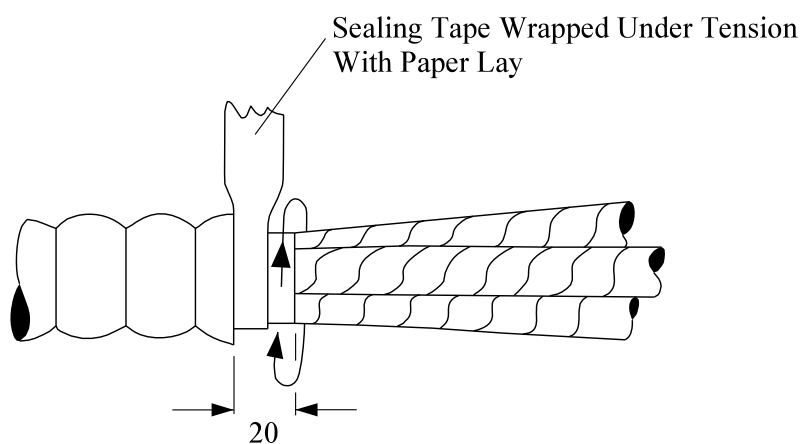


Fig 2

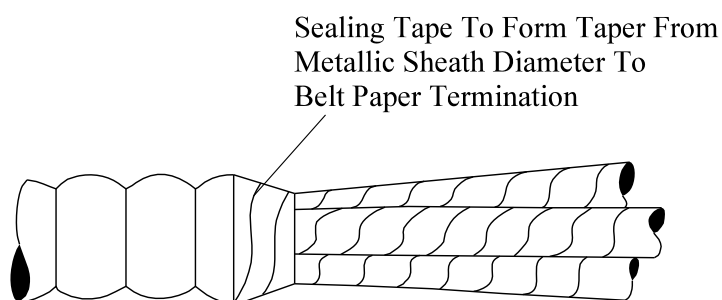
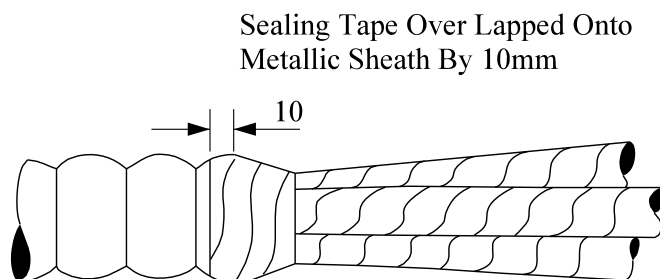



Fig 3

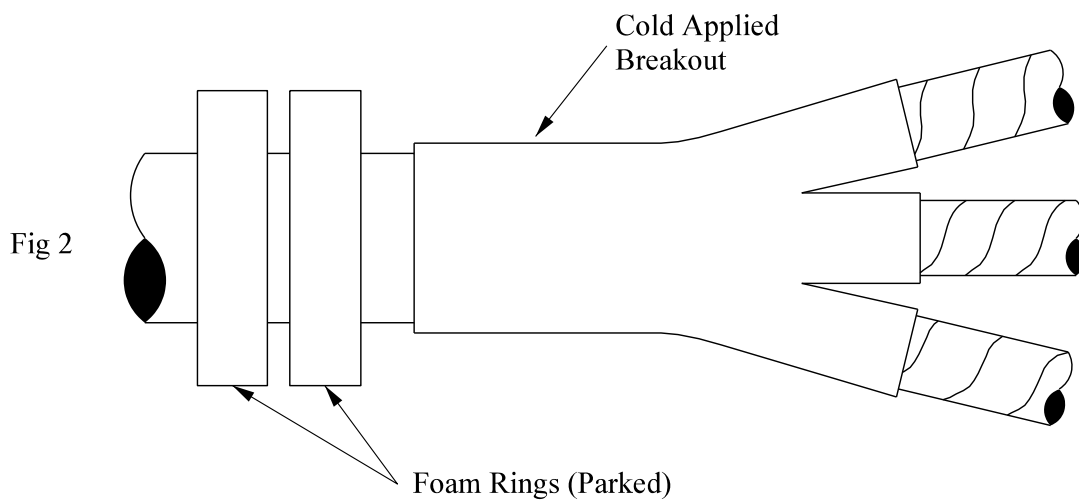
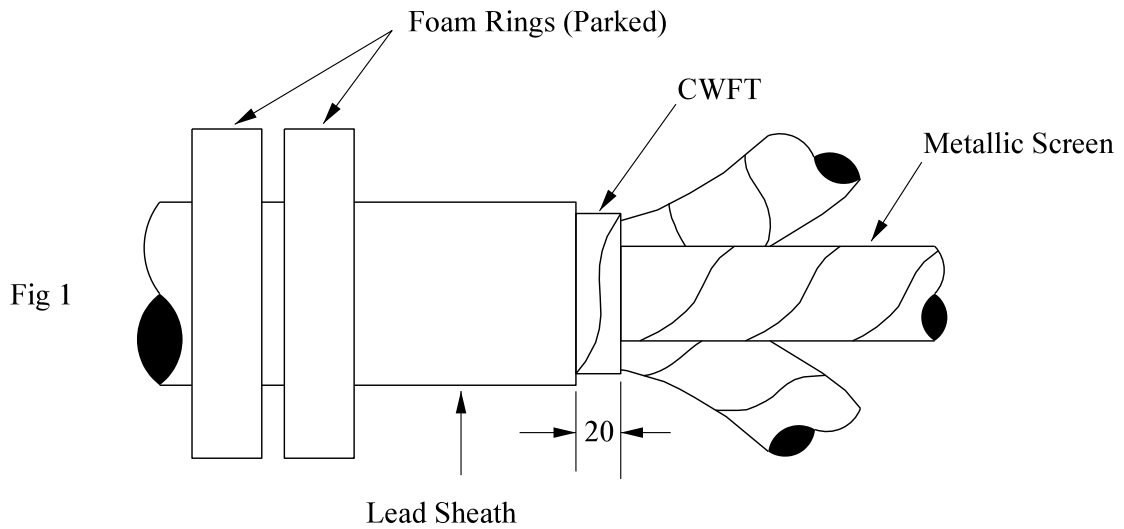


Note:- Application To PILC And PISAS Cables Also As Shown


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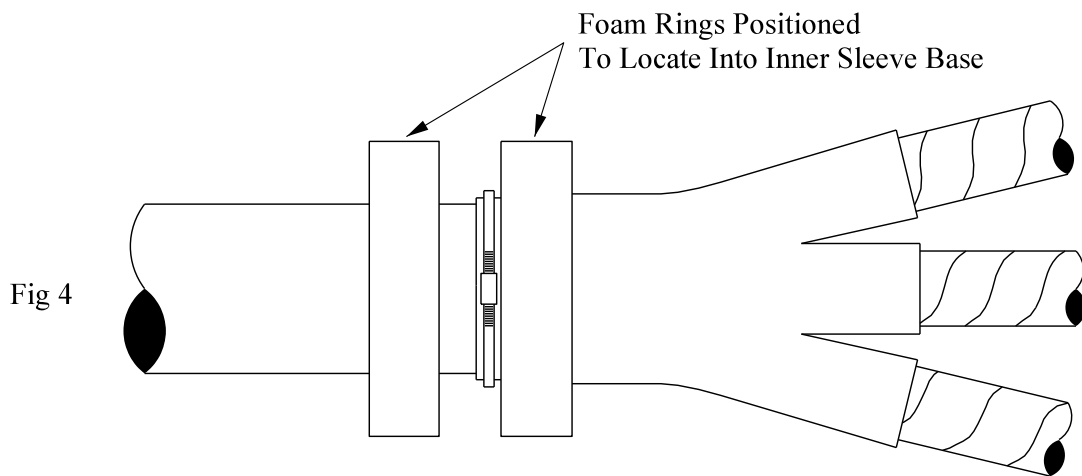
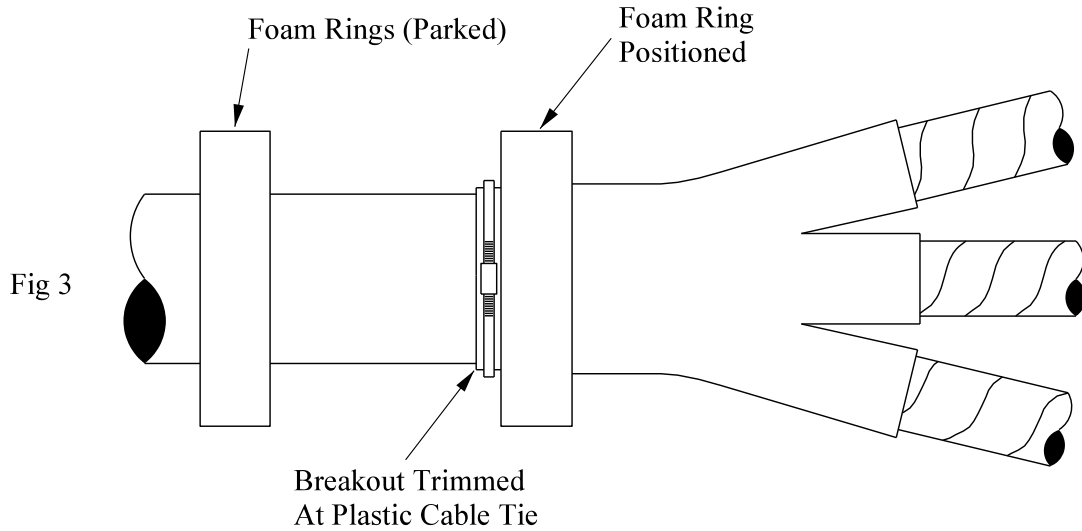


PLAN VIEW

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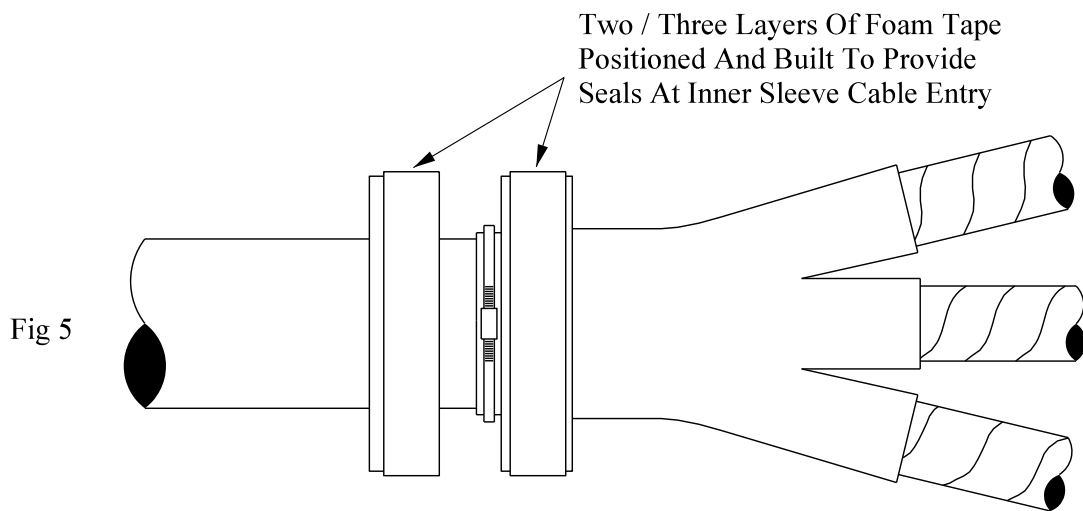


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		Title		APPLICATION OF COLD APPLIED BREAKOUT CROTCH SEAL	
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All dimensions in mm



Note :- Foam Tape Build To Be
Positioned As Shown In Drawing
The Foam Rings Are Shown
Fitted In Their Final Position

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GENERAL REQUIREMENT 22

ALIGNING CORES AND CROSSING

Before commencing the level of PPE required for this operation shall be as the matrix given in General Requirement 3.

General

On all joints, the following procedure must be adopted to ensure correct alignment and spacing of cores. Ensure the cables are in line, straight and level, it is important that this position is maintained throughout the procedure of core alignment and jointing.

Ease the cores to be jointed into their correct positions, taking care not to bend the cores too sharply as this will cause damage, when the cores are aligned they should be level and straight over the length of the mechanical connector and its insulation.

At this stage the cores will overlap by approximately 150mm. The cores are then cut in the manner described in General Requirement 26.

Note: - This General Requirement only applies to Single core and Trefoil EPR / XLPE cable.

22.1 EPR / XLPE Straight Joints

All crossing of the cores shall be undertaken on the trefoil EPR / XLPE cables clear of the joint position.

22.2 Transitional Straight Joints

All crossing of the cores shall be undertaken on the trefoil EPR / XLPE side of the joint and clear of the joint position.

GENERAL REQUIREMENT 23

TEMPORARY SPREADERS

Before commencing the level of PPE required for this operation shall be as the matrix given in General Requirement 3.

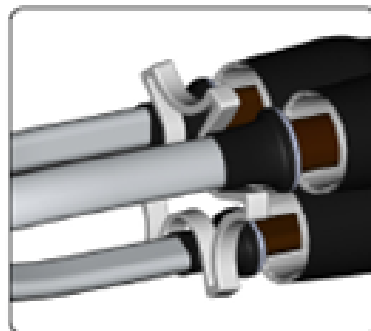
General

Spreaders are available in a variety of sizes and their purpose is to hold the cores of paper-insulated cables in position during jointing.

The spreaders shall be positioned as required in individual jointing procedures and shall be tied in place with varnish nylon tape or other forms, which do not cause damage to the paper insulation.

Unless otherwise stated, spreaders are temporary and should be removed on completion of jointing.

The Lovink M125 joint on the single cable entry end is for 3 core H cable, HSL and 3 core XLPE only. For the location of the spreader on the M125 see below: -



The joint kit has a spreader provided.

The cores are to be treated with great care whilst setting and shaping for jointing.

GENERAL REQUIREMENT 24

REMOVAL OF METALLIC SCREENS (PAPER CABLES)

Before commencing the level of PPE required for this operation shall be as the matrix given in General Requirement 3.

General

To eliminate the weakness of the belted type cable a design of cable in which each core is individually surrounded by an earth metallic layer was introduced. This design of cable was first patented by Hochstadter in 1914, hence the reference of H cable for 33kV paper cables or H cable Single Lead for HSL cables. Paper insulated 33kV cables are manufactured with a metallic screen on each core; the metallic screen effectively makes each core a single core cables with a radial stress pattern within the common lead sheath. The electrical stress patterns at the metallic screen termination if not controlled will result in cable failure. It should be noted that the stress patterns for a circular core are totally different for the elliptical found on some H cable, the elliptical requires additional insulation being added at the screen termination.

Metallic screens are manufactured from either a metallized paper or foil (copper or aluminium), normally a identification paper (numbered) is either woven into the metallic screen layers or laid up underneath the metallic screen. Cables made after the introduction of metrification will have a layer of carbon papers between the metallic screen and insulation papers.

It is essential that the metallic screens along with the carbon papers are terminated at the correct distance as given in the Jointing Procedures, and a stress cone applied at its termination point as given in General Requirement 31.

Method of Removal

Refer to Drawing GR3D 6.24.1 whilst undertaking this General Requirement.

24.1 Overlapped Ends

- 1.1 Apply two turns of 20 swg tinned copper binder at the metallic screen termination point.
- 1.2 Unwind each metallic screen and tear off at the termination point against the tinned copper binder.

Note: - To help the metallic screen to tear, place the blade of a sharp knife flat on the core, slide the point under the screen edge, nick and lift the screen away from the core.
- 1.3 Unwind the identification paper, carbon paper(s) (if present) and two conductor papers in turn, tearing against the tinned copper binder.
- 1.4 Once the tinned copper binder has been removed smooth the metallic screen edge carefully down with a wedge.

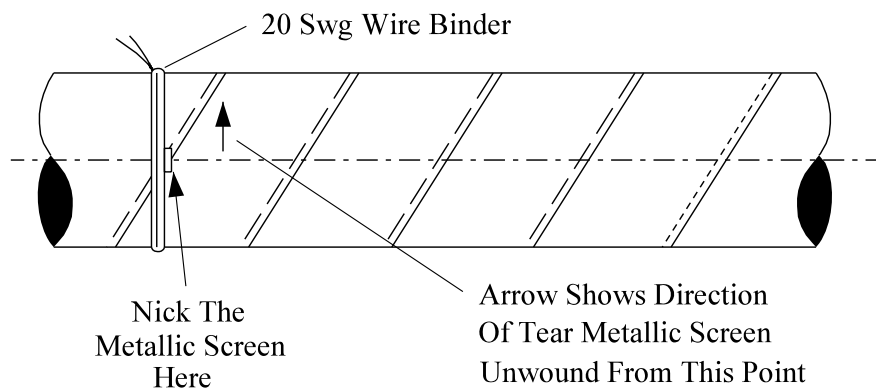
24.2 Under-lapped Ends

- 2.1 Apply two turns of 20 swg tinned copper binder at the metallic screen termination point.
- 2.2 Nick the edge of the metallic screen by placing the blade of a sharp knife flat on the core, slide the point under the screen edge, nick and lift the screen away from the core.
- 2.3 Lift the point made by the nick in the screen edge and tear against the tinned copper binder and unwind to the core end.
- 2.4 Unwind the identification paper, carbon paper(s) if present and two insulation papers in turn tearing against the tinned copper binder.
- 2.5 Once the tinned copper binder has been removed smooth the metallic screen edge down carefully with a wedge.

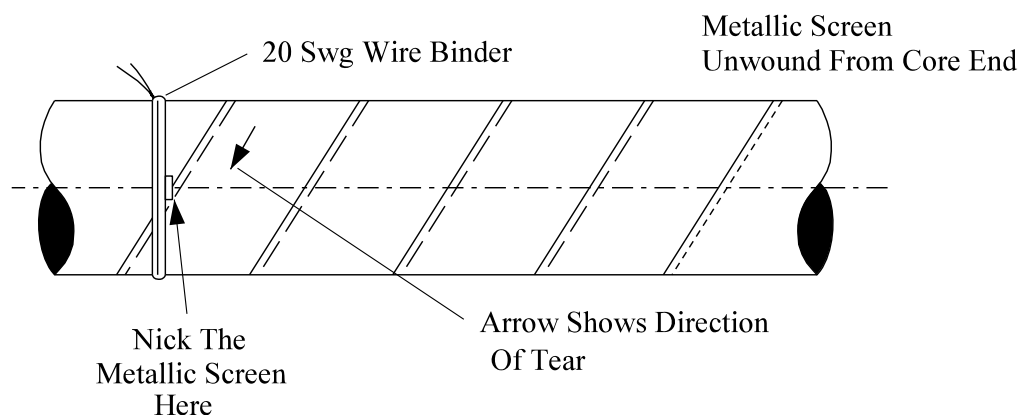
Note: - On no account must the knife be used with the blade towards the core; cuts in the insulation will result in failure.

All dimensions in mm


Underlapped Edge



Overlapped Edge



Note:- The Knife Blade Must Be Kept Flat To The Metallic Screen And Turned Away From The Mataltic Screen When Forming The Nick
Any Cut In The Underlying Insulation Will Result In A Failure At This Position

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GENERAL REQUIREMENT 25

REMOVAL OF SEMI-CONDUCTING SCREENS (POLYMERIC CABLES)

Before commencing the level of PPE required for this operation shall be as the matrix given in General Requirement 3, your attention is drawn to the Use of Solvents General Requirement 1.

25.1 General

There are two types semi-conducting screens used on polymeric cables, fully bonded and easi-strip. Virtually all polymeric cables used within WPD South have the easi-strip semi-conducting screen. While WPD Midlands have large amounts of easi-strip and fully bonded semi-conducting screens. The method described here is for the removal of the easi-strip semi-conducting screen, which requires basic but effective tooling and relative ease of removal to the installer.

Cable manufacturers currently supply two types of semi-conducting screen; both manufacturing methods can produce either easi-strip or fully bonded. With easi-strip semi-conducting the material it's important to have a compound such as ethylene vinyl acetate (EVA) which is strippable from the insulation. In order for strippable screens to have sufficient tear strength during the removal from the insulation, it is necessary for the thickness to be approximately 1mm but the screen thickness can be thinner for harder materials. There are no such constraints with bonded screens and because the semi-conducting materials are very expensive, thickness is kept to a minimum, 0.5mm being a typical figure.

The manufacturing methods are described as: -

- Monasil – identified by its smooth appearance.
- CCV (Continuous Catenary Vulcanising) – identified by its heavily ribbed appearance and characteristic acetophenone odour.
- VCV (Vertical Catenary Vulcanising) – identified by its heavily ribbed appearance and characteristic acetophenone odour.

25.2 Easi-strip Semi-conducting Screens

Note: - The method described below shall be **THE ONLY APPROVED METHOD ADOPTED FOR USE within WPD for the removal of the easi-strip semi-conducting screens.**

This phase of the jointing procedure must be undertaken with utmost care throughout this operation, failure to do so can be the cause or be a contributory factor in the failure of the joint or termination.

Cleanliness and attention to detail are vital, it is essential to avoid damaging the insulation at the semi-conducting screen termination, and any cuts or voids etc. will lead to the premature failure of the joint or termination.

2.1 Method of Removal

Refer to Drawing GR3D 6.25.1 whilst undertaking this General Requirement.

- 2.1.1 Mark the semi-conducting screen at its termination point with a white Chinagraph pencil.
- 2.1.2 Using PVC tape, apply (sticky side outermost for one complete turn) around the circumference of the cable at its termination point apply sufficient turns to provide a straight and square edge to guide the Abra file – Fig 1.
- 2.1.3 Using the Abra file with medium pressure, file evenly around the semi-conducting screen until the conductor insulation just shows – Fig 2.

Note: - The insulation must be seen continuously around the cable otherwise the semi-conducting screen may be lifted below its termination point.

- 2.1.4 Use a mirror to check the underside of the cable; there should be a smooth neat chamfer on what will be the remaining circumferential edge.

Note: - Where raggedness of the termination appears, run the Abra file with light pressure to remove high points; take care not to damage the insulation.

Ribbing of the semi-conducting screen may be removed by gently warming with a gas torch until the semi-conducting screen achieves a smooth surface.

- 2.1.5 Using the correct depth guarded knife (0.4mm for Prysmian 33kV & 0.6mm for Tratos 33kV cables) and starting just above the circumferential termination point make longitudinal scores spaced approximately 120° along the core length to its end – Fig 3.

Note: - Depending on cable size the three longitudinal scores may be reduced, two being the minimum otherwise undue stress is applied to the installers hands and cable.

Where there is extreme difficulty of drawing the depth guarded knife from the circumferential termination point to the cable end, and providing a cable tie is placed around the circumferential termination point to protect the shown insulation, the cable may be scored from the open end towards the circumferential termination point.

Utmost care must be given if using this alternative method, damage at the semi-conducting screen termination point will result in failure.

- 2.1.6 Lift the semi-conducting screen at the open cable end and peel back the strips to completely remove – Fig 4.
- 2.1.7 Using aluminium oxide tape abrade the exposed insulation ensuring a smooth finish along its length and at the semi-conducting chamfer (any ribbing within the surface of the insulation must be abraded out to a smooth finish).

Note: - 400 grit is normally sufficient to provide this finish, but a start with 320 grit and finishing with 400 grit may be required.

- 2.1.8 Using an approved degreaser and white wipes, remove all traces of the semi-conducting screen wiping from the cable end towards the termination point.

Note: - After each run change the wipe otherwise contact with semi-conducting material will come into contact with the insulation leaving possible tracking traces.

- 2.1.9 Finally remove the PVC tape applied in 2 and thoroughly check the insulation along its complete length ensuring its contamination free – Fig 5.

25.3 Fully Bonded Screens

This phase of the jointing procedure must be undertaken with utmost care throughout this operation, failure to do so can be the cause or be a contributory factor in the failure of the joint or termination.

Cleanliness and attention to detail are vital, it is essential to avoid damaging the insulation at the semi-conducting screen termination, and any cuts or voids etc. will lead to the premature failure of the joint or termination.

Note: - The stripping tool, Alroc CWB 18-60, which has been supplied to all the WPD Jointers on the 33kV Conversion course is designed for bonded screen cables ONLY and shall NOT BE USED on any EPR or XLPE EASI-STRIP CABLES.

The bonded semi-con stripping tool issued to Midlands Jointers by Central Networks SHALL NOT be used on the 33kV system.

3.1 Method of Removal

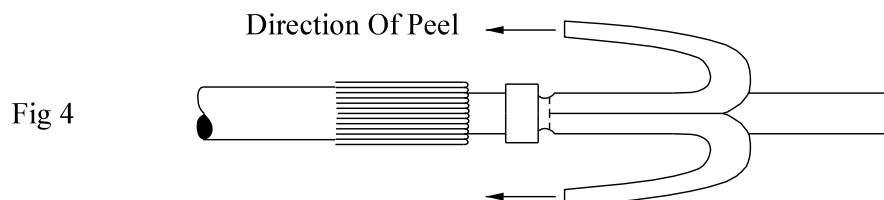
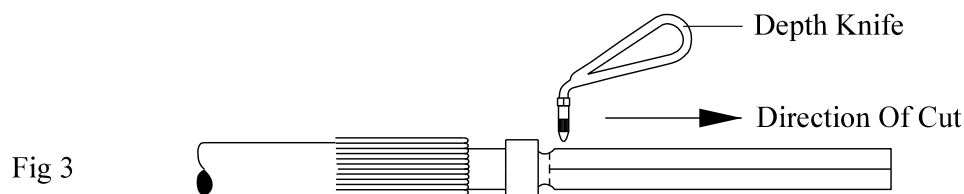
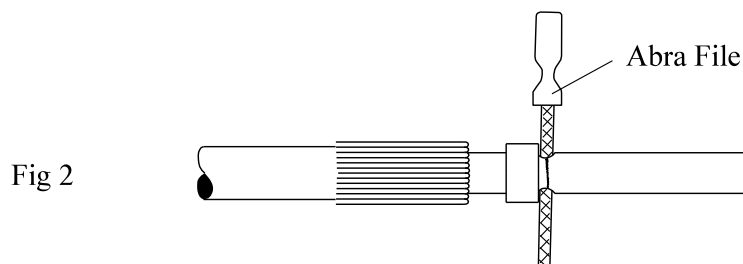
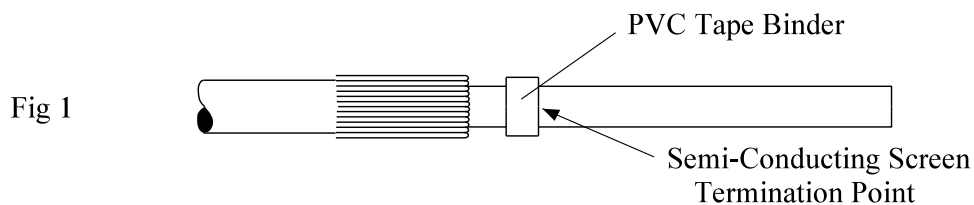
Refer to Drawing GR3D 6.25.2 whilst undertaking this General Requirement. The Alroc/Pfisterer tool works across the range of diameters over the semi-con screen of 18mm to 60mm.

Note: - THIS TOOL DOES NOT REQUIRE ANY SILICON GREASE TO OPERATE IN ADDITION THIS IS THE ONLY TOOL TO BE USED FOR BONDED SEMI-CON REMOVAL.


- 3.1.1 Ensure the cable is clean and straight.
- 3.1.2 Mark the semi-conducting screen at its termination point with a white Chinagraph pencil.
- 3.1.3 Set the tool stop to the required distance. Apply a roll spring to the white Chinagraph mark.
- 3.1.4 Close up the tool up using the large, red plastic knob, to provide a firm grip that will still allow the tool to rotate, as shown in GR3D 6.25.2.

- 3.1.5 Position the cutter at the front edge of the screen and set the depth of cut using the small metal knob as shown in GR3D 6.25.3. The adjustment is anticlockwise to increase the depth of cut, clockwise to decrease. If necessary, practice on a scrap piece of cable to obtain the correct depth setting. The ideal setup will have two thirds of the removed material to be the black semi-con and one third of the removed material being the translucent XLPE insulation.
- 3.1.6 With the correct depth set, now rotate the whole tool using the rear handle, in the direction of the arrow that is printed onto the body of the tool – as the tool is rotated it will move progressively down the cable, peeling the screen. Do not apply excess pressure. The selected depth setting should produce a clean, smooth cut free of black semi-conducting material.
- 3.1.7 When the required screen termination position is reached, the tool stop will come in contact with the roll spring thus providing clean screen edge and prevent the tool from moving down the cable. Continue to rotate the tool until a clean cut screen edge is produced. Open the tool and remove the tool on completion.
- 3.1.8 After the tool is removed, examine the surface of the insulation to ensure all semi-conducting layer has been removed.
- 3.1.9 Using aluminium oxide tape, abrade the exposed insulation ensuring a smooth finish along its length and at the semi-conducting chamfer (any ribbing within the surface of the insulation must be abraded out to a smooth finish).
- Note:** - 400 grit is normally sufficient to provide this finish, but a start with 320 grit and finishing with 400 grit may be required.
- 3.1.10 Using the approved De-Solvit 1000FD degreaser and white wipes, remove all traces of the semi-conducting screen wiping from the cable end towards the termination point.

All dimensions in mm

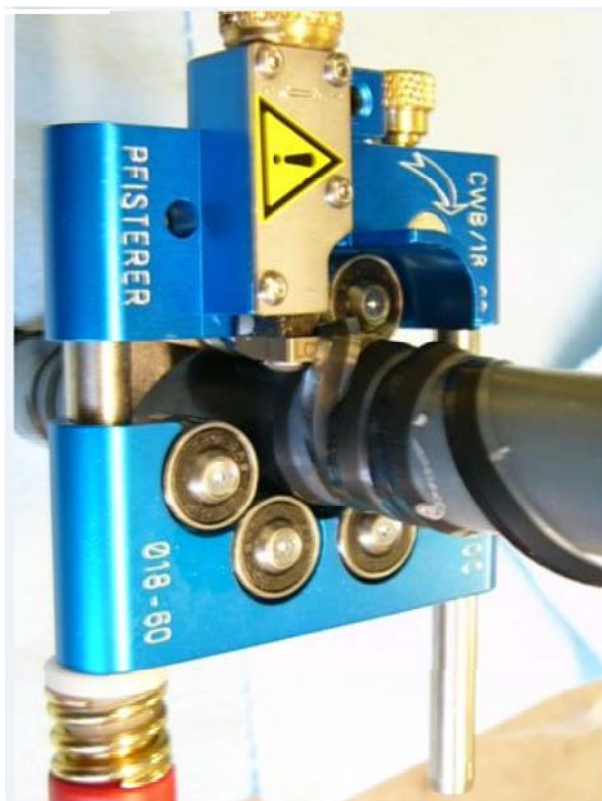
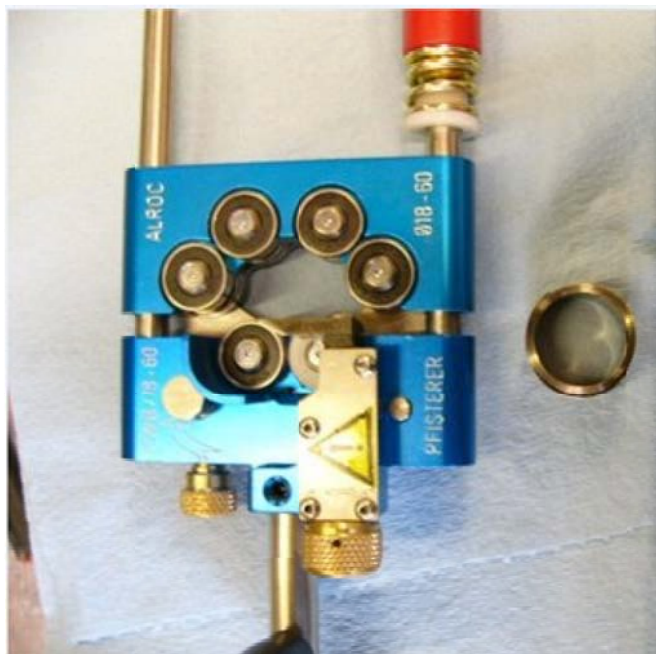



Note :- This Method Is For Easy Strip Screens Only

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GENERAL REQUIREMENT 26

TERMINATION OF COPPER TAPE SCREENS / INSTALLATION OF COPPER EARTH BRAIDS ON 3 CORE, XLPE, SWA CABLE

Before commencing the level of PPE required for this operation shall be as the matrix given in General Requirement 3, your attention is drawn to the Use of Solvents given in General Requirement 1.

General

With 3 core constructions of XLPE cable, the application of copper tape screen around each easi-strip semi-conducting screened core is more common. By the use of polypropylene strings to fill the gaps between the laid-up cores, the cable is formed into a circular shape over which is extruded a bedding sheath. The cable is then completed by the use of either steel wire or steel tape armour and an extruded oversheath.

Method of Removal

Refer to Drawing GR3D 6.26.1 whilst undertaking this General Requirement.

26.1 Overlapped Ends

- 1.1 Ensure you have sufficient core available to complete the accessory.
- 1.2 Apply two turns of 20 swg tinned copper binder at the metallic screen termination point.
- 1.3 Unwind each metallic screen and tear off at the termination point against the tinned copper binder.

Note: - To help the metallic screen to tear, place the blade of a sharp knife flat on the core, slide the point under the screen edge, nick and lift the screen away from the core.

- 1.4 Once the tinned copper binder has been removed smooth the metallic screen edge carefully down with a wedge.

26.2 Under-lapped Ends

- 2.1 Ensure you have sufficient core available to complete the accessory.
- 2.2 Apply two turns of 20 swg tinned copper binder at the metallic screen termination point.
- 2.3 Nick the edge of the metallic screen by placing the blade of a sharp knife flat on the core, slide the point under the screen edge, nick and lift the screen away from the core.

- 2.4 Lift the point made by the nick in the screen edge and tear against the tinned copper binder and unwind to the core end.
- 2.5 Once the tinned copper binder has been removed smooth the metallic screen edge down carefully with a wedge.

Note: - On no account must the knife be used with the blade towards the core; cuts in the insulation will result in failure.

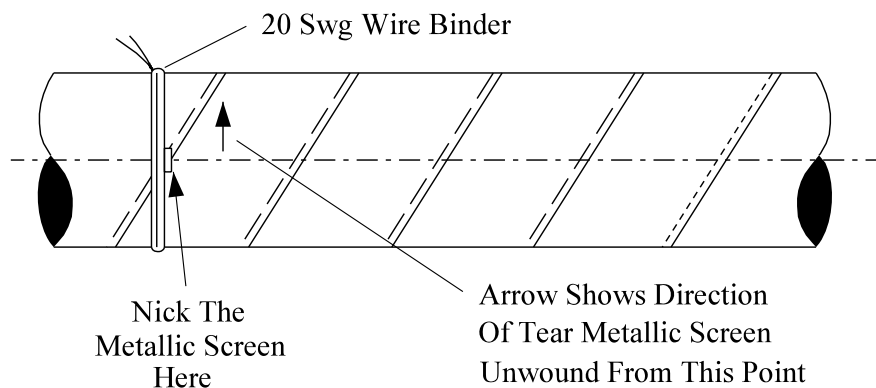
26.3 Application of Copper Braids

Refer to Drawing GR3D 6.26.2 and 6.26.3 whilst undertaking the application of the tinned copper braids.

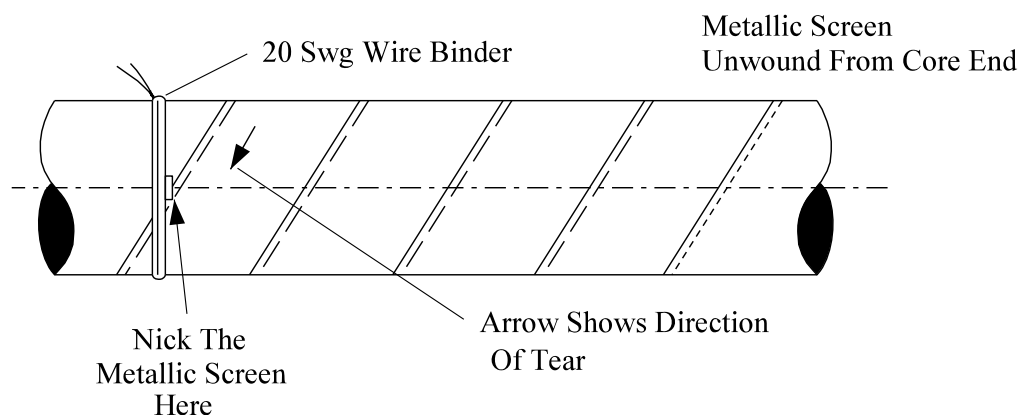
- 3.1 Using tinned copper braid E 5 No. 36802 from the van; cut a 300mm length from the roll. Open out the braid as in Figure 1 of GR3D 6.26.2.
- 3.2 Take one end of the braid and expand to the width of one core, once expanded 20mm from the end of the expanded braid open a hole in one side of the expanded braid, this hole should be large enough for the core to pass through the hole. See figure 2 of GR3D 6.26.2.
- 3.3 Slide the core through the hole in the braid and out the expanded end of the braid as I in Figure 3 of GR3D 6.26.2.
- 3.4 Position the end of the braid with the end of the termination of the copper tape screen, flattening the braid to the diameter of the core.
- 3.5 From the 3 core SWA XLPE module E 5 No. 43479 remove the roll spring and ensuring the braid and the end of the copper tape are level, apply the roll spring to the tinned copper braid. See Figure 4 of GR3D 6.26.3.
- 3.6 Apply two complete half lapped layers of 3M 88 tape, under moderate tension for a distance of 20mm up the tinned copper braid across the roll spring and on to the semi-conducting layer for a distance of 10mm. See Figure 5 of GR3D 6.26.3.
- 3.7 Once all three phase have been completed park up the Lovink three holed foam rings on to the semi-conducting layer, ensuring there is at least 50mm of clean semi-conducting material between the 3M 88 tape and the closest foam ring. Thus allowing good purchase of the two part polyurethane resin on to the semi-conducting screen thereby preventing a possible moisture path into the inner shell.

All dimensions in mm


Underlapped Edge



Overlapped Edge

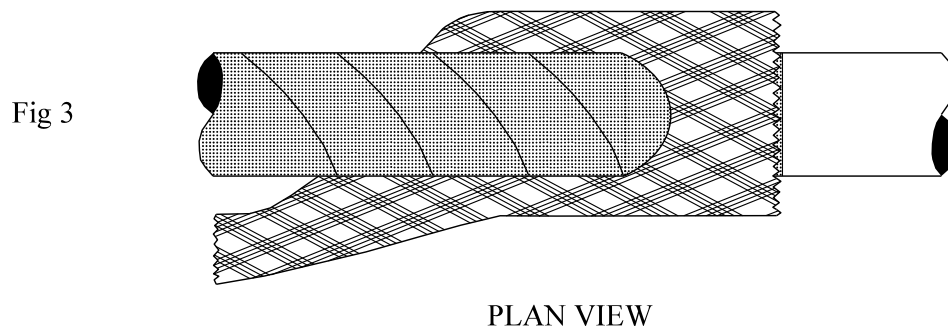
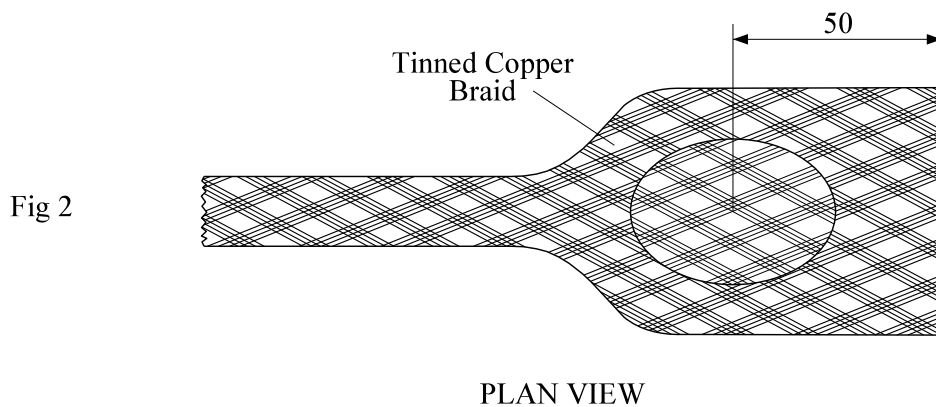
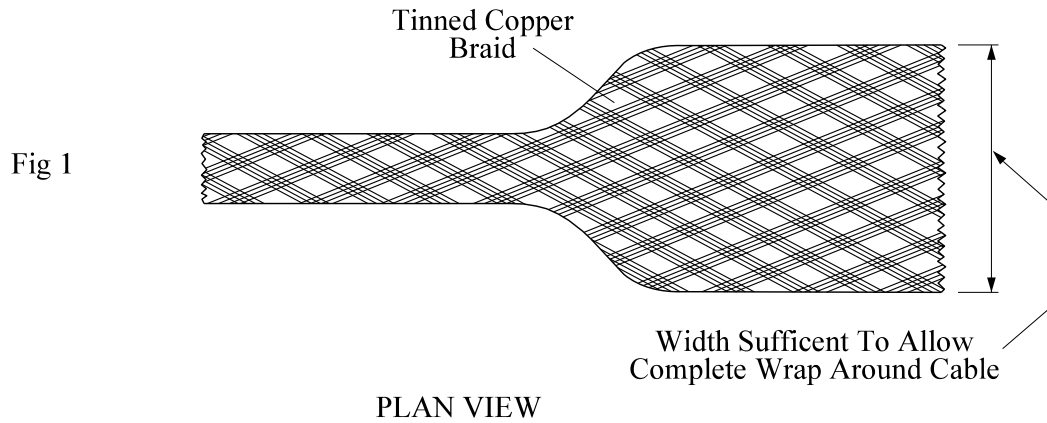



Note:- The Knife Blade Must Be Kept Flat To The Metallic Screen And Turned Away From The Mataltic Screen When Forming The Nick
Any Cut In The Underlying Insulation Will Result In A Failure At This Position

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Drawn	RJB	11/16				
Checked						
Approved						
SCALE	N.T.S.		Title REMOVAL OF METALLIC SCREENS 3 CORE SWA XLPE CABLES			Drg. No. GR3D 6.26.1
						Rev No

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All dimensions in mm



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Drawn	RJB	11/16	Title			
Checked			TERMINATION OF COPPER TAPE SCREEN OF THREE CORE XLPE SWA CABLES			
Approved			Drg. No. GR3D 6.26.2			
SCALE		N.T.S.		Rev No		

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All dimensions in mm

Fig 4

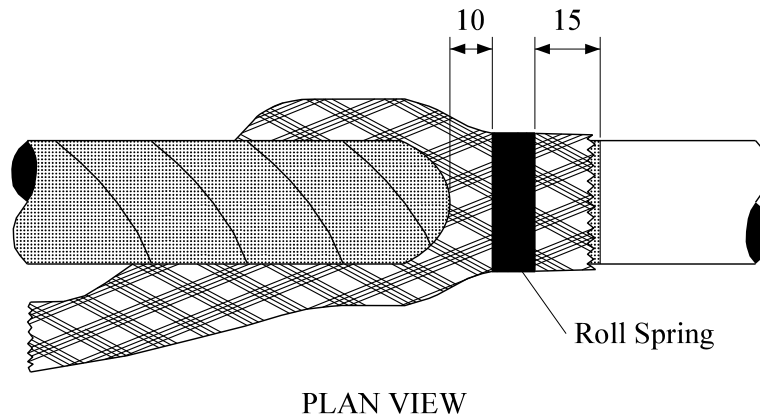


Fig 5

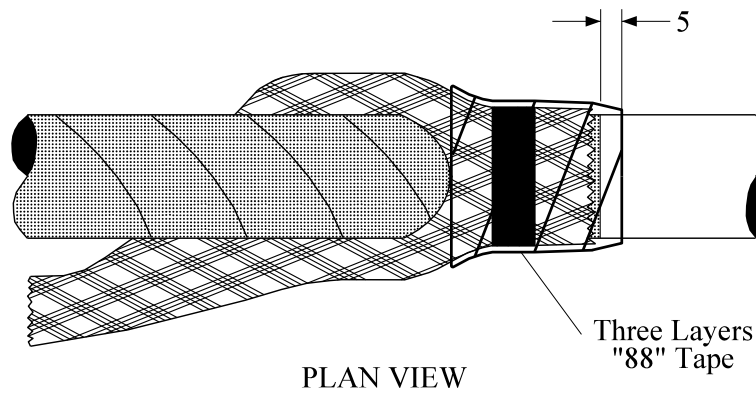
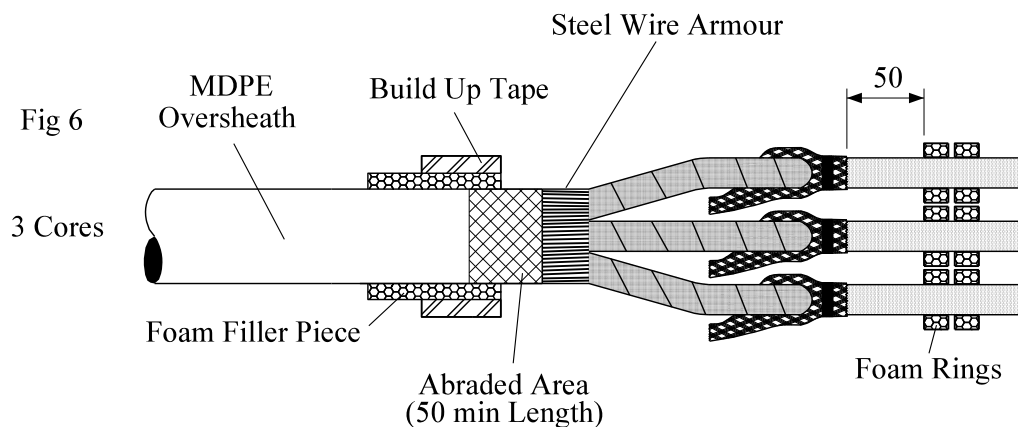


Fig 6



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Approved			TERMINATION OF COPPER TAPE SCREEN OF THREE CORE XLPE SWA CABLES		
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GENERAL REQUIREMENT 27

CUTTING CORES TO LENGTH

Before commencing the level of PPE required for this operation shall be as the matrix given in General Requirement 3.

General

Due to the reduced internal length of the conductor entry and the closeness of the inner bolt to the conductor end, it is important the conductor is cut and inserted into its full entry length. This will only be achieved providing the conductor is cut square as opposed to the “arrowhead” shape, which occurs with the use of core croppers; therefore, a hacksaw shall be used. **Core croppers shall not be used.**

This procedure should ensure that all cores are correctly aligned and spaced and that the shear bolts of the shear bolt connectors are bearing onto the entire conductor.

27.1 Method of Removal

- 1.1 Mark the centre line of the shear bolt connector on each core.
- 1.2 Measure the depth of the water block or split barrel of the connector.
- 1.3 Take half of the measurement of the water block or split barrel and mark either side of the centre line applied in 1.
- 1.4 Using a hacksaw, cut through each of the marks applied in 3.

GENERAL REQUIREMENT 28

REMOVAL OF CONDUCTOR INSULATION

Before commencing the level of PPE required for this operation shall be as the matrix given in General Requirement 3, your attention is drawn to the Use of Solvents given in General Requirement 1.

General

There are three types of conductor insulation to be found on today's 33kV cables, paper, EPR (Ethylene Propylene Rubber) and XLPE (Cross Linked Polyethylene).

Methods of removal vary and are dependent on the cable type, but the care and principals required whilst removing, each insulation type, are of the same importance.

Damage to a conductor may lead to stress point or at worst a reduction in the cross-sectional area of the conductor, which in turn results in the cables inability to carry the required load current (amperes).

Method of Removal

28.1 H Cables, HSL and PILC Paper Cables

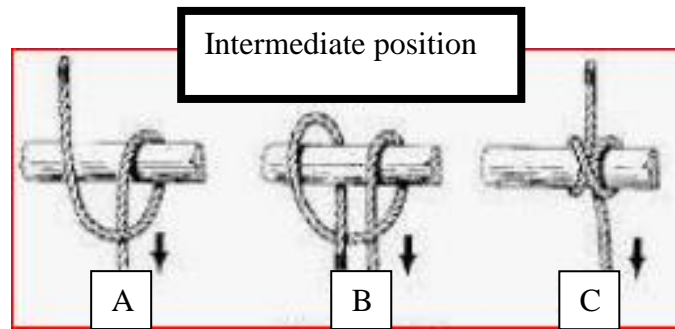
28.1.1 General

KINDLY NOTE: - When tying off any phase papers on the 33kV system jute string or whipping thread are the ONLY materials that shall be used, **NO tapes of any form or type shall be used.**

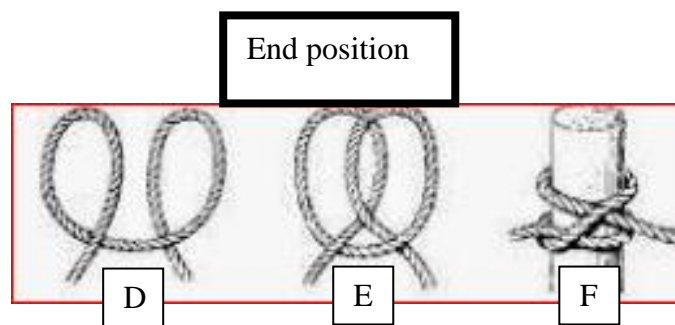
Modern three-core screened cables incorporate a carbon paper under the metalized screen. Removal of the carbon and screen paper insulation must be carried out with care, damage to the phase insulation in the form of splits or cuts during the jointing process will cause electrical stress at this critical point, which may result in failure.

28.1.2 Tying off Whipping Thread or Jute String

If tying a clove hitch at an intermediate position on a cable, then with a length of jute string or whipping thread of sufficient length, wrap whipping thread around the cable as shown in figure A, being sure to cross over the top of the whipping thread. Loop the whipping thread around the cable being sure to bring the leading end of the whipping thread through the newly created loop as shown in figure B. Pull the whipping thread tight, as shown in figure C, and tie off the whipping thread using a reef knot.



If tying a clove hitch at the end of a cable, then with a length of jute string or whipping thread of sufficient length, put two loops into the whipping thread as shown in figure D this should then give you the configuration as shown in figure E, slip this configuration over the end of the core and slide down to the requisite position as shown in figure F and pull the whipping thread tight and tie off using a reef knot. Figures D, E and F are shown below.



- 1.1 Apply a whipping thread binder 2mm behind the termination point.
- 1.2 Using a sharp knife make a circumferential cut around the core.
Note: - Ensure that the conductor is not made contact with whilst making the cut.
- 1.3 Using water pump pliers and working from the core end, carefully round the core up to the paper termination point.
- 1.4 Remove the paper insulation by unwinding and if required make a further circumferential cut.
Note: - The last few papers should not be cut but be torn against the previously removed paper termination.
- 1.5 Remove the remaining papers by tearing, and remove the impregnate from the conductor with a dry wipe.

28.2 EPR / XLPE Insulation

General

The MF2/60 tool is capable of covering cables with diameters of 16mm to 58mm. Do not use any lubricant when using the MF 2/60 tool. Spare blades are the Alroc LMF2.

When setting the blade, allow 1mm clearance from the metallic core. If the tool is not set correctly and the blade is down to the copper the blade at the final cut will make contact and cause it to break. In addition when using the tool on 11kV having the blade fully opened is no issue, provided it does snag the conductor, but at 33kV only half opening the blade allows a fast peel yet no unnecessary pressure is applied to the blade.

- 2.1 Adjust and set the depth stop to the required depth on the Pfisterer supplied Alroc MF2/60 insulation removing tool.
- 2.2 Apply the tool to the core and adjust the clamping screw until the tool is secure on the core, adjust the blade depth to a point where the conductor semi-conducting screen is just touched.
- 2.3 Rotate the tool in an anti-clockwise direction to remove the insulation.

Note: - Check to ensure the conductor is not being damaged during this operation due to incorrect setting of the depth of cut.

- 2.4 Once the depth stop engages the conductor end, slacken the clamping screw and remove the tool.
- 2.5 If any insulation or semi-conducting screen is not removed, using whipping thread as a garrotte at its termination point and with a sawing action cut through to the conductor.

Use a knife with the blade flat to the conductor and slice under and along the remaining insulation semi-conducting screen.

Note: - This method may be used, as an alternative if specialised tooling is not available.

GENERAL REQUIREMENT 29

APPLICATION OF A CHAMFER ON THE PHASE INSULATION

Before commencing the level of PPE required for this operation shall be as the matrix given in General Requirement 3, your attention is drawn to the Use of Solvents given in General Requirement 1.

General

There are two types of conductor insulation found on today's 33kV cables, EPR (Ethylene Propylene Rubber) and XLPE (Cross Linked Polyethylene) which will require a chamfer being applied to the leading edge of phase insulation.

Methods of removal for both cable types is identical, but the care and principals required whilst removing, each insulation type, are of the same importance.

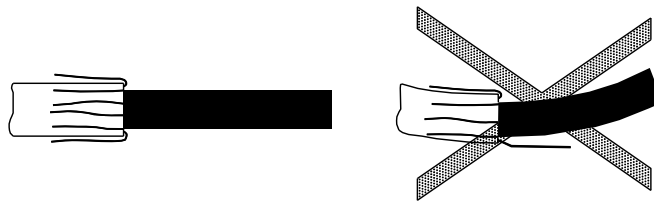
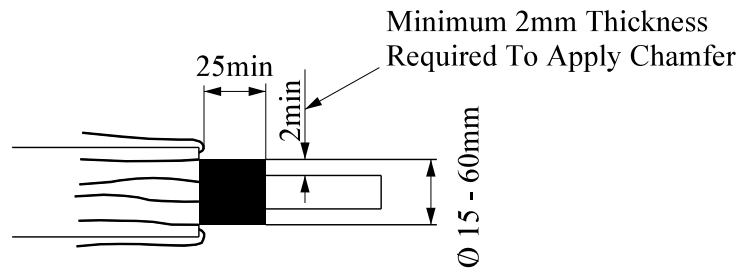
Part of the 33kV Jointers tool kit includes the Boddingtons Chamfer tool 244240, this tool is able to apply a chamfer on the leading edge of all 33kV EPR and XLPE cables ranging in size from 15mm to 60mm in diameter.

Refer to Drawing GR3D 6.29.1 whilst undertaking this General Requirement.

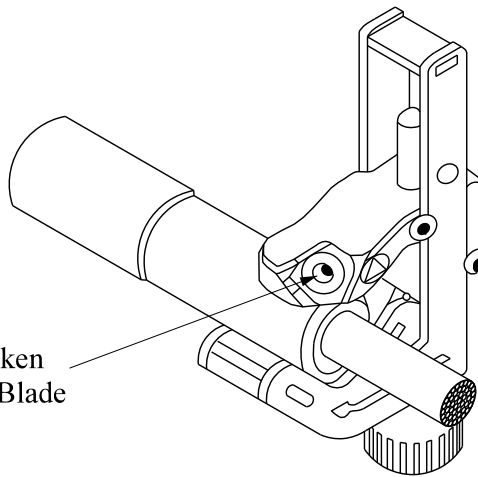
29.1 EPR / XLPE Insulation

- 1.1 Ensure the phase insulation to be worked on is straight and that there is at least 25mm clearance to the screen wires and oversheath or lead sheath of the EPR/XLPE cables. Do not attempt to use the tool on cable which is not straight.
- 1.2 Position the tool on the cable at where the phase insulation has been terminated.
- 1.3 Tighten the knurled adjustment knob, and rotate the tool in the direction of the arrow shown embossed on the tool. (i.e. clockwise).
- 1.4 The tool is set to apply a 2mm chamfer to the end of the insulation.
- 1.5 The Allen key supplied in the kit is for the blade replacement.

All dimensions in mm



This Screw To Be Slacken
Before Replacing The Blade



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GENERAL REQUIREMENT 30

BUILDING UP CABLES TO MATCH OUTER SLEEVE ENTRIES (LOVINK)

Before commencing the level of PPE required for this operation shall be as the matrix given in General Requirement 3, your attention is drawn to the Use of Solvents given in General Requirement 1.

General

To build up the cable entries of the outer sleeve a self-amalgamating build up tape is used, this has two functions, to centralize the inner sleeve within the outer sleeve ensuring a uniform thickness of resin around the inner sleeve end, to prevent the migration of resin during filling and curing.

The build-up tape when applied should be bound under light tension and built to a diameter given by the calliper gauge of the appropriate joint size, should a small weep of resin appear during filling this might be blocked using putty.

Method of Application

30.1 EPR / XLPE Single Core Cables

Refer to Drawing GR3D 6.30.1 whilst undertaking this General Requirement.

- 1.1 Lay the three prepared cables in the foam filler piece; position the foam filler piece so that the internal end to the joint reference line is at the dimension given in the table overleaf, approximately 25mm of abraded MDPE oversheath should be showing.
- 1.2 Bind the full length of the foam filler piece using PVC tape; do not overlap the ends of the foam filler piece.
- 1.3 Apply the self-amalgamating build up tape under light tension in line with the internal of the foam filler piece, bind until the diameter is achieved using the calliper gauge appropriate to the joint size.

30.2 H Cable and PILC / EPR / XLPE Single Core

- 2.1 Place a mark on the oversheath applicable to the dimension taken from the joint reference line given in the table 1 overleaf.
- 2.2 Apply the self-amalgamating build up tape under light tension in line with the mark applied in 2.1, bind until the diameter is achieved using the calliper gauge appropriate to the joint size.

30.3 3 CORE XLPE, COPPER TAPE SCREEN, SWA.

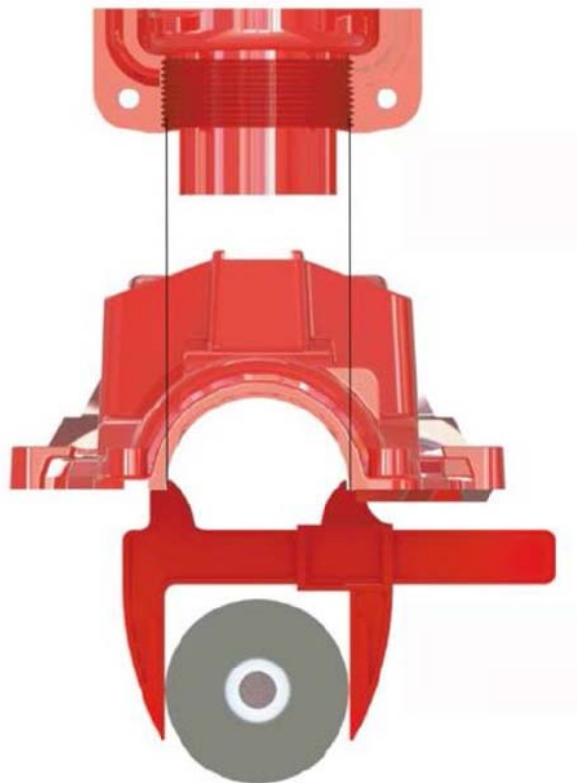
- 3.1 Place a mark on the oversheath applicable to the dimension taken from the joint reference line given in the table 2 below.
- 3.2 Apply the self-amalgamating build up tape under light tension in line with the mark applied in 3.1, bind until the diameter is achieved using the calliper gauge appropriate to the joint size.


30.4 Table 1 - Standard Lovink Joints

Joint Type	M85	M105	M125
Straight	490	635	880
Stop End	490	635	N/A

Note: - Dimensions given within this table are taken from the reference line (centre line of connector) of the relevant Jointing Procedure to the internal edge of the grey self-amalgamating build up tape.

All dimensions in mm



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GENERAL REQUIREMENT 31

INSTALLATION OF FOAM RINGS (LOVINK)

Before commencing the level of PPE required for this operation shall be as the matrix given in the General Requirement 3.

General

The closed cell foam rings are used within the inner sleeve of the Lovink system to provide centralisation to the joint and cables and to act as “shuttering” for the Lovifit or Protolin glue or resin which seals the inner sleeve to the cables, preventing the ingress of moisture and subsequently retains the Lovisil silicon oil insulating compound.

Certain cable sizes will require the use of foam tape in place of rings or where a smaller diameter ring is to be used in a larger joint size, the ring will require building up with foam tape. A build up calliper is available to ensure the foam tape is built to the correct diameter.

Rings are to be placed onto the cable sheaths dry, **on no account is the use of any form of grease or lubricant shall be used**, otherwise the Lovifit glue will not adhere to the cable sheaths.

31.1 Method of Installation M 125 transition joint

Refer to Drawing GR3D 6.31.1 whilst undertaking this General Requirement.

31.1.1 Foam Rings

- 1.1 Select and remove the required insert ring from the foam ring.
- 1.2 Carefully open and stretch the rings to allow ease of fitting.

Note: - The rings should be of a snug fit to the cable sheaths, overstretching will allow gaps and subsequent leaking of the Lovifit glue either into or out of the inner sleeve.

- 1.3 Pass two rings over each cable sheath and park in a position to avoid interference with the joint construction.

Note: - These will be moved to their final position when the inner sleeve is installed.

31.1.2 Foam Tape

- 2.1 **Direct to cable sheaths** – ensure the three spacers are fitted in such a way as the maximum hole diameter of the spacer points into the joint, offer the inner sleeve to the joint and mark the position of the foam tape, apply the foam tape until the required build-up is achieved to the build-up calliper.
- 2.2 **Direct to foam rings** – apply the foam tape direct to the foam ring until the required build-up is achieved to the build-up calliper. Ensure that the final end of the foam tape is not opposite where the two halves of the inner shell meet.

31.2 Method of Installation M 85 and M105 straight joint

31.2.1 Foam Rings

- 2.1 Offer the inner sleeve to the joint and mark the position of the foam ring.
- 2.2 Select and remove the required insert ring from the foam ring.
- 2.3 Carefully open and apply the ring to the cable ensuring that the overlap is at the top of the joint. As shown below: -

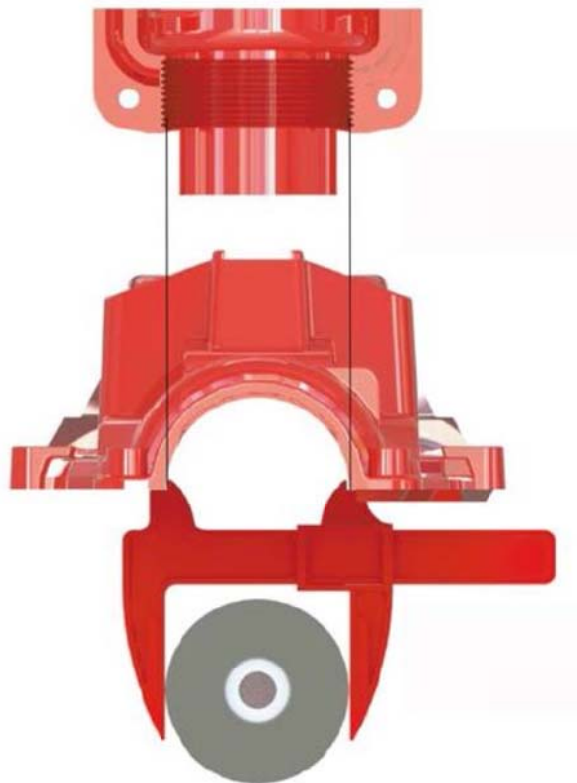



Note: - The ring should be of a snug fit to the cable sheaths, overstretching will allow gaps and subsequent leaking of the Lovifit glue either into or out of the inner sleeve. Once in position using Scotch 88 tape under light tension apply two complete turns to hold the foam ring in place.

31.2.2 Foam Tape

- 2.1 **Direct to cable sheaths** – offer the inner sleeve to the joint and mark the position of the foam tape, apply the foam tape until the required build-up is achieved to the build-up calliper.
- 2.2 **Direct to foam rings** – apply the foam tape direct to the foam ring until the required build-up is achieved to the build-up calliper. Ensure that the final end of the foam tape is not opposite where the two halves of the inner shell meet.

All dimensions in mm



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GENERAL REQUIREMENT 32

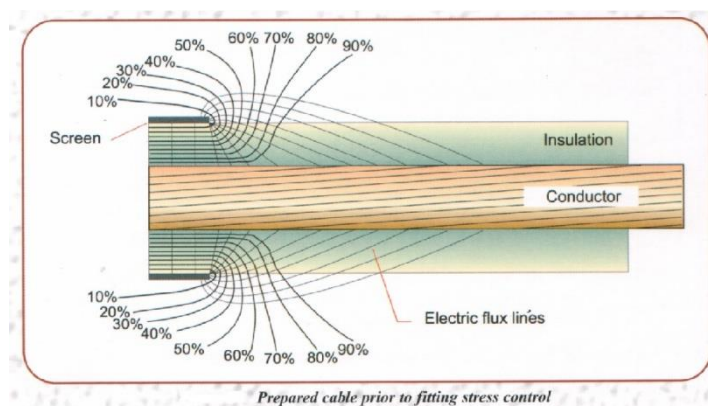
INSTALLATION OF STRESS CONTROL CONES (LOVINK)

Before commencing the level of PPE required for this operation shall be as the matrix given in General Requirement 3, your attention is drawn to the Use of Solvents given in General Requirement 1.

General

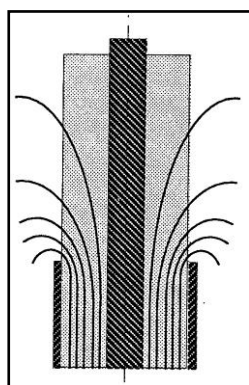
The most common cause of failure of screened cables, be they paper or polymeric cables, is the breakdown of the cable insulation at the end of the screen termination.

When the metallised screen on paper insulated or the semi-conducting screen on a polymeric EPR / XLPE insulated cable is terminated, some form of stress control must be provided to relieve the high stress levels produced at the screen termination point. See the typical stress diagram of a terminated insulation screen, without stress control, of a screened cable below.

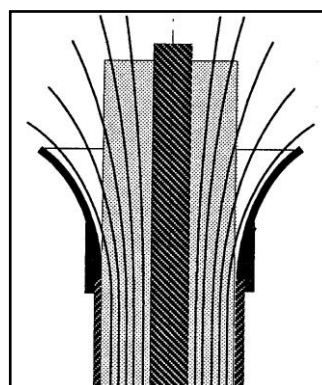


Poor preparation of the screen termination will result in partial discharges and ultimately failure of the accessory.

The Lovink jointing system achieves stress control of the screen termination by using a form of semi-con tape and a rubber stress control cone, which provides a geometric control of the stresses. The semi-con tape and stress cone is applied to all imperial, metric sized single core or three core screened paper insulated cables or single core polymeric insulated cables. There are five sizes of stress control cones which cover 70mm², 95/150mm², 185/300mm², 400/630mm² and 800/1000mm² EPR / XLPE and screened paper cables.



Simple stress drawing showing semi-conducting screen termination without stress control.



Semi-conducting screen termination with geometric stress control as in the Lovink jointing system.

A stress cone applicator is used to install the stress control cones, there are five sizes of applicator available which covers the range of the following sizes of conductor 70/95/185/300/400 and 630mm², see drawing GR3D 6.32.4.

Method of Installation

Refer to Drawings GR3D 6.32.1, 6.32.2, 6.32.3 and 6.32.4 whilst undertaking this General Requirement.

32.1 Application of Semi-con Tape on Paper Cables

- 1.1 **Metallic screens on Paper Cables** – place two white Chinagraph marks on the metallic screen, one at 5mm and the second at 5mm both points taken from the metallic screen termination point – see Fig 1 & 2 of GR3D 6.32.1.
- 1.2 Place a third white china graph mark on the core insulation 10mm from the metallic screen termination point – Fig 1 of GR3D 6.32.1.

Note: - Remove the tinned copper termination binder before applying the semi-con tape.

- 1.3 Take a length of semi-con tape remove both release papers and starting on the metallic screen just forward of the 5mm mark apply a half lapped layer over the termination point and onto the paper core insulation, ensuring a fine edge is achieved, with a long lay return to and onto the metallic screen finishing at the 5mm mark – Fig 2 of GR3D 6.32.1.

A sloping profile is to be achieved from the metallic screen termination to the core insulation, the tape being applied with a 50% stretch – Fig 1 of GR3D 6.32.1.

Note: - It is important not to overbuild and to keep within the dimensions given.

32.2 Application of Semi-Con Tape on Semi-conducting Screens of Polymeric Cables

- 2.1 Semi-conducting Screens on Polymeric Cables – place two white Chinagraph marks on the semi-conducting screens, one at 5mm and the second at 15mm both points taken from the semi-conducting screen termination point – Fig 3 & 4 of GR3D 6.32.2.
- 2.2 Place a third white Chinagraph mark on the core insulation 5mm from the semi-conducting screen termination point – Fig 3 . of GR3D 6.32.2
- 2.3 Take a length of semi-con tape remove both release papers and starting on the semi-conducting screen just forward of the 5mm mark apply a half lapped layer over the termination point and onto the core insulation, ensuring a fine edge is achieved, with a long lay return to and onto the semi-conducting screen finishing at the 5mm mark – Fig 4 of GR3D 6.32.2.

A sloping profile is to be achieved from the semi-conducting screen termination to the core insulation, the tape being applied with a 50% stretch – Fig 3 of GR3D 6.32.2.

Note: - It is important not to overbuild and to keep within the dimensions given

32.3 Application of Stress Control Cones – Paper and Polymeric Cables

- 3.1 Take the stress cone applicator and liberally grease the removable coned head using Lovink silicon grease.
- 3.2 Rest the applicator base on a clean dry flat surface, taking a “trumpet” shaped stress control cone with the trumpet end facing away from the applicator coned end slide the stress control cone over and down the applicator body until the straight end of the stress control cone just passes the join of the applicator body and removable end.

Remove the coned end clean and place on a dry clean surface.

- 3.3 Pass the stress cone applicator with the base away from you over and down the core stopping when the body end of the applicator reaches the 10mm mark on the metallic or semi-conducting screen.
- 3.4 Carefully slide the stress control cone off the applicator and onto the metallic or semi-conducting screen so that the end of the stress control cone is parked in line with the 15mm mark. A final adjustment may be made by sliding the stress control cone into position carefully by hand once in contact with the core.
- 3.5 Thoroughly clean the applicator upon completion of the application.

All dimensions in mm

Fig 1

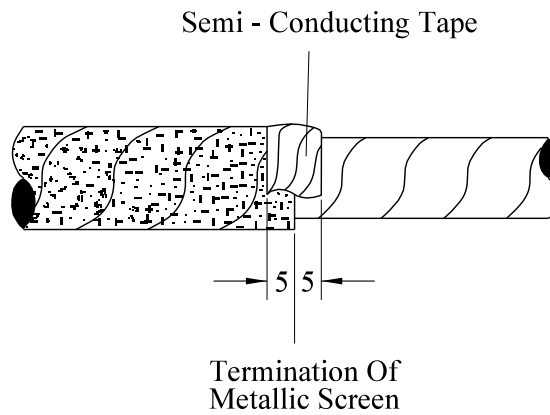
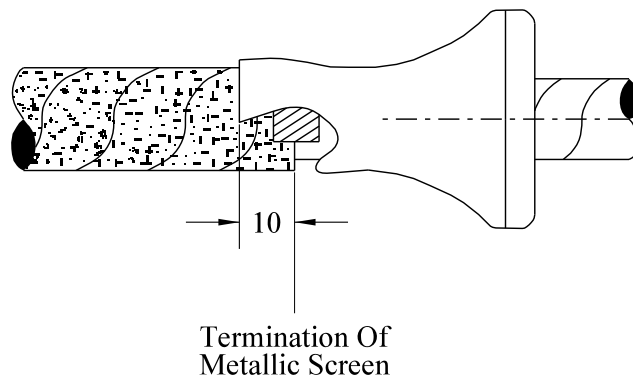



Fig 2



Rev No	Drawn	Chk'd	App'd	Date	Revision	
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SCALE	N.T.S.		Title APPLICATION OF STRESS CONTROL CONES (PAPER CABLE)			Drg. No. GR3D 6.32.1 Rev No

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All dimensions in mm

Fig 3

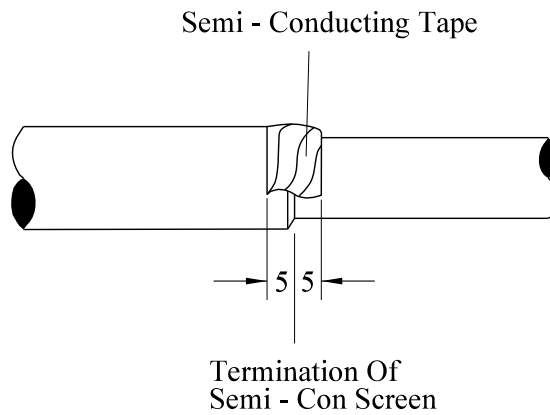
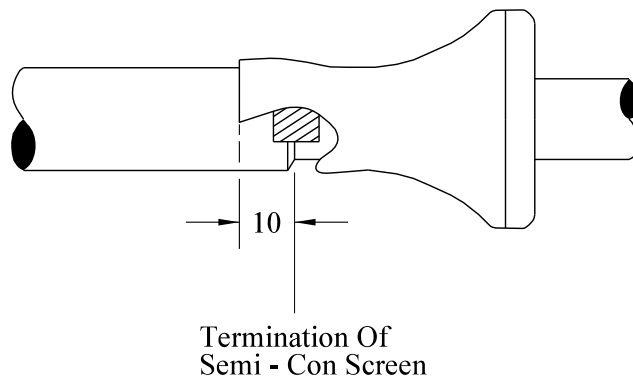



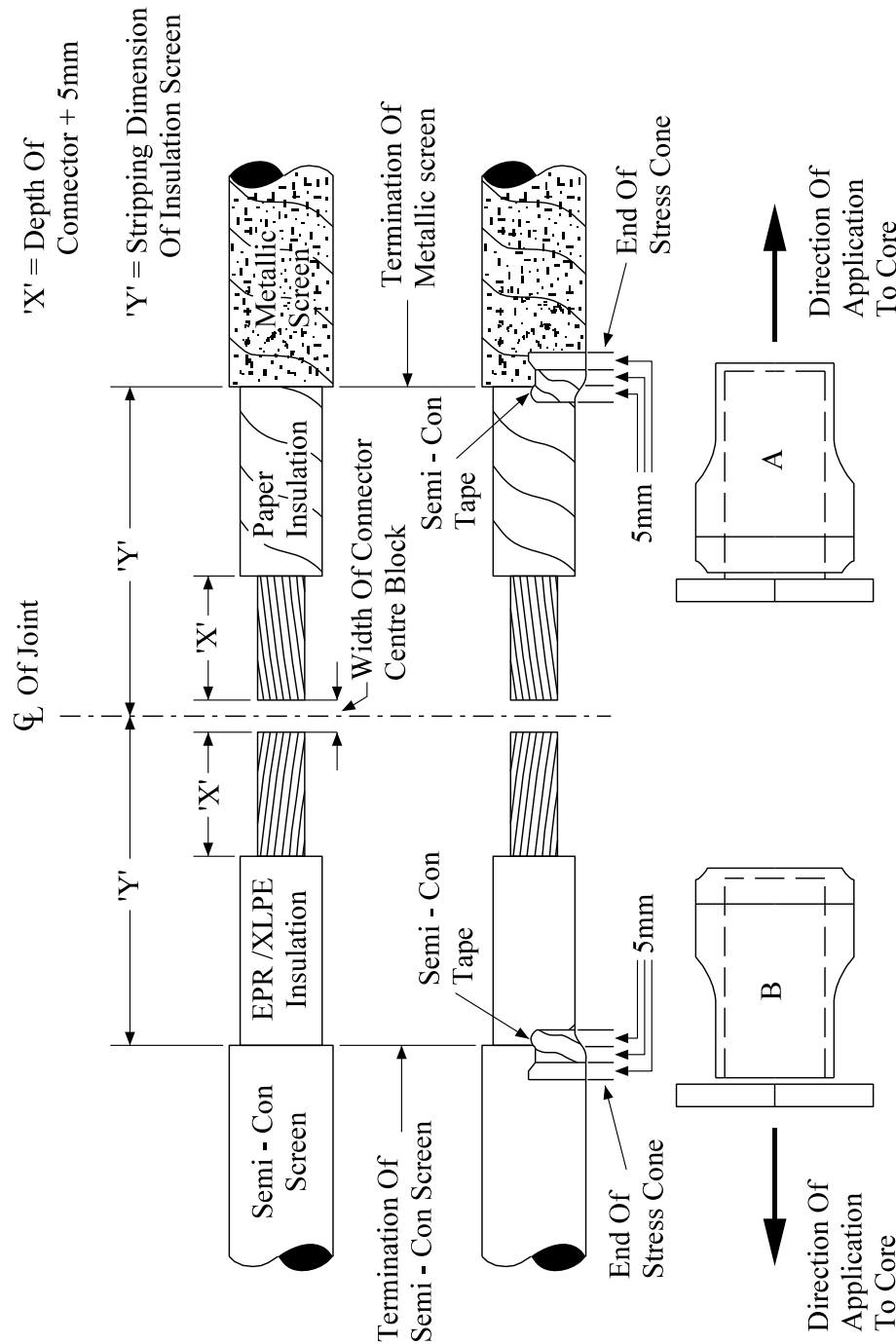
Fig 4



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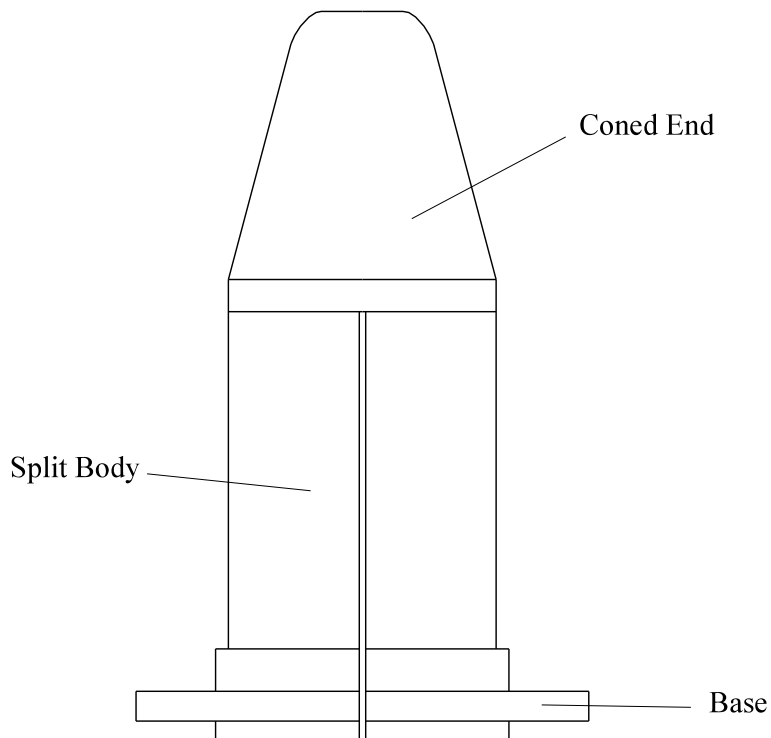
All dimensions in mm



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Stress Control Cone Applicator



Applicator Sizes :-

- No 1 - Conductor Size 70mm²
- No 2 - Conductor Size 95 \ 120 \ 150
- No 3 - Conductor Size 185 \ 240 \ 300
- No 4 - Conductor size 400 \ 500 \ 630
- No 5 - conductor size 800 \ 1000

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GENERAL REQUIREMENT 33

INSTALLATION OF MECHANICAL CONNECTORS

Before commencing the level of PPE required for this operation shall be as the matrix given in General Requirement 3, your attention is drawn to the Use of Solvents given in General Requirement 1.

General

All connections on the 33kV underground distribution system whether straight, branch, loop joints, indoor and outdoor terminations will be made using a mechanical shear bolt connectors.

They cover all cable types H Cable, HSL, PILC, 3 core XLPE, single core EPR and XLPE.

Only those connectors stated in the relevant jointing procedure are to be used.

As all connectors used are water blocked they shall have a 5mm gap between the connector and the phase insulation.

33.1 Straight Joints

Phase connectors: -	
70-185mm ² all cable types	- VTPB21-UTB.
120-300mm ² all cable types	- VTPB27-UTB.
120-400mm ² all cable types	- VTPC28G8-UTB.
400-630mm ² all cable types	- VTPC36-UTB.
630-1000mm ² all cable types	- VTPC44-UTB

Note: - In the unlikely event that conductor sizes other than those stated are required to be fitted then contact the Company Cable Engineer Avonbank.

Earth connector: -	
All cable types	- BCNE-3 UTB

33.2 Indoor terminations

Phase connectors: -	
185mm ² Cu	- VETB21-12/16UTB.
300mm ² Cu.	- VETB27-12/16UTB.
400mm ² Cu.	- VETB28-12/16UTB.
630mm ² Cu.	- VETC33-12/16UTB.
800mm ² Cu	- VETC44-12/16UTB

Earth Connectors: -	
Covers up to 35mm ²	- BET 35-12.
Covers up to 60mm ²	- BET 60-12.
Covers 50-120mm ²	- BET 120-12.

33.5 Outdoor terminations

Phase connectors: -

185mm² Cu - VETB21-OHUTB.
300mm² Cu. - VETB27-OHUTB.
300mm² Cu. - VETB28-OHUTB.
630mm² Cu. - VETC33-OHUTB
800mm² Cu - VETC44-OHUTB

Earth Connectors: -

Covers up to 35mm² - BET 35-12.
Covers up to 60mm² - BET 60-12.
Covers 50-120mm² - BET 120-12.

33.6 Pin Connectors (compound terminations)

Phase/neutral connectors: -

70/95mm² - BAH-0221307.
185mm² - VETB21PxxDyy-UTB.
300mm² - VETB28PxxDyy-UTB.
630mm² - VETB33PxxDyy-UTB.

Earth Connectors: -

Covers up to 35mm² - BET 35-12.
Covers up to 60mm² - BET 60-12.
Covers 50-120mm² - BET 120-12.

APPLICATION OF CONNECTORS – INDEX

Manufacturer's Part Number	Connector Type	Page
VTPB 21 UTB	- straight	98
VTPB 27 UTB	- straight	98
VTPC 28G8 UTB	- straight	98
VTPC 36 UTB	- straight	98
VTPC 44 UTB	- straight	98
VETB 21 12/16 UTB	- termination (indoor)	99
VETB 27 12/16 UTB	- termination (indoor)	99
VETB 28 12/16 UTB	- termination (indoor)	99
VETC 33 12-UTB	- termination (indoor)	99
VETB 21-OHUTB	- termination (outdoor)	100
VETB 27-OHUTB	- termination (outdoor)	100
VETB 28-OHUTB	- termination (outdoor)	100
VETC 33-OHUTB	- termination (outdoor)	100
VETC 44-OHUTB	- termination (outdoor)	100
BAH-0221307	- pin	101
VETB 21 PxxDyy-UTB	- pin	101
VETB 28 PxxDyy-UTB	- pin	101
VETB 33 PxxDyy-UTB	- pin	101
BET 35-12	- earth (termination)	102
BET 60-12	- earth (termination)	102
BET 120-12	- earth (termination)	102
BCNE-3 UTB	- earth (joints)	102
BTC-1-45W	- screen wires	104
BTC-3-60W	- screen wires	104

33.1 Straight Connectors

The following connectors are the only approved connectors to be used in 33kV straight joints, they are to be used on aluminium and copper oval shaped stranded, and round stranded copper conductors, up to their maximum cross section to which they are designed.

All connectors within the range are of the “split V” blocked design which allows the conductor to be entered into the connector conductor entry hole without “springing” the cable. The connectors are constructed of brass or tinned copper and are supplied with shear bolts which range take across specific conductor sizes as follows: -

VTPC 21 UTB	covers 50-185mm ² copper conductors (stranded circular)
VTPB27-UTB	covers 120-300mm ² copper conductors (stranded circular)
VTPC28G8-UTB	covers 120-400mm ² copper conductors (including shaped)
VTPC 36 UTB	covers 400-630mm ² copper conductors (stranded circular)
VTPC 44 UTB	covers 630- 1000mm ² Cu. Conductors (stranded circular)

For sector shaped paper insulated stranded conductors, fitting is facilitated if prior to removal of the insulation the conductor is rounded using water pump pliers along its entry length, this is only necessary on the largest conductor size for which the connector is intended.

Where aluminium conductors are to be used in a copper connector then the aluminium conductor shall be wrapped with brass gauze.

Tooling – the connector bolts require either an 18mm A/F or 19mm socket which may be attached to either an approved Izumi power driven tool or ratchet spanner, the connector being held stable whilst shearing with an adjustable holding tool.

Connector Installation

Refer to Drawings GR3D 6.33.1 and GR3D 6.33.2 whilst undertaking this General Requirement.

- 1.1 Overlap the two cores to be jointed together in the positions they will finally occupy.
- 1.2 Place the two halves of the connector together and fit the connector-joining bolt finger tight.
- 1.3 Mark the insertion depth of the conductor entry hole on the outside of each half of the connector body.
- 1.4 Place the connector alongside the two cores arranged in 1.1 above, in the position it will finally occupy.
- 1.5 Transfer the insertion depth mark made on one half of the connector body onto the corresponding core.
- 1.6 Cut the core at the mark made in 1.5.
- 1.7 Remove the insulation from the end of the one core cut in 1.6 for a distance equal to the insertion depth of the connector, remove any impregnate and abrade the conductor.

- 1.8 Remove the centre joining bolt from the connector and insert half of the connector over the conductor bared in 1.7.
- 1.9 Ensure that the conductor extends to the bottom of the entry hole and fit the universal bolts, finger tight.
- 1.10 Support the connector with the holding tool, starting at the bolt nearest to the core insulation; tighten each bolt sequentially by half a turn, until the heads shear off.
- 1.11 Arrange the two cores into the positions they will finally occupy and transfer the insertion depth marks on the second half of the connector body onto the second core.
- 1.12 Cut the second core at the mark made in 1.11.
- 1.13 Remove the connector-joining bolt.
- 1.14 Remove the insulation from the second core for a distance equal to the insertion depth of the connector, remove any impregnate and abrade the conductor.
- 1.15 Insert the bared end of the conductor into the second half of the connector.
- 1.16 Wipe clean the contact faces of the two halves of the connector, once more. Fit the connector joining bolt; finger tight, to join the two halves of the connector together.
- 1.17 Connect the second core into the second half of the connector as detailed in 1.9 and 1.10 above.
- 1.18 Support the connector with the holding tool and tighten the connector-joining bolt until the head shears off.

33.2 Indoor Termination Connectors

The following connectors are the only approved connectors to be used on 33kV EPR indoor terminations; they are to be used on solid aluminium and stranded copper round conductors, up to their maximum cross section to which they are designed.

The indoor connector palm is drilled to accept a M16 stud, for M12 stud connections the brass bush is inserted into the M16 hole. An aluminium sleeve is provided to allow a 95mm² conductor to be placed in the BAH-02-403-0127 connector, this sleeve being discarded when the connector is used on 185mm² conductor.

All connectors within the range are constructed of brass or copper and are supplied with shear bolts which are dedicated to a conductor size as follows: -

VETB 21 12/16 UTB	covers 50/185mm ² Copper conductors
VETB 28 12/16 UTB	covers 185/400mm ² Copper conductors
VETC 33 12/16 UTB	covers 400/630mm ² Copper conductors
VETC 44 12/16 UTB	covers 630/800/1000mm ² Cu. Conductors

Tooling – the connector bolts require an 18mm socket which may be attached to either an approved Izumi power driven tool or ratchet spanner, the connector being held stable whilst shearing with an adjustable holding tool.

Connector Installation

Refer to Drawings GR3D 6.33.3, and 6.33.4 whilst undertaking this General Requirement.

- 2.1 Mark the insertion depth of the conductor entry hole on the outside of the connector body.
- 2.2 Place the connector onto its connection point.
- 2.3 Place the core alongside the connector and transfer the insertion depth mark onto the core.
- 2.4 Cut the core at the mark made in 2.3.
- 2.5 Remove the insulation for a distance of the insertion depth from the core.
- 2.6 Insert the conductor into the connector.
- 2.7 Ensure the conductor extends to the bottom of the entry hole and fit the connector bolts.
- 2.8 Ensure that the connector palm is in the correct orientation to its connection point and finger tighten the bolts.
- 2.9 Support the connector with the holding tool, starting at the bolt nearest to the core insulation; tighten each bolt sequentially by half a turn until the head shears off.

33.3 Outdoor Termination Connectors

The following connectors are the only approved connectors to be used on 33kV EPR outdoor terminations; they are to be used on stranded copper round conductors, up to their maximum cross section to which they are designed.

The outdoor connector palm being drilled with a hole and a slot, the slot being for connection to the surge diverter and the hole for overhead line jumper connection.

All connectors within the range are constructed of brass or copper and are supplied with shear bolts which are dedicated to a conductor size as follows: -

VETB 21-OHUTB	covers	50/185mm ² Cu. conductors
VETB 28-OHUTB	covers	185/300mm ² Cu. conductors
VETC 33-OHUTB	covers	400/630mm ² Cu. conductors
VETC 44-OHUTB	covers	630/800/1000mm ² Cu. Conductors

Tooling – the connector bolts require an 18mm socket which may be attached to either an approved Izumi power driven tool or ratchet spanner, the connector being held stable whilst shearing with an adjustable holding tool.

Connector Installation

Refer to Drawings GR3D 6.33.3, and 6.33.4 whilst undertaking this General Requirement.

- 3.1 Mark the insertion depth of the conductor entry hole on the outside of the connector body.
- 3.2 Place the connector onto its connection point.
- 3.3 Place the core alongside the connector and transfer the insertion depth mark onto the core.
- 3.4 Cut the core at the mark made in 3.3
- 3.5 Remove the insulation for a distance of the insertion depth from the core.
- 3.6 Insert the conductor into the connector.
- 3.7 Ensure the conductor extends to the bottom of the entry hole and fit the connector bolts.
- 3.8 Ensure that the connector palm is in the correct orientation to its connection point and finger tighten the bolts.
- 3.9 Support the connector with the holding tool, starting at the bolt nearest to the core insulation; tighten each bolt sequentially by half a turn until the head shears off.

33.4 Pin Connectors

The following connectors are the only approved connectors to be used on 33kV EPR cable box compound filled terminations; they are to be used on standard copper round conductors, up to the maximum cross section to which they are designed.

They replace the traditional soldered “thimble” socket used in transformer or OCB cable boxes, which have either the two-bolt clamp or four bolt lamination connection arrangement.

Connectors are to be ordered direct from the manufacturer on a “as and when”, with the exception of the 70/95mm² connector the pin length and diameter will need to be given upon placement of the order.

All connectors within the range are manufactured from brass or copper and are supplied with shear bolts which are dedicated to a conductor size as follows: -

Compound Filled Terminations: -

VETB21 PxxDyy-UTB	covers 185mm ² conductors
VETB28 PxxDyy-UTB	covers 300mm ² conductors
VETB33 PxxDyy-UTB	covers 630mm ² conductors

Tooling – the connector bolts require 13mm or 16mm sockets, which may be attached to either a approved Izumi power driven tool or ratchet spanner, the connector being held stable whilst shearing with an adjustable holding tool.

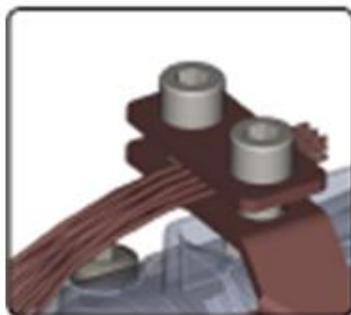
Connector Installation

Refer to Drawings GR3D 6.33.5 whilst undertaking this General Requirement.

- 4.1 Mark the insertion depth of the conductor entry hole on the outside of the connector body.
- 4.2 Place the connector to its connection point.
- 4.3 Place the core alongside the connector and transfer the insertion depth mark onto the core.
- 4.4 Cut the core at the mark made in 4.3.
- 4.5 Remove the insulation for a distance of the insertion depth from the core.
- 4.6 Insert the conductor into the connector.
- 4.7 Ensure the conductor extends to the bottom of the entry hole and fit the connector bolts.
- 4.8 Ensure that the connector pin is correct to its connection point and finger tighten the bolts.
- 4.9 Support the connector with the holding tool, starting at the bolt nearest to the core insulation; tighten each bolt sequentially by half a turn until the head shears off.

33.5 Earth Bond Connectors

These connectors are the only approved connectors to be used to bond stranded copper screen wires in 33kV joints and terminations; they are to be used on copper to copper screen wires and will include a copper earth braid. They are to bond copper screen wires to the associated earth bars of 33kV switchgear and transformers up to their maximum cross section to which they are designed.



Terminations

BET 35-12	covers	16-35mm ² Cu. conductors
BET 60-12	covers	16-60mm ² Cu. conductors
BET 120-12	covers	50-120mm ² Cu. conductors

Tooling – The BET 35-12 requires a 3mm Allen key for the remaining BET lugs the connector bolts require 13mm or 16mm sockets which may be attached to either an approved Izumi power driven tool or ratchet spanner, the connector being held stable whilst shearing with an adjustable holding tool.

Connector Installation – BCNE 3-UTB

Refer to Drawing GR3D 6.33.6 whilst undertaking this General Requirement.

- 5.1 Cut the copper earth wires and copper earth braid 15mm beyond the connector centre line.
- 5.2 Position the copper earth wires and copper earth braid so that they overlay one on top of the other.
- 5.3 Position the main body of the connector around the conductors and slide the bridge into place.
- 5.4 Ensure the connector is correctly positioned and aligned, support the connector with the holding tool and tighten the bolt until the head shears off.

Connector Installation – BET Range

Refer to Drawing GR3D 6.33.6 whilst undertaking this General Requirement.

- 5.1a Cut the copper screen wire conductor so that it will occupy the full depth of the connector entry hole.
- 5.2a Insert the copper screen wires into the connector.
- 5.3a Ensure the conductor extends to the bottom of the entry hole and fit the connector bolts.
- 5.4a Ensure the connector palm is in the correct orientation to its connection point and finger tighten the bolts.
- 5.5a Support the connector with the holding tool, starting at the bolt nearest to the bare copper screen wires; tighten each core sequentially by half a turn until the head shears off.

BTC CONNECTOR (Screen wire Connections)

General

These connectors are to be used in all single core 33kV EPR straight joints on stranded copper round conductors up to the maximum cross section for which the connector is designed.

There are two connectors in the range with non-shear socket head grub screws which range take across specific conductor sizes as follows:-

BTC-1-45W covers 4-35mm² conductors

BTC-3-60W covers 4-60mm² conductors

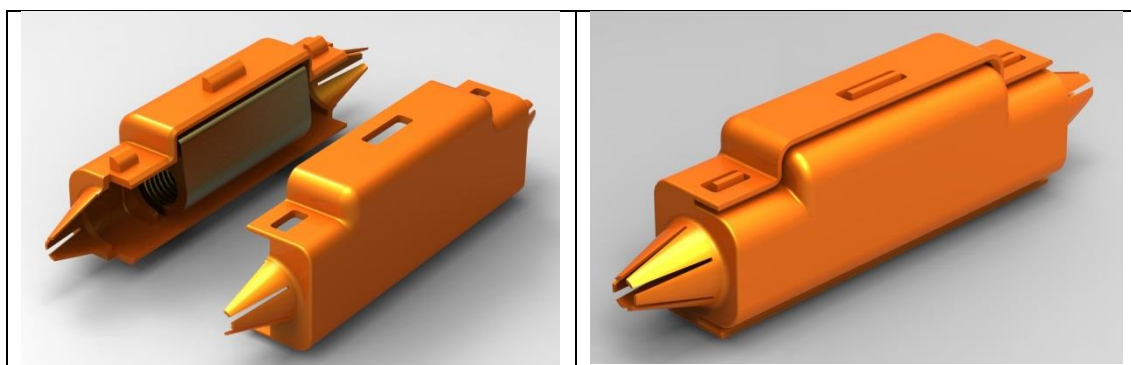
Tooling - the BTC connector requires a 3mm Allen key to tighten the grub screws.

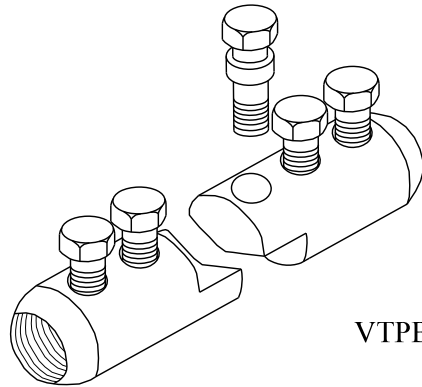
All tooling used is to be fully insulated and Company approved.

Connector Installation (BTC) - Drawing GR3D 6.33.7

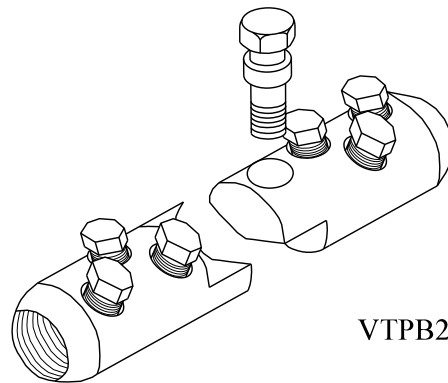
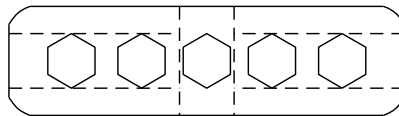
When making phase connections each phase must be dealt with in turn. Remove insulation, make connections and reinsulated **before** commencing the operation on the next phase.

1. Cut each core so that it will occupy the depth of the connector barrel.
2. Remove the insulation from each conductor to a position the depth of the barrel plus 5mm.
3. Degrease the conductor if necessary.
4. Using a file card abrade any aluminium conductors.
5. Install the connector on one conductor and tighten the grub screws.
6. Insert the remaining conductor into the connector and tighten the grub screws.
7. BTC connectors now come with a pre-made polypropylene two piece insulation which is clipped around the BTC connector, as shown below. For the 33kV this pre-made insulation can be discarded.

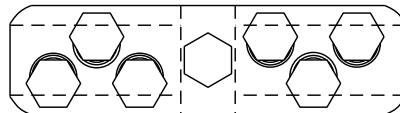





VTPB21UTB

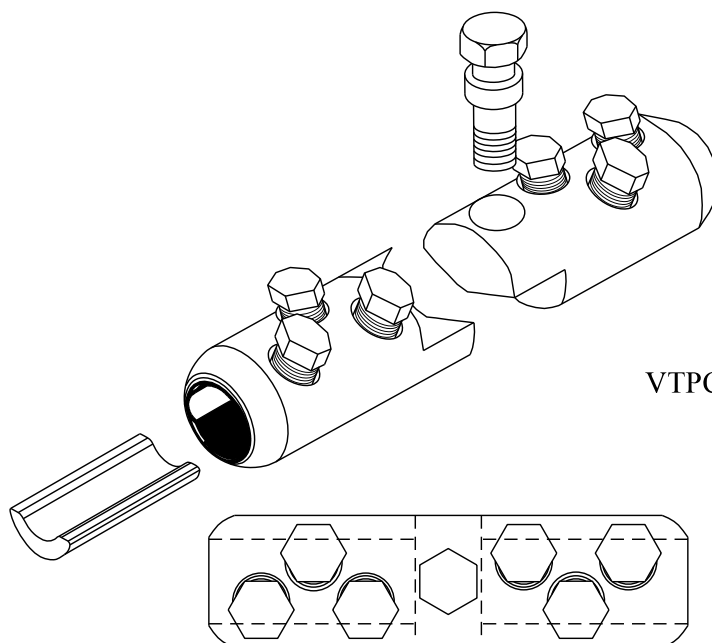


VTPB27/36UTB




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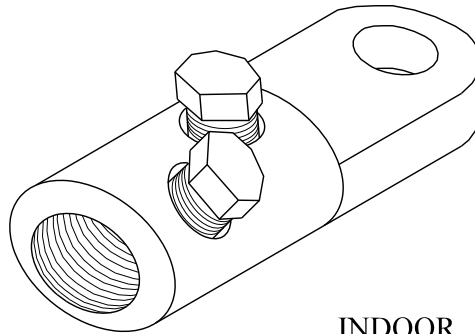
VTPC28G8-UTB

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				Drg. No.	
				GR3D 6.33.2	
				Rev No	

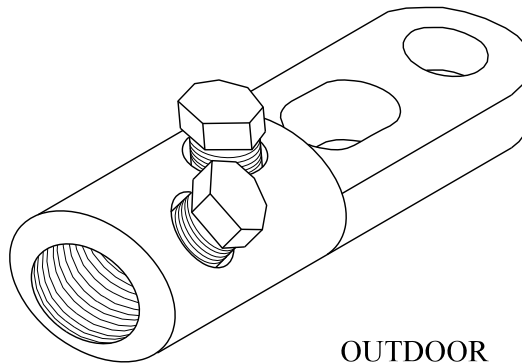
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Brass
Bush



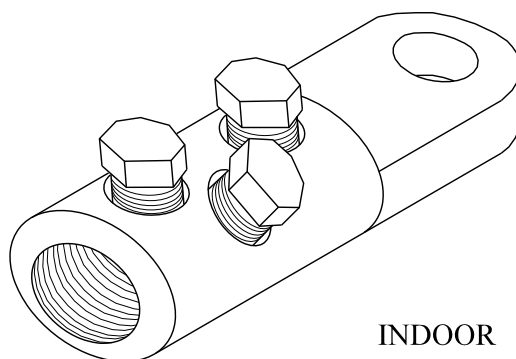
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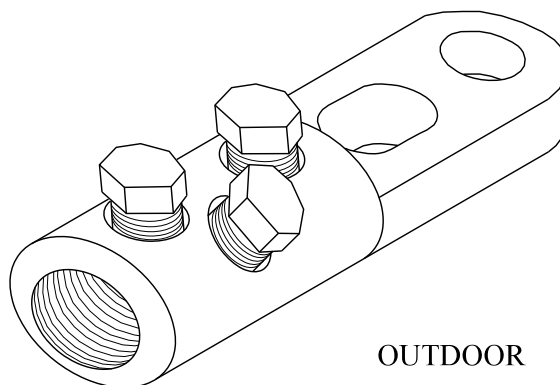
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SCALE	N.T.S.		Title 300mm ² INDOOR AND OUTDOOR TERMINATION CONNECTOR			Drg. No. GR3D 6.33.3
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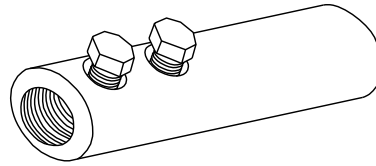
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SCALE	N.T.S.		Title 630mm ² INDOOR AND OUTDOOR TERMINATION CONNECTOR			Drg. No. GR3D 6.33.4
						Rev No

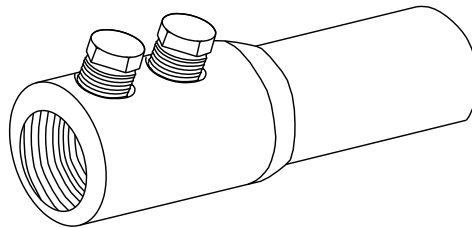
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All dimensions in mm

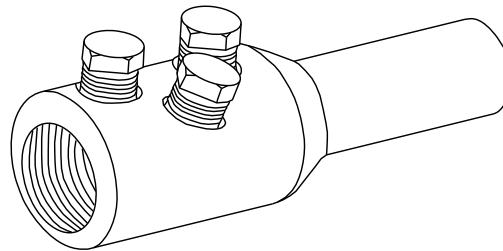
70 / 95mm² Conductor



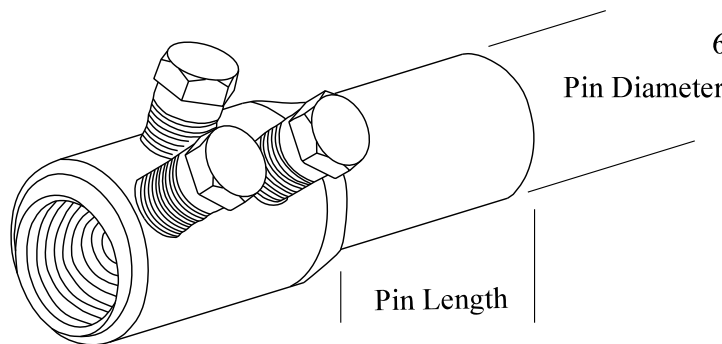
185mm² Conductor




300 / 400mm² Conductor



630mm² Conductor



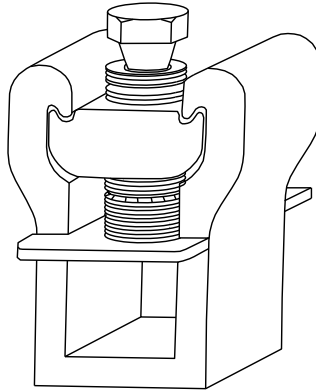
Note:- Pin Diameter And Length Machined To Size By The Manufacturer When Placing Order

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Approved					
SCALE		N.T.S.		Title	
				70 to 630mm ² PIN TERMINATION CONNECTORS	
				Drg. No. GR3D 6.33.5	
				Rev No	

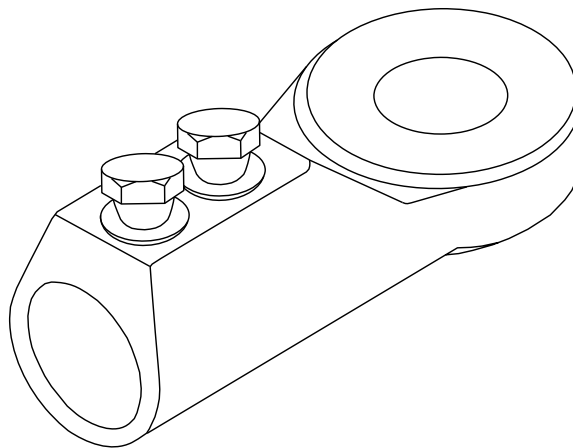
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All dimensions in mm

BCNE Connector



BET Connector

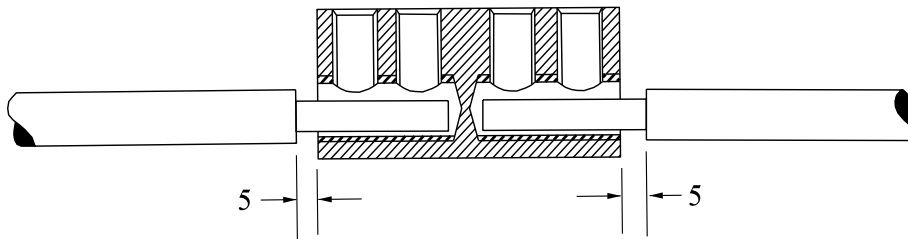
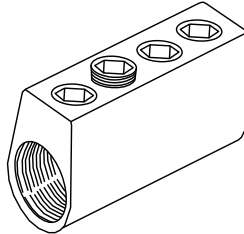



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SCALE		N.T.S.		Title	
				INSTALLATION OF MECHANICAL CONNECTORS	
				Drg. No. GR3D 6.33.6	
				Rev No	

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All dimensions in mm

BTC Connector



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Drawn	RJB	11/16				
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Approved						
SCALE	N.T.S.		Title INSTALLATION OF BTC CONNECTOR - SERVICE STRAIGHT JOINT			Drg. No. GR3D 6.33.7
				Rev No		

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GENERAL REQUIREMENT 34

INSTALLATION OF CONNECTOR INSULATION SLEEVE (LOVINK)

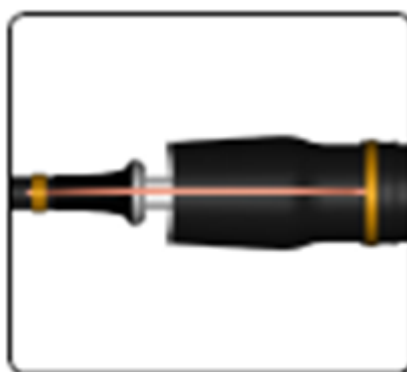
Before commencing the level of PPE required for this operation shall be as the matrix given in General Requirement 3, your attention is drawn to the Use of Solvents given in General Requirement 1.

General

Primary insulation of connectors within the Lovink system is undertaken using silicon tubes, each tube having a connector semi-con inner sleeve (faraday cage) to provide electrical stress control within the tube and an outer layer of semi-con material to provide an earthed electrical screen. **Note: - It is essential that this insulation sleeve is parked centrally over each phase connector so that the ends of the faraday cage terminate onto the phase insulation of the cables being jointed, as shown in GR3D 6.34.1.**



The outer semi-con layer requires earthing to the metallic/semi-con screen provided by the core type. The attachment of an earth braid to either a metallic or semi-con screen provides the equalisation of the components within the joint, see below.



Method of Installation

Refer to Drawings GR3D 6.34.1, 6.34.2 and 6.34.3 whilst undertaking this General Requirement.

34.1 Straight Joints

- 1.1 Using an approved degreaser clean the full length of EPR core insulation and the connectors; do not apply degreaser to paper insulation, dry wipe only.
- 1.2 Ensure that two stress cones are parked either side of the connectors.
- 1.3 Grease the insulation tubes and slide them over the connectors, to one side of the joint.
- 1.4 Ensure correct connector setup and shear centre bolt.
- 1.5 Position the first stress cone into its respective position and remove the applicator.
- 1.6 Slide the insulation tubes and centralise the insulation tube assembly to the connectors.
- 1.7 Position the second stress cone into its respective position and remove the applicator.
- 1.8 Connect earth braids to the insulation tubes and free ends to the metallic/semi-con screens.

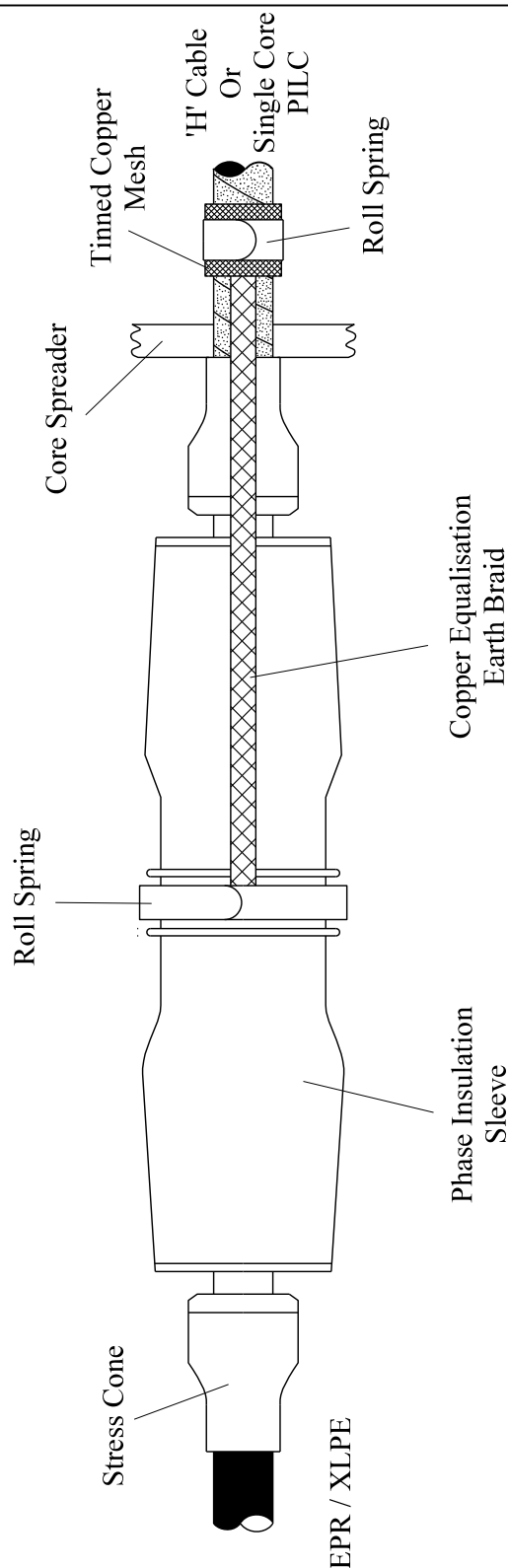
34.2 Straight Joints – Single Core

- 2.1 Using De-Solvit 1000FD degreaser clean the full length of EPR core insulation and the connector; do not apply degreaser to paper insulation, dry wipe only.
- 2.2 Follow steps in 1.2, 1.3, 1.4, 1.5, 1.6 and 1.7 in 32.1 above for single core.

34.3 Stop Ends – trefoil and transitional

- 4.1 Using an approved degreaser clean the full length of the EPR core insulation, do not apply degreaser to paper insulation, dry wipe only.
- 4.2 Slide the spacers into the insulation tube slots, taking the complete assembly position over the cores.
- 4.3 Centralise the insulation tube assembly to the core ends.

- Note :- 1) The Roll Spring Connections Are Not To Be Covered With PVC Or VM Tape
2) The Phase Insulation Sleeve To Be Equi - Distant Between The Two Stress Cones



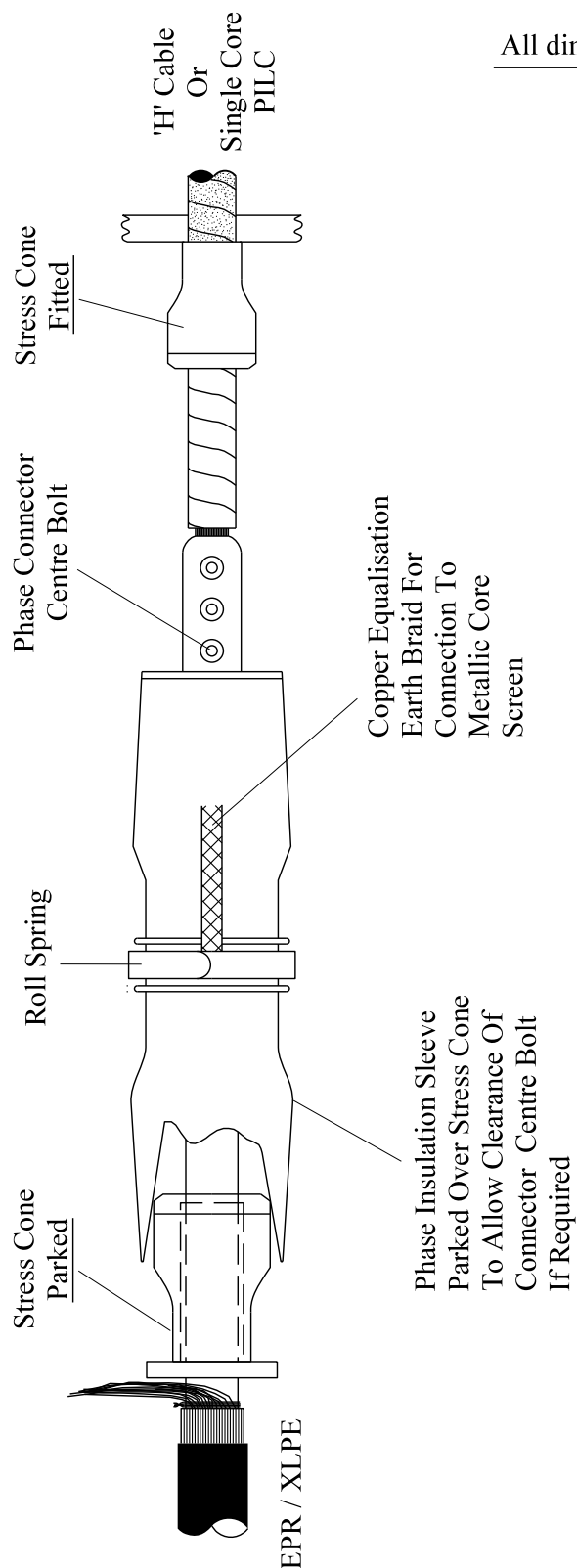
All dimensions in mm

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Drawn	RJB	02/17		<div>WESTERN POWER DISTRIBUTION</div> <div><div></div></div>	
Checked					
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SCALE		N.T.S.		<div>Title</div> <div>INSTALLATION OF PHASE INSULATION SLEEVE GENERAL LAYOUT</div> <div>Drg. No. GR3D 6.34.1</div> <div>Rev No</div>	

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Note :- 1) Roll Spring Connections Are Not To Be Coverd With PVC Or VM Tape

2) The Phase Insulation Sleeve Is To Be Parked Over The Polymeric Core Not The Paper Core

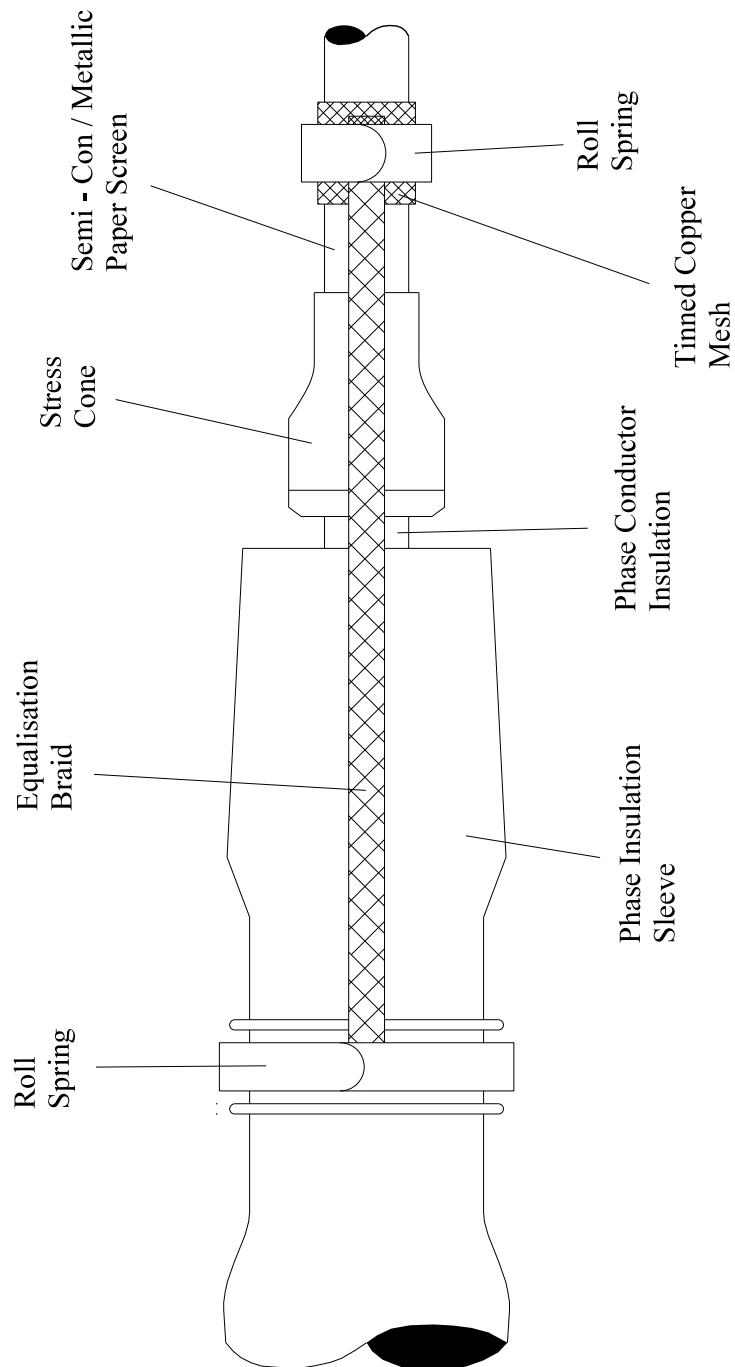


All dimensions in mm

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Drawn	RJB	02/17		Title PARKING OF PHASE INSULATION SLEEVE PRIOR TO FITMENT	
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Approved					
SCALE N.T.S.				Drg. No. GR3D 6.34.2	
				Rev No	

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Note :- Roll Springs Within The Inner Joint Sleeve Are Not To Be Enclosed With PVC Tape

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Drawn	RJB	11/16			
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SCALE		N.T.S.		Title	
				APPLICATION OF EQUALISATION BRAID TO PHASE INSULATION SLEEVE	
				Drg. No. GR3D 6.34.3	
				Rev No	

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GENERAL REQUIREMENT 35

INSTALLATION OF STOP END MODULES IN M85 and M105 (LOVINK)

Before commencing the level of PPE required for this operation shall be as the matrix given in General Requirement 3, your attention is drawn to the Use of Solvents given in General Requirement 1.

General

Both the Lovink systems use base straight joint modules to provide a stop end.

The system converts existing base modules to a stop end joint by the introduction of a polymer-insulated rod.

Method of Installation

Refer to Drawing GR3D 6.35.1 whilst undertaking this General Requirement.

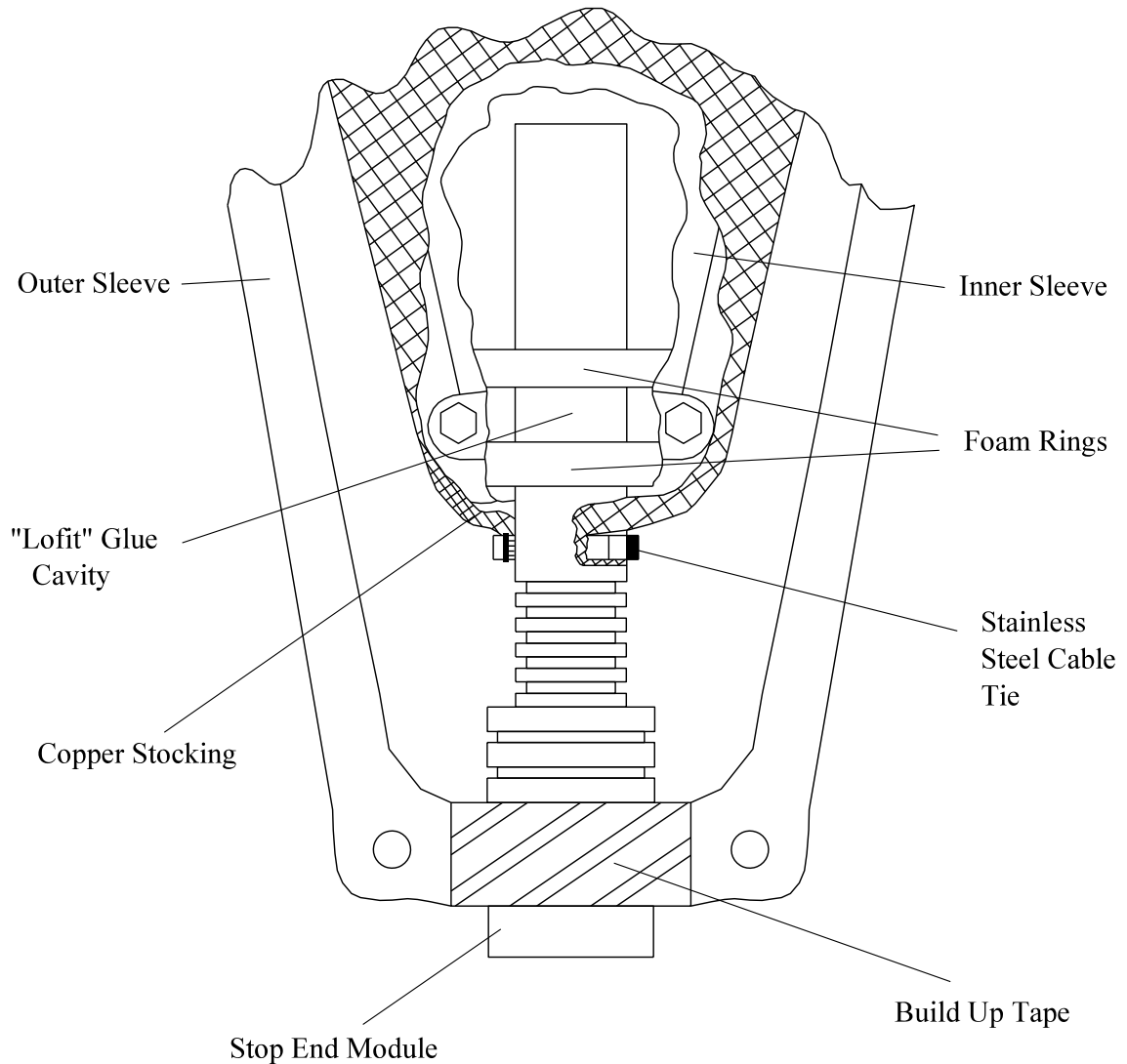
35.1 Lovink Stop End / Loop Joint

- 1.1 Ensure the insulation rod is thoroughly cleaned using an approved degreaser.
- 1.2 Slide two foam rings over the rod.
- 1.3 Offer the rod to the inner sleeve and position the foam rings to their required position.


Note: - When the top half of the inner sleeve is fitted ensure the funnel filling holes are clear.

- 1.4 Complete the joint to the relevant jointing procedure.

All dimensions in mm



PLAN VIEW

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Drawn	RJB	11/16			
Checked				<div>Title</div> <div>INSTALLATION OF STOP END JOINT MODULE</div> <div>Drg. No. GR3D 6.35.1</div> <div>Rev No</div>	
Approved					
SCALE		N.T.S.			

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GENERAL REQUIREMENT 36

INSTALLATION OF INNER SLEEVE (LOVINK)

Before commencing the level of PPE required for this operation shall be as the matrix given in General Requirement 3, your attention is drawn to the Use of Solvents given in General Requirement 1.

General

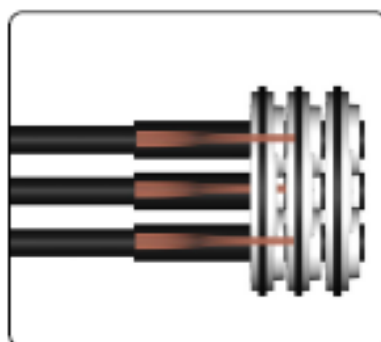
The correct installation of the inner sleeve is of the utmost importance, the inner sleeve has the following roles in the joint design which is to provide insulation, retain the insulating compound and prevent the ingress of moisture.

It is therefore important the cables are set correctly in line and straight to the joint position, they must be free from grease and any temporary binders are to be removed, the foam rings are intact (free from splits etc.) and close fitting to the cable sheaths.

Should these areas not meet the requirements then the Lovifit glue or Protolin resin compound will not seal or at worst leak into or out of the sleeve, therefore not providing a moisture seal or retention of the Lovisil silicon compound.

36.1 Method of Installation

- 1.1 Remove all temporary binders, and ensure the joint is grease free.
- 1.2 Offer the lower half of the inner sleeve to the joint; on the M125 ensure that the 3 spacer plates are positioned on the cables, with the larger diameter towards the joint.

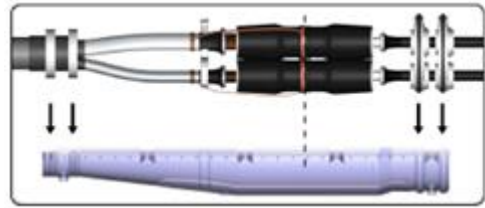


- 1.3 Adjust the two foam rings at the joint ends until they are positioned into their respective ribbed rings and butted against their sealing ridges.
- 1.4 **Depending on cable sizes foam rings or metallic sheaths will at times thus requiring building up with foam tape to the respective joint size.**
If this is not a requirement move to step 5.
Remove the backing paper and apply the tape sticky side to the foam ring under light tension, ensuring each layer is directly over the previous layer, the correct diameter is achieved when the calliper is a 'snug' fit to the foam tape calliper.

- 1.5 Offer the upper half to the lower half of the inner sleeve ensuring the funnel holes are clear of the foam rings. For the M85 and M105 see below.



M 85 & M 105

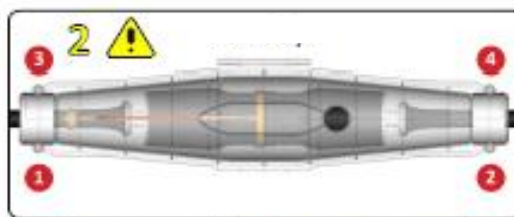


M 125

- 1.6 For the M85 and M105 click the upper shell partly on the lower shell then tighten the fixing screws as shown below, and then snap the shells into the second slot of the snapper construction. See below.



4. Click the upper shell partly on the lower shell.

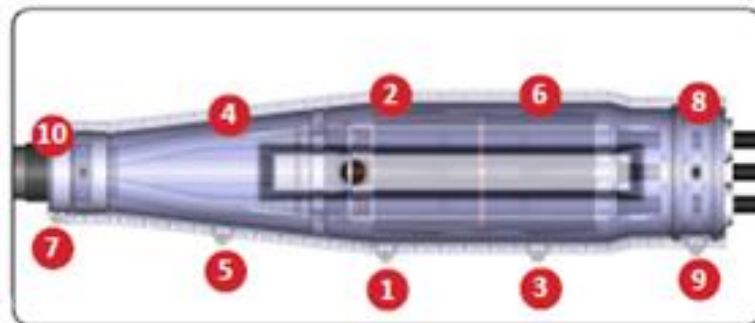


5. Tighten all screws with an Allen key according to the image above (5Nm).



6. Snap the shells into the second slot of the snapper construction.

For the M125 tighten the screws as shown below: -



- 1.7 For the M125 insert the funnels into the upper half of the inner sleeve.



- 1.8 Mix the Lovifit glue compound for one minute until a uniform colour is achieved, the compound must be above 10°C before and whilst mixing, General Requirement 33.

- 1.9 On the M125 joint pour the mixed compound into the funnels until it fills the void.
- 1.10 Once the Lovifit glue compound has cured (normally after the inner sleeve has been filled with silicon compound) saw off the funnels between the stem flange rings close to the inner sleeve.

GENERAL REQUIREMENT 37

MIXING AND POURING OF TWO-PART LOVIFIT GLUE (LOVINK)

Before commencing the level of PPE required for this operation shall be as the matrix given in General Requirement 3, your attention is drawn to the Use of Solvents given in General Requirement 1.

General

The Lovifit glue is used to provide a watertight seal between the cable sheaths and inner sleeve. To ensure adhesion and subsequent sealing to metallic sheaths the sheaths must be abraded and thoroughly degreased, semi-conducting screens must be kept free of grease or other contaminates.

The liquid components of the two-part Lovifit glue used in Lovink cable joints are contained in a foil pack, which forms an enclosed system. This ensures that mixing of the resin and hardener components are completed without exposure to the mixer.

Although the enclosed system should be effective in preventing contact with harmful materials, the following basic precautions shall be taken when using two-part Lovifit glue.

37.1 Safety / First Aid

Skin Contact

The hardener is irritating to the skin. The use of the disposable plastic gloves provided should eliminate any contact, but if it occurs, the affected area should be washed immediately with plenty of soap and water.

Splashes in the Eye

The hardener is irritating to the eyes. Suitable protection such as goggles or a face visor shall be worn when pouring or stirring. In case of contact with the eyes, rinse immediately with plenty of water and seek medical advice.

Breathing of Vapour

Ensure that adequate ventilation is provided to prevent high concentrations of vapour building up in the working area. Pay particular attention to this requirement when working in confined areas.

If adequate ventilation cannot be provided, suitable respiratory equipment shall be worn.

Fire Hazard

The resin and hardener have low flammability but, if a fire occurs in an area where the hardener is stored; a dangerous vapour will be produced. Anyone tackling the fire must wear suitable respiratory equipment.

Decontamination/Disposal of Containers

Isocyanate containers must be neutralised before disposal, this is unnecessary with the foil pack. The internal mixing bag can be disposed of as non-harmful after the contents have been mixed.

A WPD label stating the contents are inert and safe to handle, must be applied to the DSD or CLP label before disposal.

37.2 Method of Mixing

Safety and handling information is printed on the outside of the pack and must be observed.

- 2.1 Examine the foil pouch containing the hardener and polyol to ensure it is free of damage.
- 2.2 Support the foil pouch and using scissors make a small cut to the bag top, carefully tear the top edge along its length starting at the cut position.
- 2.3 Remove the contents from the foil pouch checking the two compartments for damage.
- 2.4 Support the two compartments with the rubber cord uppermost, take the free end of the rubber cord and pull gently this will release the green channel.
- 2.5 With the bag extended to its full length and with a tumbling action allow the two components to mix thoroughly until a uniform colour is achieved.

Mixing thoroughly for one minute only ensuring all components are removed from the seams of the bag.
- 2.6 Cut a corner of the bag and pour into the inner sleeve.
- 2.7 Pour the mix slowly into the funnel at one end of the inner sleeve, mixing and pouring should be continuous so that delays are kept to a minimum.
- 2.8 Apply decontamination labels to all hazardous warning signs and remove to WPD depots for correct disposal, drawing GR3D 6.37.1.

Note: - If the white substance in the resin compartment of the mix has hardened and become lumpy do not attempt to mix into the two-part mix, bits may breakaway and block the channels of the inner sleeve.

All dimensions in mm

Adhesive Backed Label


WESTERN POWER 
DISTRIBUTION

Serving the Midlands, South West and Wales

THE CONTENTS OF THIS PACKAGE
HAVE BEEN RENDERED INERT AND
ARE NO LONGER HARMFUL

Note :- This Label Is To Be Placed Across The Black
Warning Cross On The Orange Background
Of The Suppliers Harmful Warning Label

This Is To Be Undertaken On All Harmful Substance
Containers / Packaging Used Within WPD
Once The Substance Has Been Rendered Inert

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SCALE	N.T.S.		Title DECONTAMINATION LABEL FOR HARMFUL SUBSTANCE CONTAINERS / PACKAGING			Drg. No. GR3D 6.37.1
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GENERAL REQUIREMENT 38

FILLING OF INNER SLEEVE (LOVINK)

Before commencing the level of PPE required for this operation shall be as the matrix given in General Requirement 3, also your attention is drawn to the Use of Solvents given in General Requirement 1.

General

The inner sleeve is filled with Lovisil silicon cold pour compound, which provides insulation and helps to prevent the build-up of electrical stress within the joint.

As with any joint filling compound the need for care in the preparation and pouring is very important and protection from the elements i.e. moisture, dust etc. must be maintained throughout the operation.

Due to the silicon compound being cold pour and very viscous the need for topping after filling is no longer a requirement, although a little time should be given to allow for settlement and to ensure air voids are expelled.

During filling and throughout its service the joint must be maintained in a level position, a tolerance of two degrees maximum out of level is the most acceptable.



38.1 Method of Filling

Refer to Drawing GR3D 6.38.1 whilst undertaking this General Requirement.

- 1.1 Position the Lovisil bag on the filling port as indicated on the filling instructions shown on the bag.

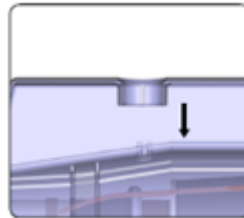


- 1.2 Hold the spout firmly in the filling port and slowly pour the Lovisil into the inner shell.



- 1.3 Slowly fill the inner shell with Lovisil until the level reaches the maximum and minimum marks on the inner shell.

Correct level is achieved when the silicon compound is between the two maximum and minimum marks on the M85 and M105, for the M125 see below: -



- 1.4 Tighten the plug firmly using a 19mm spanner.
- 1.5 Thoroughly clean the inner sleeve using De-Solvit 1000FD.

Fig 1



Position The Lovisil Bag
On The Fill Opening
As Indicated In The
Instructions On The Bag

Fig 2



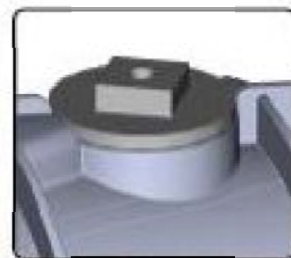
Hold The Spout Firmly
In The Fill Opening
Pour The Lovisil SLOWLY

Fig 3




Fill The Inner Joint With
Lovisil To A Level Between
MIN And MAX

Fig 4



Tighten The Plug Firmly
With A 19mm Spanner

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SCALE		N.T.S.		Title	
				FILLING OF INNER SLEEVE	
				Drg. No. GR3D 6.38.1	
				Rev No	

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GENERAL REQUIREMENT 39

INSTALLATION OF METALLIC SHEATH / CSW EARTH BONDS (LOVINK)

Before commencing the level of PPE required for this operation shall be as the matrix given in General Requirement 3, also your attention is drawn to the Use of Solvents General Requirement 1.

General

The application of any earth bond connection within a joint is very important, the necessary care of preparation and installation will ensure continuity through the joint and its associated cable system.

Wherever a fault occurs due to third party damage, lighting strikes or for other reasons, high fault currents flow, therefore the materials and installation must be able to sustain this change until the system trips.

Incorrect use of materials or poor installation can lead to failure of the bond, in the form of heat being produced causing possible burn of the connection or melting of the metallic sheath, it is therefore of the utmost importance that the assembly is installed correctly.

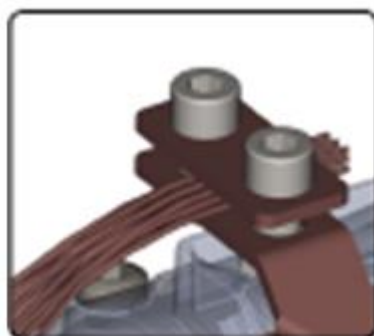
CAUTION: – Roll springs may have sharp edges and where possible gloves shall be worn.

Method of Installation

Refer to Drawings GR3D 6.39.1, 6.39.2, 6.39.3, 6.39.4 and 6.39.5 whilst undertaking this General Requirement.

39.1 EPR / XLPE Cables

- 1.1 Birdcage the copper screen wires of each cable and form into a single conductor, offer the copper earth braid to the earth connector and cut off the excess copper screen wires.
- 1.2 Make off the connector.



39.2 PILC Cables

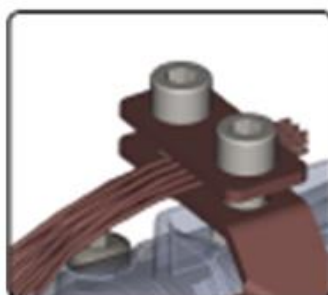
- 4.1 Abrade the lead sheath circumferentially along the complete length using a file card, and clean with an approved degreaser – Fig 1.
- 4.2 Take the length of tinned copper mesh and fold in half along its length (thus reducing the width), wrap two layers around the lead sheath – Fig 2.
- 4.3 Lay the earth braid directly onto the tinned copper mesh ensuring there is sufficient tail to allow the earth braid to be turned back over the roll spring – Fig 3.
- 4.4 Starting with the end of the roll spring opposite the earth braid apply one complete turn **over** the earth braid wrapping in the same direction as the tinned copper mesh – Fig 4.
- 4.5 Turn the earth braid tail back over the roll spring and gently dress down to flatten – Fig 4.
- 4.6 Apply the remaining turns of the roll spring; tighten by hand using a twisting action – Fig 5.
- 4.7 Cover the complete assembly using 19mm “VM” tape; first fold 50mm of the tape end in half with the mastic side to the outside.

Lay the folded end between the earth braid and lead sheath abutting the roll spring; wrap the tape in the same direction as the roll spring with the mastic side down.

Apply a half lapped layer over the assembly overlapping 10mm onto the metallic sheath either side of the roll spring ensuring the assembly is completely covered see – Fig 6.

39.3 3 Core XLPE SWA Cables

- 5.1 Prepare the cable as per General Requirement 14.
- 5.2 Prepare the copper tape screens as per General Requirement 25.
- 5.3 Take the copper braid applied in 5.1 and lay into a BCNE3 UTB connector.
- 5.4 Take each braid applied in 5.2 to the copper tapes and lay into the connector mounted onto the earth bar.
- 5.5 Terminate the braid into the connector mounted onto the earth bar.



Note :- For Electrical And Mechanical Stability
The Roll Spring Assembly Must Be Assembled In The Following Sequence.

Fig 1

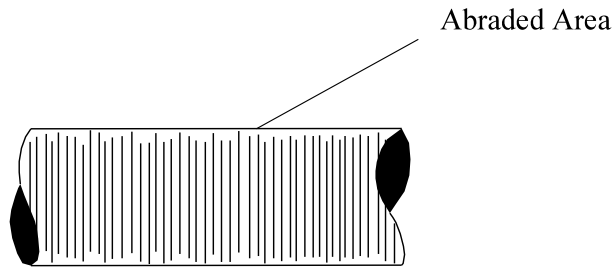
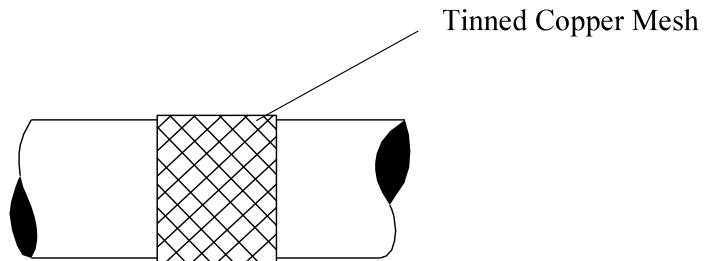


Fig 2



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Approved					
SCALE		N.T.S.		<div>Drg. No. GR3D 6.39.1</div>	
				<div>Rev No</div>	

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Note :- The Application For All Cable Types Is Identical
From Fig 3 Onwards

Fig 3

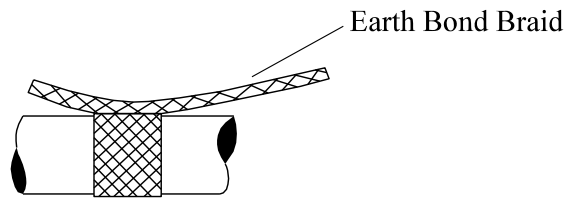


Fig 4

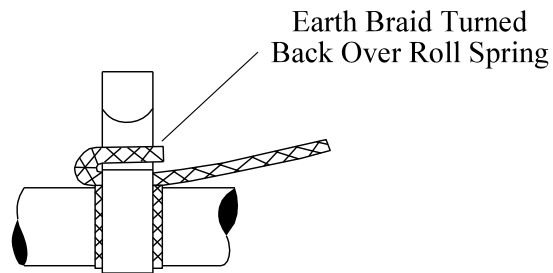


Fig 5

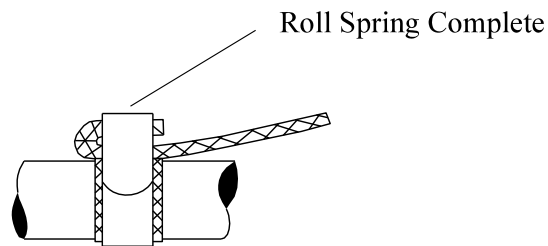
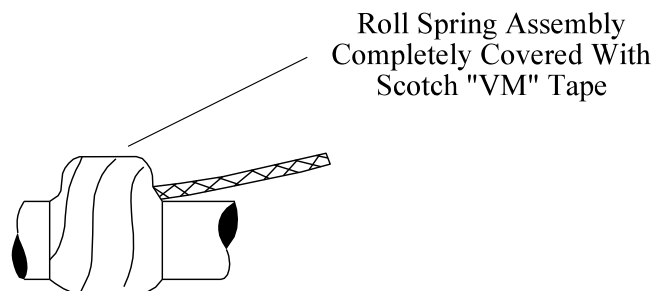



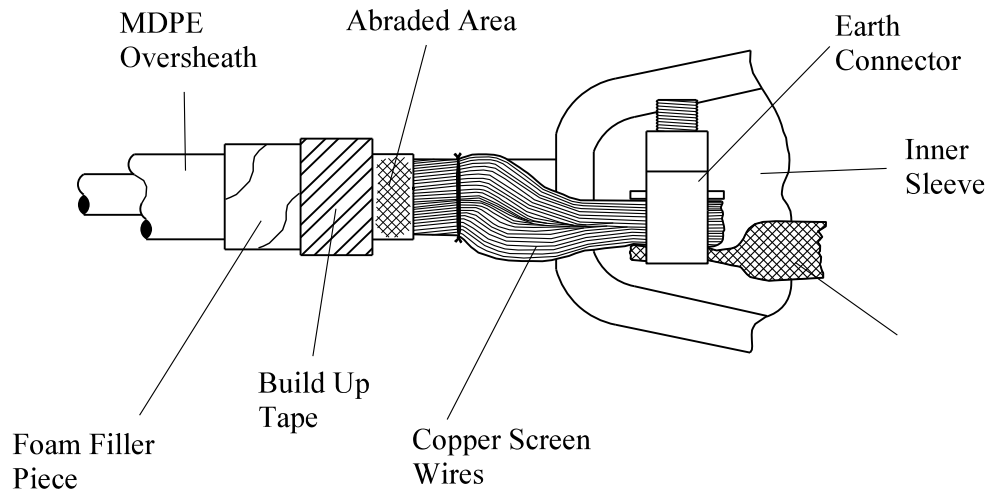
Fig 6



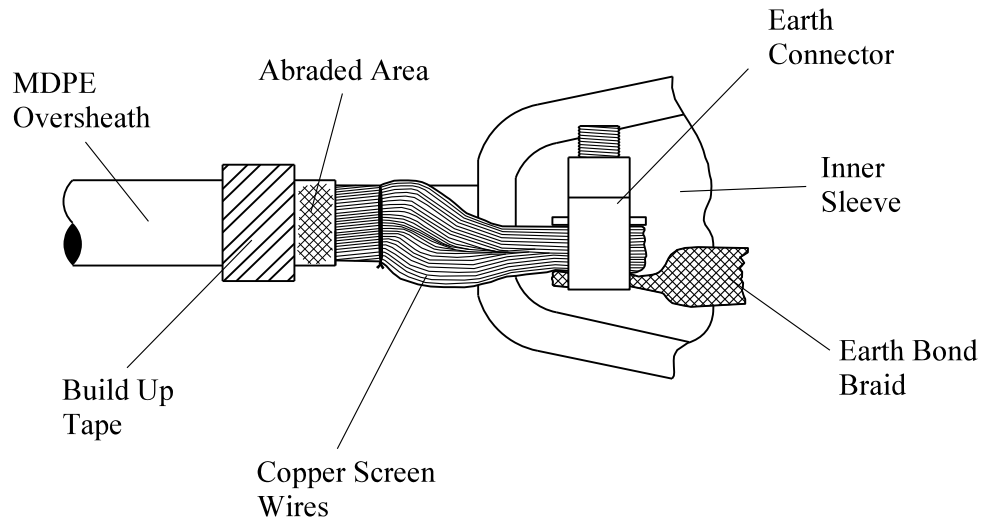
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EPR TRIPLEX



EPR SINGLE CORE

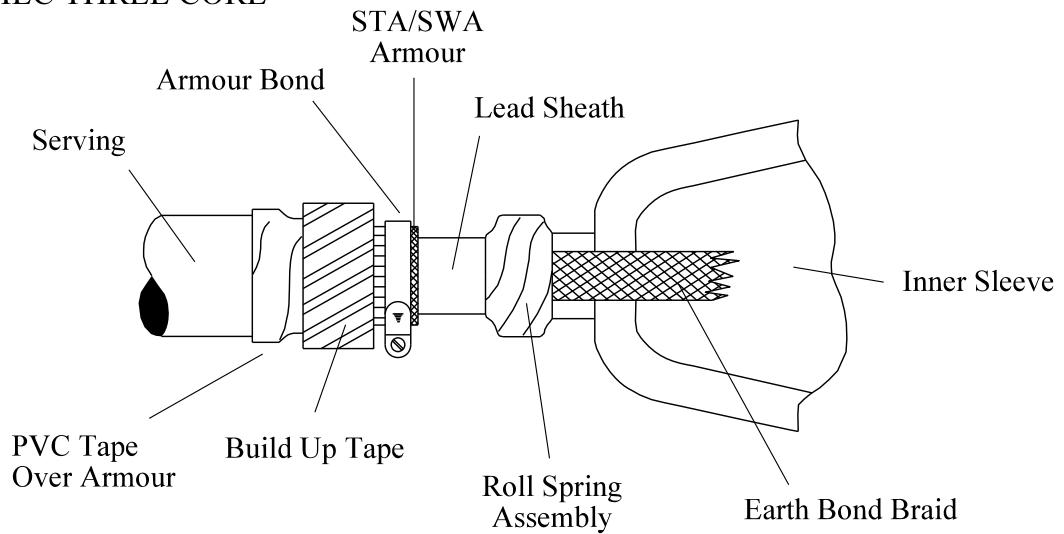


PLAN VIEW

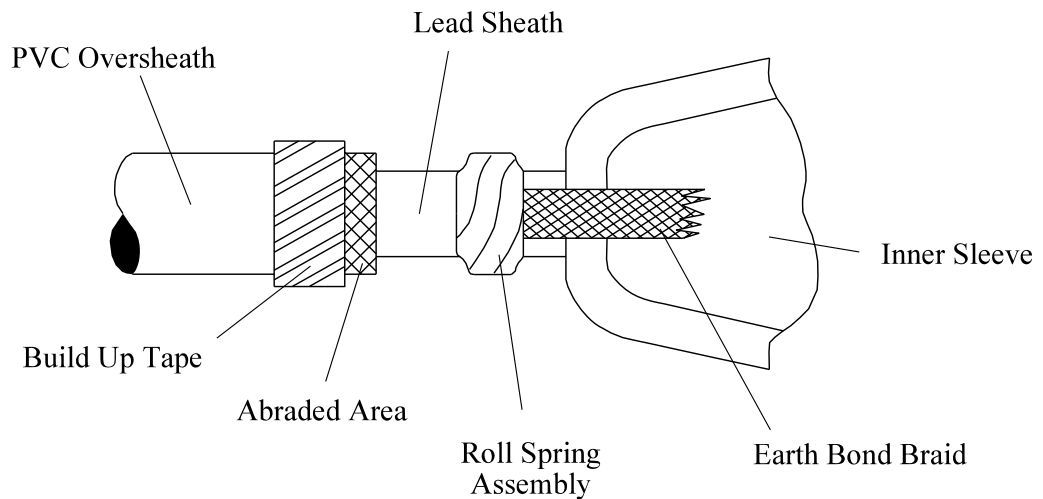
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PILC THREE CORE



PILC SINGLE CORE

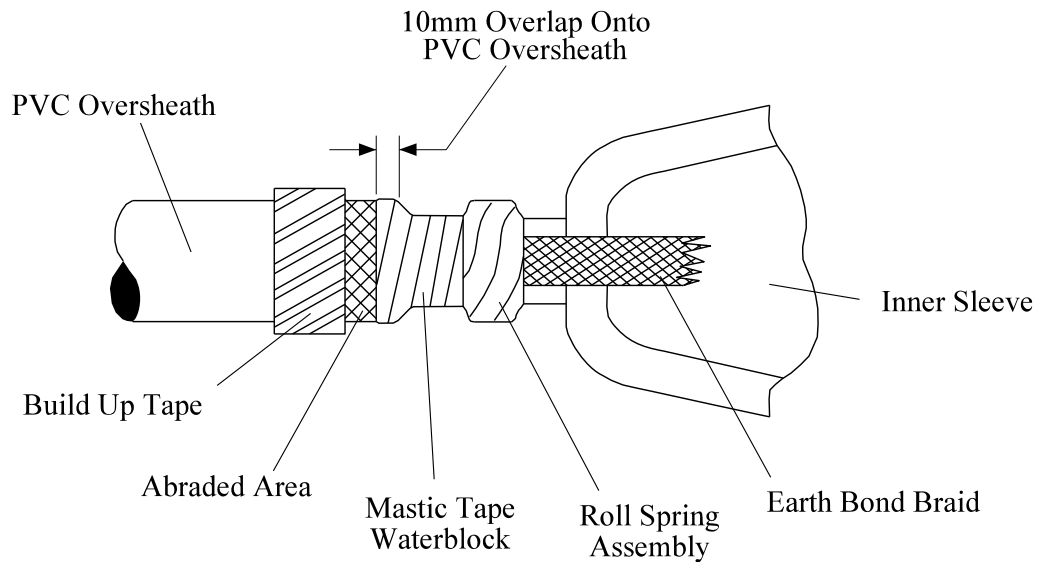


PLAN VIEW

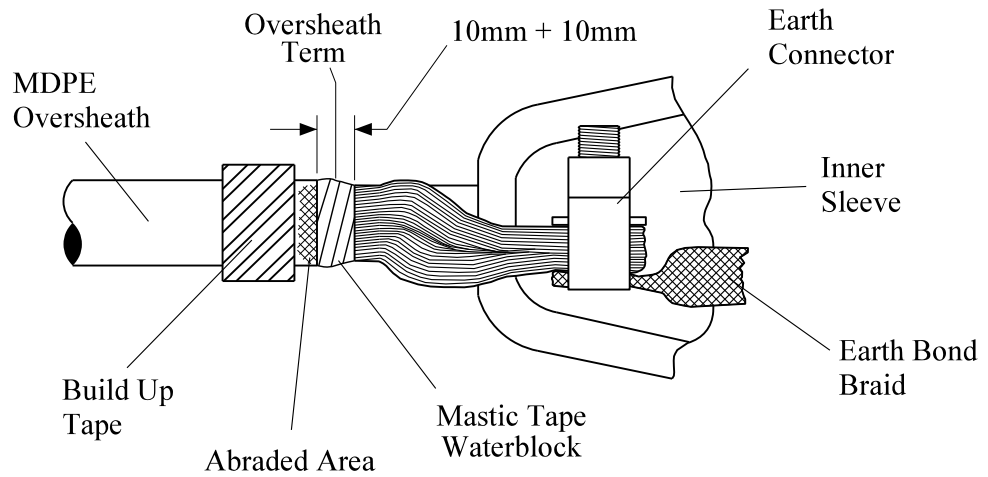
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PILC SINGLE CORE



EPR SINGLE CORE



PLAN VIEW

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SCALE		N.T.S.		Title	
				APPLICATION OF WATER MASTIC TAPE WATER BLOCK	
				Drg. No. GR3D 6.39.5	
				Rev No	

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GENERAL REQUIREMENT 40

DEGREASING OF JOINTS AND TERMINATIONS

Before commencing the level of PPE required for this operation shall be as the matrix given in General Requirement 3, also your attention is drawn to the Use of Solvents given in General Requirement 1.

General

Failure to degrease or clean contamination from joints or terminations will prevent the sealing of glues and resins to prevent the ingress of moisture, whereas traces of contamination on conductor insulation may lead to tracking and possible electrical failure.

Degreasers must be approved and only approved degreasers are to be used.

Safety

The degreasers should only be dispensed from the small containers provided, do not use large cans.

Ensure good ventilation, particularly if working in confined places.

Dispense only sufficient degreaser onto the wiper, it is unnecessary, wasteful and potentially harmful to pour out large quantities which merely splash onto the ground.

Contact of the degreaser with naked flames and red-hot surfaces should be avoided.

Do not smoke while using the degreasers.

Avoid unnecessary contact with the skin; the approved PVC gloves provided shall be worn, if considered necessary, eye protection may be worn.

Follow any safety precautions printed on the container.

Containers are to only be disposed of at Company depots, and a decontamination label is to be placed over the hazardous warning label.

40.1 Degreasing Terminations

The degreasing operation must be carried out prior to the fitting of the termination body and after all semi-conducting screen removal has been completed.

- 1.1 Apply the approved degreaser to a clean wipe, only use sufficient to effectively remove any contaminant present.
- 1.2 Firstly degrease the insulation taking care as to not touch the semi-conducting screen with the wipe, changing the wipe as it becomes contaminated.

- 1.3 To ensure the insulation is clean a full 360-degree contact is made with the insulation and in a single motion wipe down towards the semi-conducting screen. Throw away the wipe once this operation has been completed.
- 1.4 When degreasing has been completed, replace the top on the container to avoid spillage.

40.2 Degreasing Joints

The degreasing operation must be carried out prior to the fitting of the outer sleeves.

- 2.1 Apply the approved degreaser to a clean wipe, only use sufficient to effectively remove any contaminant present.
- 2.2 Firstly degrease the metallic sheaths and inner sleeve, changing the wipe as it becomes contaminated.
- 2.3 Degrease any abraded PVC or MDPE sheaths.
- 2.4 When degreasing has been completed, replace the top on the container to avoid spillage.

GENERAL REQUIREMENT 41

INSTALLATION OF COPPER STOCKING (LOVINK)

Before commencing the level of PPE required for this operation shall be as the matrix given in General Requirement 3.

General

The copper stocking provides a conductive screen around the joint so eliminating any potential difference, which may arise.

The copper stocking is to be bonded onto the metallic cable sheaths/copper wires using metallic stainless steel cable ties at either end of the joint.

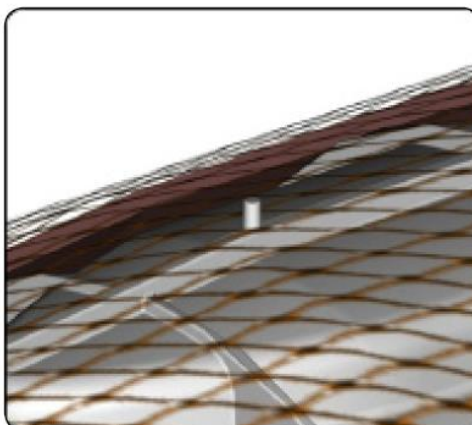
Method of Installation

41.1 Transitional Straight Joints – H Cable to EPR / XLPE Cables

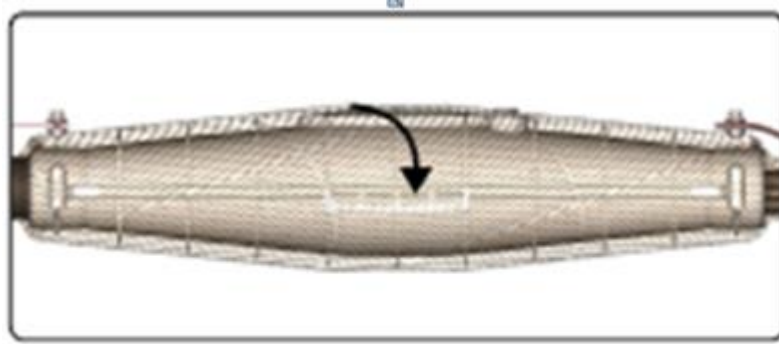
- 1.1 Take the parked copper stocking and position equidistant over the inner sleeve.
- 1.2 Fold and tailor the copper stocking to the profile of the inner sleeve.
- 1.3 Using a stainless steel cable ties secure the copper stocking to the copper screen wires between the cable oversheath and 20 swg tinned copper binding wire, trimming of the excess copper stocking.
- 1.4 Ensure all excess copper stocking is clear of the mastic water block tape applied to the oversheath termination.

41.2 Straight Joints – EPR / XLPE Cables

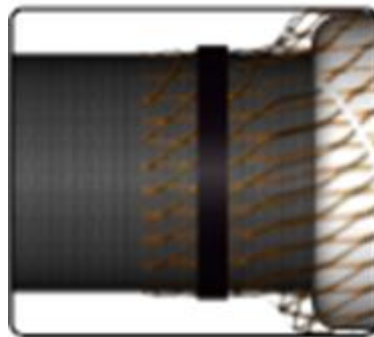
- 2.1 Take the copper stocking and position equidistant over the inner sleeve.
- 2.2 Locate the leading edge of the copper stocking/mesh on to the ABS spines across the top of the inner shell, see below.



- 2.3 Fold and tailor the copper stocking to the profile of the inner sleeve, see below.



- 2.4 Using a stainless steel cable ties secure the copper stocking to the copper screen wires between the cable oversheath and 20 swg tinned copper binding wire, trimming of the excess copper stocking, see below.



- 2.5 Ensure all excess copper stocking is clear of the mastic water block tape applied to the oversheath termination.

41.3 Stop End Joints – EPR/XLPE/PILC Cables

- 3.1 Take the copper stocking and position equidistant over the inner sleeve.
- 3.2 Locate the leading edge of the copper stocking/mesh on to the ABS spines across the top of the inner shell.
- 3.3 Fold and tailor the copper stocking to the profile of the inner sleeve.
- 3.4 Using a stainless steel cable ties secure the copper stocking to the copper screen wires between the cable oversheath and 20 swg tinned copper binding wire, trimming of the excess copper stocking.
- 3.5 Ensure all excess copper stocking is clear of the mastic water block tape applied to the oversheath termination.

GENERAL REQUIREMENT 42

APPLICATION OF MASTIC TAPE WATER BLOCK

Before commencing the level of PPE required for this operation shall be as the matrix given in General Requirement 3, also your attention is drawn to the Use of Solvents General Requirement 1.

42.1 General

Due to the possible ingress of moisture between the single cores of EPR or XLPE cables, being jointed with the Lovink jointing system, this ingress of moisture then in turn causes problems when the particular circuit is sheath tested. The following method shall be undertaken on all EPR/ XLPE single core cables which are jointed with the Lovink resin filled system.

In addition polyurethane resin will not form an effective moisture seal to the lead/copper wire screen; therefore it is necessary to introduce a mastic tape seal.

42.2 Method of Application

Refer to Drawing GR3D 6.42.1 whilst undertaking this General Requirement.

42.2.1 Lead Sheaths

- 1.1 Thoroughly clean the exposed lead sheath between the two earth bonds with an approved degreaser.
- 1.2 Abrade circumferentially the whole area with a file card.
- 1.3 Clean the abraded lead sheath with an approved degreaser.
- 1.4 Apply with light tension two half lap layers of black mastic water blocking tape over the exposed lead sheath.

42.3 EPR/XLPE Cables within Lovink Joints

41.3.1 Method of application

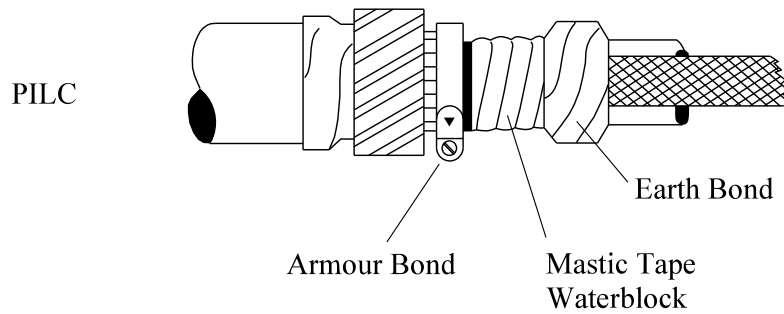
Refer to Drawing GR3D 6.42.2 (see attached) whilst undertaking this General Requirement.


- 3.1 Prep the cables as per the relevant jointing procedure.
- 3.2 The oversheaths are to be thoroughly abraded and cleaned with De-solvit 1000FD.
- 3.3 Apply two layers of 5313 water blocking tape starting 10mm from the over sheath termination with half lap layers, using light tension move towards and onto the copper screen wires for a distance of 10mm, return with half lap layers back to the start point on the oversheath.

- 3.4 On completion of step 3 cover the mastic tape with the yellow wax backing paper to keep the water block tape clean, undisturbed and to prevent cores from sticking together at this stage.
- 3.5 Fit the foam filler piece between the three single core cables, a cable tie is to be placed around the oversheath of each core before final positioning of the foam filler piece.
- 3.6 Proceed with the jointing procedure until the point is reached whereby the wax backing tape requires removal to allow completion of the joint.

Note: - The mastic blocks will touch and seal as the cores are positioned into their final position, the cable ties around the outer sheaths will touch therefore allowing a gap between the cores for resin to flow between and allow sealing between the oversheaths.

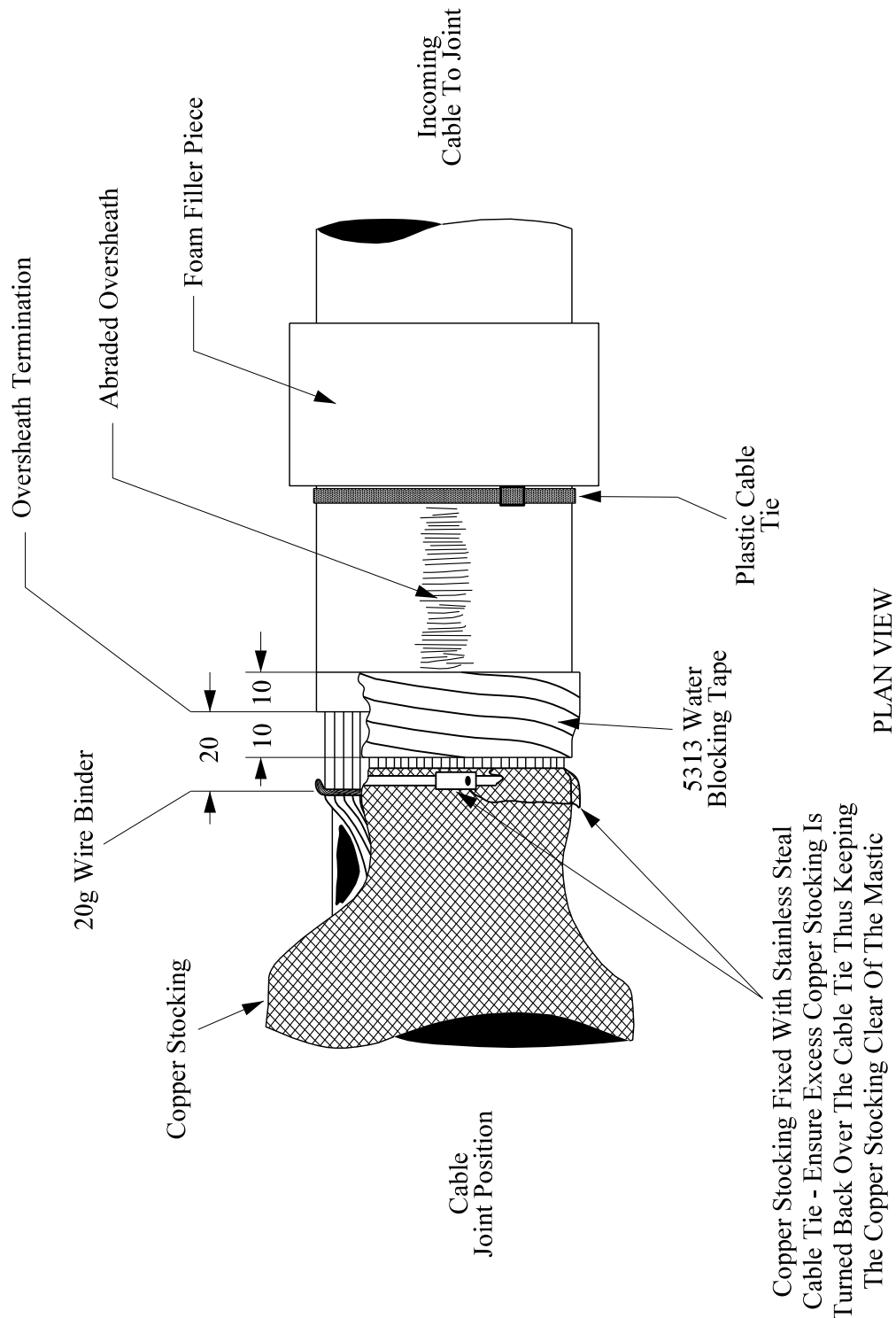
All dimensions in mm




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SCALE		N.T.S.		Title		Drg. No.	Rev No
				PROCEDURE FOR WATER BLOCKING OF EPR / XLPE SINGLE CORE CABLE		GR3D 6.42.2	

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GENERAL REQUIREMENT 43

INSTALLATION OF OUTER SLEEVE (LOVINK)

Before commencing the level of PPE required for this operation shall be as the matrix given in General Requirement 3, also your attention is drawn to the Use of Solvents General Requirement 1.

42.0 General

The outer sleeve forms part of the mechanical protection and moisture sealing requirements of the joint along with the two-part polyurethane resin fill.

A level of 7mm from the filling port top is to be achieved, this will allow for displacement when the metal filling port lids are inserted. These lids also act as a heat sink to assist heat dissipation during the resin-curing phase, so helping to control shrinkage.

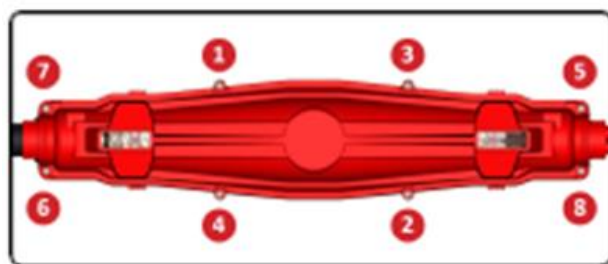
Build-up of the cable entries is important to ensure centralisation of the sleeve and retention of the resin fill; small weeps, which appear during filling, may be blocked using sealing putty.

Support stand offs are positioned at the sleeve ends, these provide temporary support by binding the two halves with cable ties or PVC tape whilst the sleeve fixing screws are fitted and tighten.

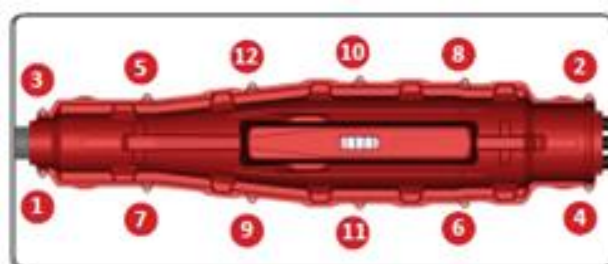
The fitted sleeve base shall be supported before the commencement of pouring the resin fill.

43.1 Method of Installation

- 1.1 Degrease the inner surface of the sleeve halves.
- 1.2 Position the bottom half of the outer sleeve under the joint, and adjust so that the inner sleeve is equi-distant inside the outer sleeve, support in its required position.
- 1.3 Place the upper half of the sleeve to the lower half and fit the fixing screws.
- 1.4 Fit and tighten the fixing screws across the diagonal, see below.



M 85 & M 105



M 125

- 1.5 Fill the outer sleeve with Protolin two-part polyurethane resin.
- 1.6 Fit the metallic filling lids into the filling ports.

GENERAL REQUIREMENT 44

MIXING AND POURING OF TWO-PART PROTOLIN RESIN (LOVINK)

Before commencing the level of PPE required for this operation shall be as the matrix given in General Requirement 3.

44.0 General

Protolin two part polyurethane provides mechanical and moisture sealing to the completed joint.

The liquid components of the Protolin two-part polyurethane resin used in the Lovink cable joints are contained in a foil pack, which forms an enclosed system. This ensures that mixing of the polyol and hardener components are completed without exposure to the mixer.

Although the enclosed system should be effective in preventing contact with harmful materials, the following basic precautions shall be taken when using Protolin two-part polyurethane resin.



Once the foil bag protecting the two part polyurethane mix has been opened the resin needs to be mixed, if for some reason the resin is not required then the two part polyurethane resin shall be mixed and once mixed disposed of correctly. Do not try to store the resin for some period of time as moisture will penetrate the bag and cause the resin to foam.

44.1 Safety/First Aid

Skin Contact

The hardener is irritating to the skin. The use of the disposable plastic gloves provided should eliminate any contact, but if it occurs, the affected area should be washed immediately with plenty of soap and water.

Splashes in the Eye

The hardener is irritating to the eyes. Suitable protection such as goggles or a face visor shall be worn when pouring or stirring. In case of contact with the eyes, rinse immediately with plenty of water and seek medical advice.

Breathing of Vapour

Ensure that adequate ventilation is provided to prevent high concentrations of vapour building up in the working area. Pay particular attention to this requirement when working in confined areas.

If adequate ventilation cannot be provided, suitable respiratory equipment shall be worn.

Fire Hazard

The resin and hardener have low flammability but, if a fire occurs in an area where the hardener is stored, a dangerous vapour will be produced. Anyone tackling the fire must wear suitable respiratory equipment.

Decontamination/Disposal of Containers

Isocyanate containers must be neutralised before disposal, this is unnecessary with the foil pack. The internal mixing bag can be disposed of as non-harmful after the contents have been thoroughly mixed.

A WPD label stating the contents are inert and safe to handle, must be applied to the hazardous black cross on the orange background before disposal.

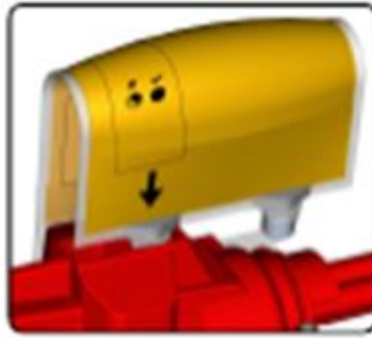
44.2 Method of Mixing

Safety and handling information is printed on the outside of the pack and must be observed.

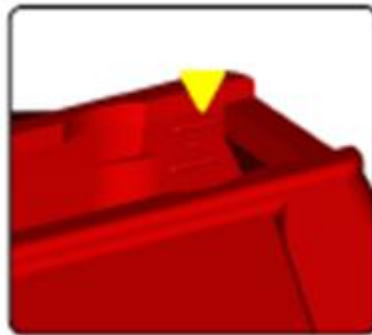
- 2.1 Examine the foil pouch containing the hardener and polyol to ensure it is free of damage.
- 2.2 Support the foil pouch and using scissors make a small cut to the bag top, carefully tear the top edge along its length starting at the cut position.
- 2.3 Remove the contents from the foil pouch checking the two compartments for damage.
- 2.4 Support the two component bag in the vertical, gently squeeze the two sections of the Protolin bag together so that the weak central seam bursts and allows the hardener and polyol to mix.
- 2.5 With the bag extended to its full length and with a tumbling action allow the two components to mix thoroughly until a uniform colour is achieved.

Mixing thoroughly for two minutes ensuring all components are removed from the seams of the bag.

- 2.6 Position the filling port of the bag into one of the filling ports of the outer shell and pour resin into the outer sleeve.



- 2.7 Pour the mix slowly into one end of the outer sleeve, mixing and pouring should be continuous so that delays are kept to a minimum.

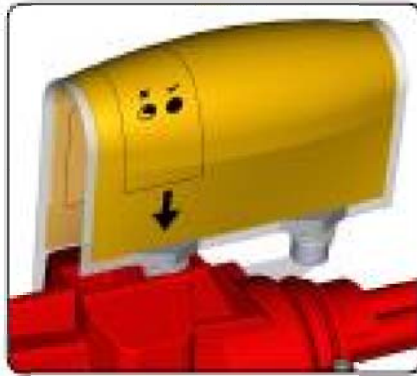


- 2.8 Push both covers into the filling ports, see below.



- 2.9 Apply decontamination labels to all hazardous warning signs and remove to WPD depots for correct disposal, drawing GR3D 6.44.1.

All dimensions in mm



Adhesive Backed Label


WESTERN POWER 
DISTRIBUTION

Serving the Midlands, South West and Wales

**THE CONTENTS OF THIS PACKAGE
HAVE BEEN RENDERED INERT AND
ARE NO LONGER HARMFUL**

Note :- This Label Is To Be Placed Across The Black
Warning Cross On The Orange Background
Of The Suppliers Harmful Warning Label

This Is To Be Undertaken On All Harmful Substance
Containers / Packaging Used Within WPD
Once The Substance Has Been Rendered Inert

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				DECONTAMINATION LABEL FOR HARMFUL SUBSTANCE CONTAINERS / PACKAGING		GR3D 6.44.1	

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GENERAL REQUIREMENT 45

USE OF HEAT SHRINK MATERIALS

Before commencing the level of PPE required for this operation shall be as the matrix given in General Requirement 3, also your attention is drawn to the Use of Solvents General Requirement 1.

General

The use of heat shrink materials with 33kV cables is reducing with the introduction of cold applied materials; the use will mainly be in the sealing of cable oversheaths, cable glands and end caps.

It is essential that heat shrinkable materials are used only in approved situations and that correct materials are used along with the correct gas torches.

Cleanliness is of the utmost importance particularly where heat-melt adhesives are involved; no dirt or grease must be allowed to contaminate the materials. The surface to which a seal is to be made must be thoroughly cleaned using an approved degreaser and abraded.

When tubing has to be cut to length before fitting, this should be undertaken in one clean cut with a pair of sharp scissors. Any unevenness where a cut has been made may lead to splitting of the tubing.

The shrinking operation should be carried out using a “quiet” blue flame, which must be kept moving during the operation.

The flame should be applied around the component and not along its length, to obtain even shrinkage and to prevent air bubbles being trapped.

Since there is usually some change of length during shrinkage, it is important to carry out the shrinkage operation in the correct sequence. The sequence to be used is given in the appropriate Jointing Procedure.

Where heat-melt adhesives and mastics are involved, additional heat (with a moving flame) must be applied to ensure good adhesion and flow of the mastic or adhesive.

GENERAL REQUIREMENT 46

DIMENSIONS OF CABLE BOXES FOR COLD APPLIED TERMINATIONS (ENSTO)

General

For the cold applied indoor termination to fit into a cable box the cable box dimension from the bushing stud to the gland/base plate needs to be a minimum of 400mm but the ideal measurement is 450mm.

The impulse voltage withstand at 33kV, in accordance with BS 2562, on EPR/XLPE cables with cold shrink terminations and insulated boots fitted is 170kV, provided the minimum clearances shown below are met.

The minimum clearance at 33kV, in accordance with BS 2562, between live metal works, phase to phase, with insulated bushing boots fitted is 125mm.

The minimum clearance between live metal and earthed metal work is 100mm.

GENERAL REQUIREMENT 47

PREPARATORY WORK ON INDOOR CABLE BOXES

Before commencing the level of PPE required for this operation shall be as the matrix given in General Requirement 3.

47.1 General

Ensure that the EPR/XLPE cable is laid to a point directly below the cable box gland position. If the cable is not in line with the gland adjust the cable ground entry to the correct position.

Sufficient trench length and depth must be available to allow for core crossing, application of temporary earth continuity bonds, parking of sealing sleeves, breakout, gland and gland/base plate.

47.2 Method

- 2.1 Remove the gland / base plate and cable gland from the cable box, and park over the cable.
- 2.2 Position and line up the cable in the cable box and apply a PVC marker to each core at the through bushing centre and connector position, add a further 300mm and cut the cable at this position.

Note: - Do not remove the PVC tape markers at this stage.

- 2.3 Align the PVC tape markers applied in 2 with the through bushing bolt centre.
- 2.4 Check core phasing and make any adjustments of the cores below the cable gland position.
- 2.5 Complete the termination to the relevant Jointing Procedure.

GENERAL REQUIREMENT 48

TORQUE SETTINGS.

It is important that all nuts and bolts are correctly tightened to allow good load transfer between the cable and the various types of plant. Usually torque settings are given by the particular manufacturers, be they Plant manufacturers or Accessory manufacturers, if this torque setting is known then the values will be given in the relevant Jointing Procedures, if there are no torque settings given, then the torque settings given in this General Requirement are typical values shall be applied to the relevant nuts and bolts.

General

Offer up the connector to the equipment terminal and bolt up according to the manufacturer's instructions if no guidance is given on the bolting torque, then the settings given below in Table 1 should be used.

Recommended torque wrench settings for aluminium and copper terminations.		
Stud size (full nut) mm	Grade 8.8 stainless steel or equivalent studs Nm	Brass or high conductivity copper studs Nm
6	7	5
8	20	10
10	35	20
12	50	40
14	70	65
16*	90	90
20	150	-
* 16mm aluminium or copper stemmed bushings: - full nuts = 70Nm; half nuts = 55Nm.		

Table 1 – Recommended torque wrench settings.

GENERAL REQUIREMENT 49

ASSEMBLY OF OUTDOOR POLE TERMINATION CRUCIFIX

Before commencing the level of PPE required for this operation shall be as the matrix given in General Requirement 3.

General

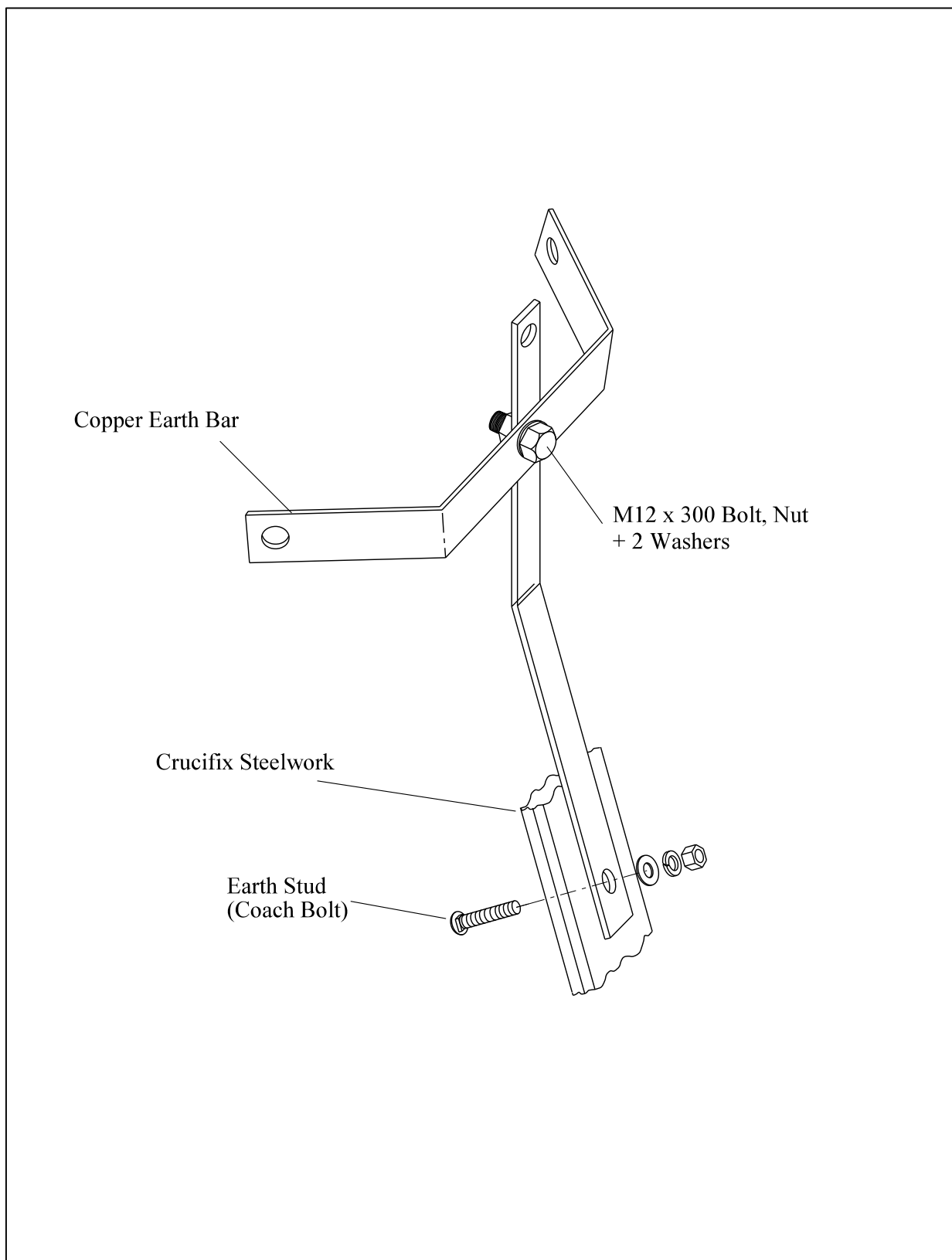
Prior to commencement of the termination the craftsmen will require to know the height to which the crucifix is to be erected on the pole (reference point being the crucifix pole bolt fixing hole) and the phasing of the overhead line.


The termination is to be made off to the crucifix at ground level and raised when required, this may not always be possible and alternatives such as working at erection height from scaffolding or a hydraulic platform, a tail and straight joint may be the only answer if the above information is not available beforehand.

49.1 Method of Assembly

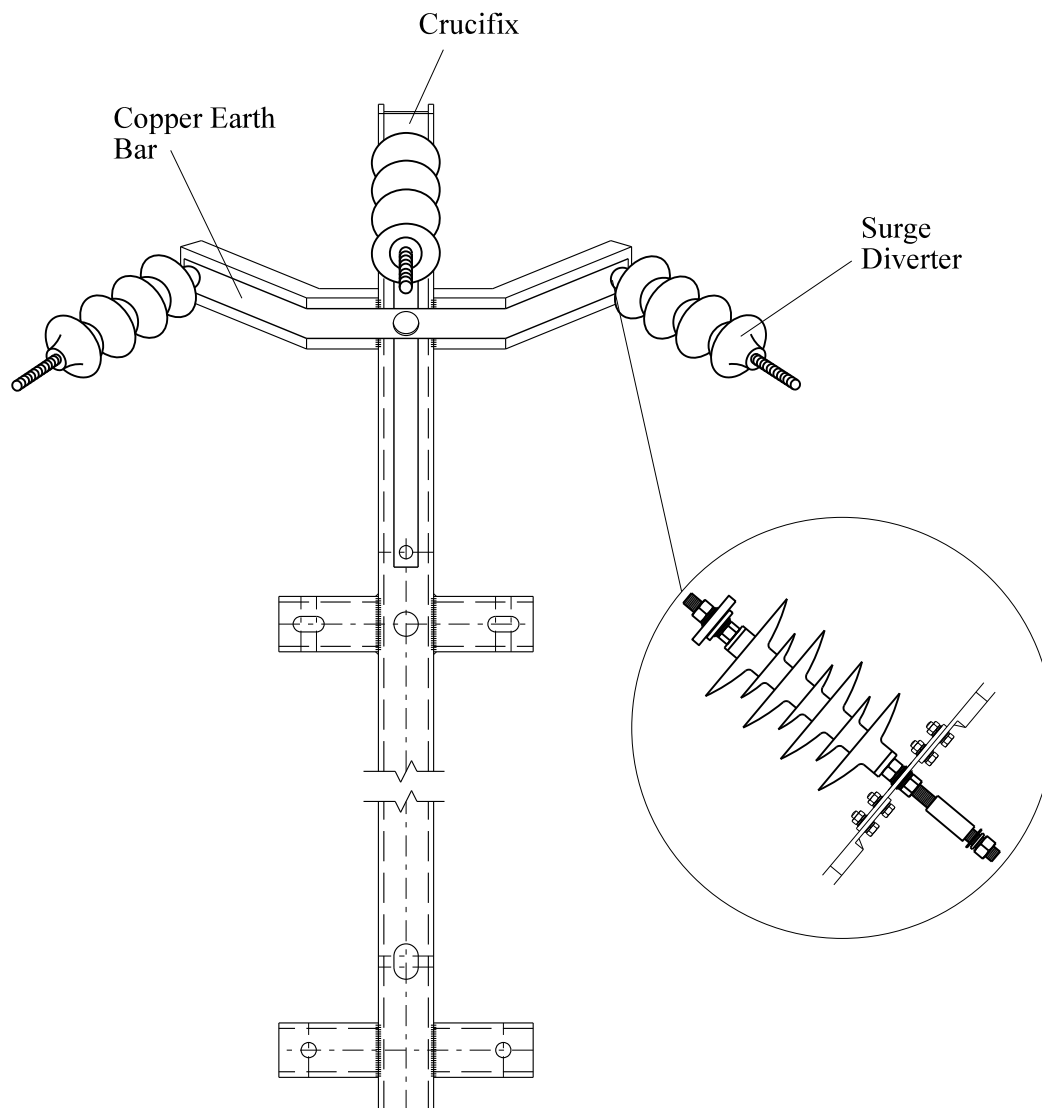
Refer to Drawings GR3D 6.49.1, 6.49.2, 6.49.3 and 6.49.4 whilst undertaking this General Requirement.


- 1.1 Bolt the copper earth bars together and fix the assembly to the crucifix with the coach bolt provided. Attach the cable cleat, surge diverters and the surge diverter adaptor plate to the crucifix.
- 1.2 From the top-fixing hole of the crucifix, position the crucifix on the pole approximately 1.7m above ground level. Ensure that the crucifix is in the correct plane in relation to the overhead line, fixing in position with a ratchet strap.
- 1.3 Ensure that the EPR / XLPE cable is laid to a point directly below the crucifix's final fixing position. If the cable is not in the correct position adjust the cable ground entry position.
- 1.4 Using the height given by the supervisor, measure the cable and apply a PVC tape marker to each core, add a further 400mm and cut the cable at this position.
Do not remove the PVC tape markers at this stage.
- 1.5 Forming the cable into a loop, take the end of the cable up to the crucifix and position in the cable cleat aligning the first PVC tape marker applied in 4 with the pole bolt fixing hole.
- 1.6 Check core phasing and make any adjustments of the cores below the cable cleat, clamp the cable into position within the cable cleat.
- 1.7 Complete the termination to the relevant Jointing Procedure.



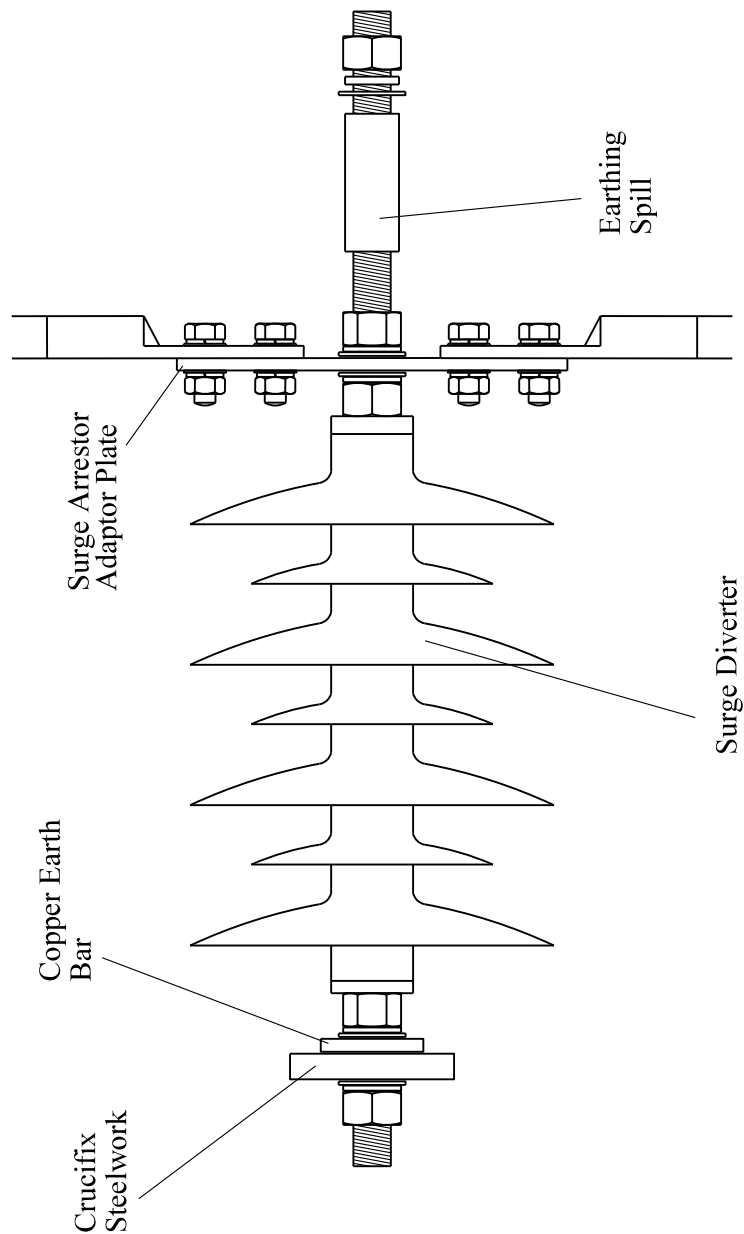
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EARTH BAR TO CRUCIFIX				Rev No	

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				Drg. No.	Rev No
				GR3D 6.49.2	

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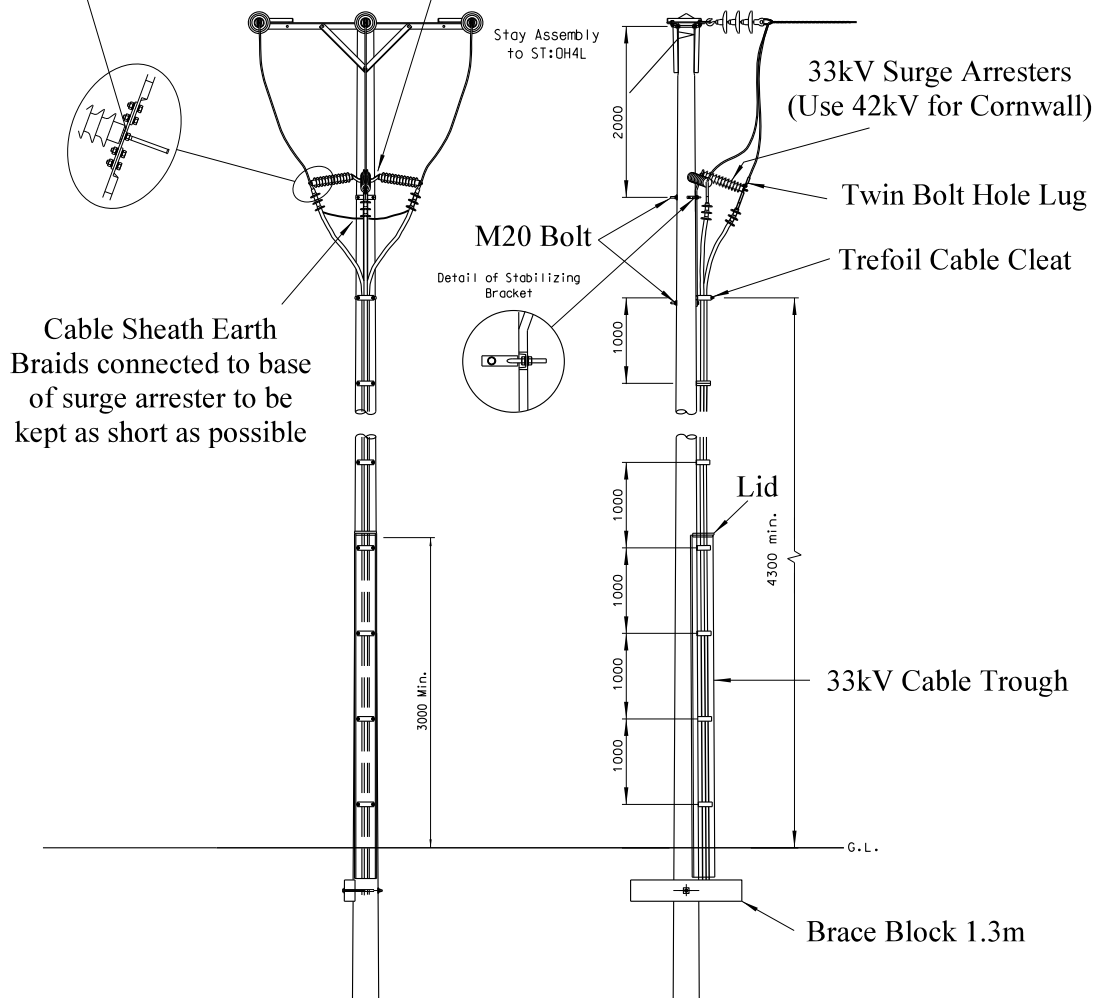
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All dimensions in mm


The Adapter Plate Is
Designed To Allow The
Cable And OH Line Jumpers
To Be Disconnected
Independently

Surge Arrester
Support Bracket

Terminal arrangement as
ST:OH4T Fig. F5 or F13



Note: Anti-climbing device as detailed in ST:OH4M required.

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Title 33kV CABLE TERMINATION SINGLE POLE ARRANGEMENT (3 x SINGLE CORE EPR CABLES)					Drg. No. GR3D 6.49.4 Rev No

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GENERAL REQUIREMENT 50

INSTALLATION OF INDOOR / OUTDOOR TERMINATION BODY (ENSTO)

Before commencing the level of PPE required for this operation shall be as the matrix given in General Requirement 3.

50.1 General

The Ensto cold applied termination covers all sizes of EPR / XLPE cable both indoor and outdoor.

The body is manufactured from silicon rubber, the body being expanded on a spiral carrier and incorporates the geometric stress control, and connector sealing mastic as one unit and is applied as one.

Length of body, stripping dimensions and installation for both the indoor and outdoor are of the same, the outdoor termination having the larger rain sheds as opposed to the indoor termination which has the smaller creepage extenders.

Termination bodies when used on 70mm² EPR may feel loose or spongy to the conductor insulation; if this occurs the body overtime will collapse further and should not cause electrical problems.

50.2 Method of Installation

- 2.1 Inspect the termination body for defects.
- 2.2 Slide the body over the cable core and support and position just above the 20 swg wire binder placed around the copper screen wires.
- 2.3 Carefully and slowly remove the white collapsible spiral coil former by unwinding in a anti-clockwise direction, once a small amount of the body has come off the coil former, slide the termination body up to the 20 swg binding wire. A slight twisting of the body in the clockwise direction helps this.
- 2.4 Support the body and remove the remainder of the former.

Note: - 630mm² terminations will require a slight pulling of the body towards the open end.
- 2.5 Should the body extend beyond the connector shoulder depending on length it may be eased back by hand.

Similarly if the body is just short of the lug shoulder this may be gained by pushing to the level of the shoulder.

GENERAL REQUIREMENT 51

INSTALLATION OF TAPE APPLIED BUSHING BOOTS

Before commencing the level of PPE required for this operation shall be as the matrix given in General Requirement 3, also your attention is drawn to the Use of Solvents General Requirement 1.

Ensure that cable box meets the requirements of General Requirement 45 and General Requirement 46 of ST: CA3C/2.

General

The 3M cold applied taped bushing boots can be used on both vertical and horizontal elliptical or round shaped bushings. The first part of the exercise is to apply Scotchfil putty to any sharp edges, nuts or bolts etc. to ensure there is an even thickness and a smooth profile of the installation being covered with Scotchfil putty, when applying the Scotchfil putty ensure no voids are included in the application of the putty.

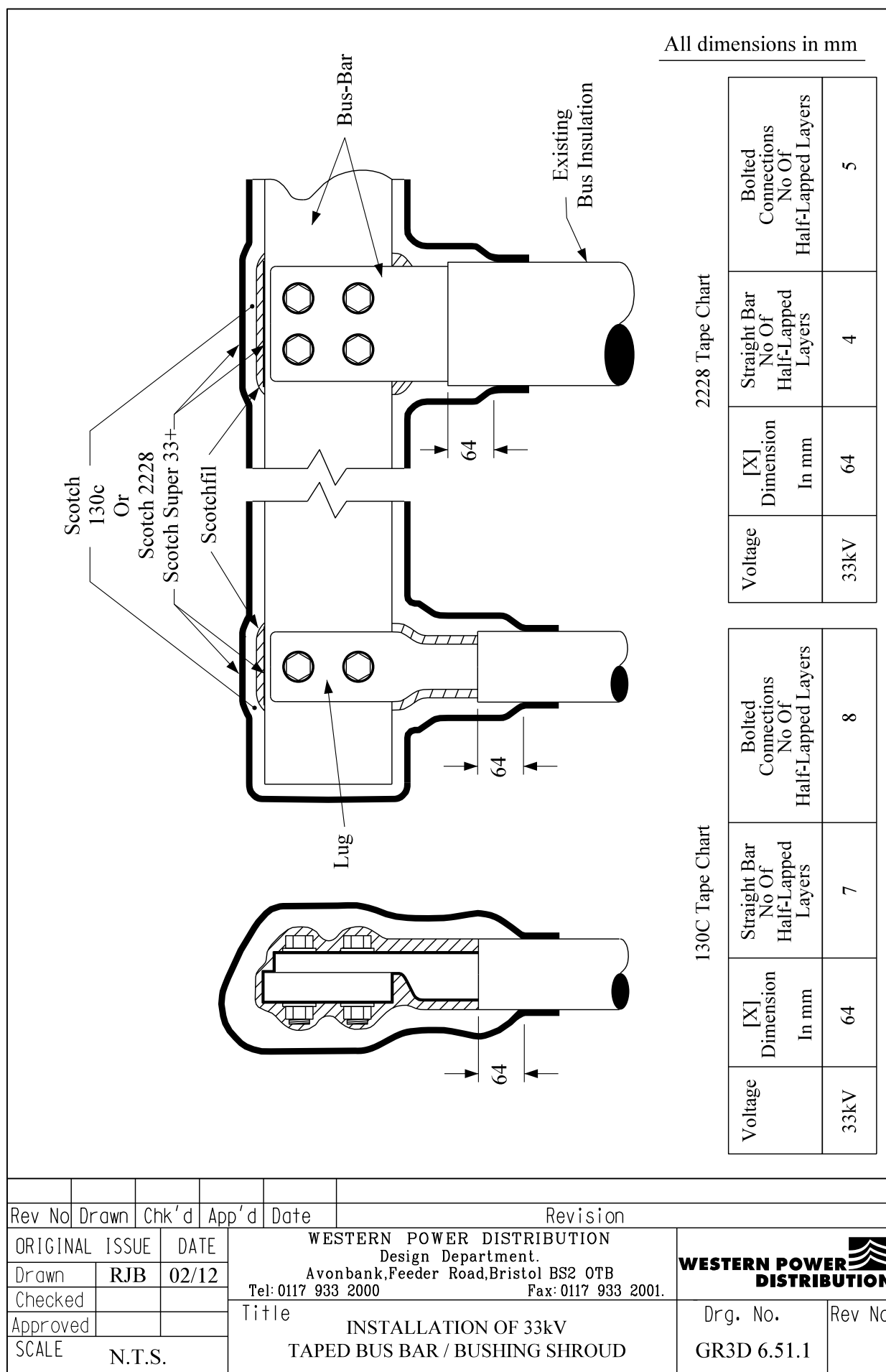
The putty shall be taken down over the lug to the phase insulation termination as shown in drawing GR3D 6.50.1.

Once the Scotchfil putty has been applied then all bolted connections shall be covered 5 half lapped layers of Scotch 2228 tape, this tape is to be applied with approximately 20% stretch of its original width.

The Scotch 2228 tape shall be taken down the lug barrel and on to the cold shrink body by 64mm, this Scotch 2228 tape when applied to the lug barrel and cold shrink termination shall consist of 5 half lapped layers of Scotch 2228 tape, this tape is to be applied with approximately 20% stretch of its original width.

Once the application of the Scotch 2228 tape is complete then 2 half lapped layers of Scotch 33+ tape, this tape is to be applied with approximately 20% stretch of its original width.

Ensure that the minimum clearances within the cable box are as detailed in General Requirement 45 of ST: CA3C/2.



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GENERAL REQUIREMENT 52

APPLICATION OF ABB RULLE TAPE

Before commencing the level of PPE required for this operation shall be as the matrix given in General Requirement 3, also your attention is drawn to the Use of Solvents General Requirement 1.

General

The Rulle tape is a two-layer tape the outer layer is a strong EPDM rubber, which provides the insulation and the inner layer is soft butyl mastic that provides good adhesion properties.

The outer EPDM rubber has white ellipses printed on the surface. Stretch the Rulle tape until the ellipses become circular, this ensures that the tape is being applied under the correct tension. Once the correct tension has been obtained the Rulle tape is applied using a 50% overlap to the complete installation.

52.1 Method of Installation

- 1.1 Thoroughly clean and degrease the area to be worked on with the approved degreaser DeSolvit 1000FD.
- 1.2 Remove the white backing paper tape, using half lap layers, apply to the exposed metal work of the termination lug and bushing connection, ensuring the ellipses become circular.

Note: - When first starting Rulle tape do not apply tension for one complete turn, once the first turn has been applied then stretch the tape to the requisite tension. Likewise when finishing the application of Rulle tape the final complete turn shall be completed with no tension on the tape.

- 1.3 Overlap the tape onto the bushing and termination body by 30mm finishing on the connection point.

Note: - Ensure a minimum of two half-lap layers and correct applied tension at all times, except for at the start and finish of the taping.

GENERAL REQUIREMENT 53

INSULATED EARTH STUD ASSEMBLY

Before commencing the level of PPE required for this operation shall be as the matrix given in General Requirement 3.

General

All cable boxes dry or compound filled are to be fitted with an insulated earth stud, the stud being insulated to provide cable to switchgear earth segregation where required for new or existing distribution feeders. New or refurbished boxes will have the stud fitted by either the switchgear manufacturer or WPD plant centre.

When the need arises to break and remake and a compound filled box in situ the box will require drilling (14mm diameter hole) and the stud assembly fitted on-site, rubber seals are fitted to prevent compound leakage.

The stud assembly is to be installed as shown in drawing GR3D 6.53.1 whether the box is dry or compound filled.

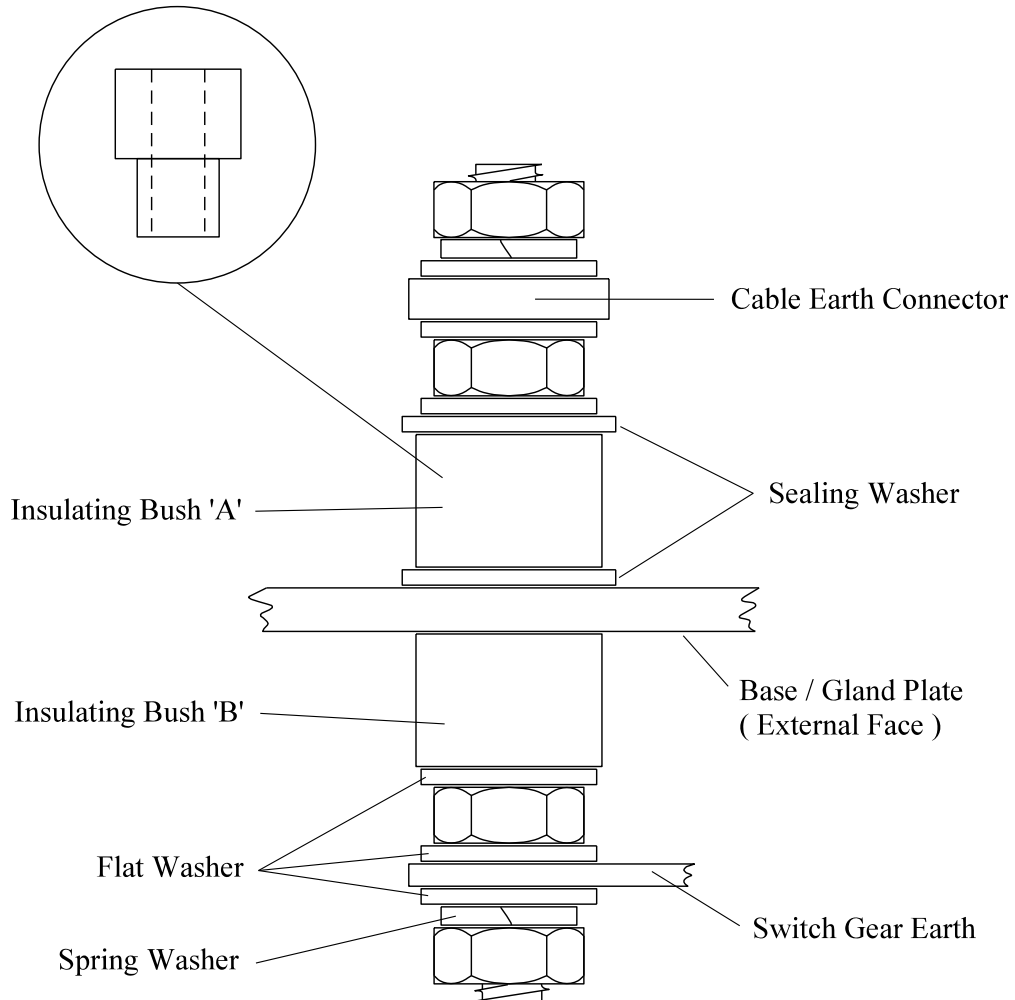
52.1 Installation

Refer to Drawing GR3D 6.53.1 whilst undertaking this General Requirement.

- 1.1 Remove the nuts, washers and white nylon insulating bush from the stud.
- 1.2 Ensure the rubber seals are in place and pass the red nylon bush from the outer face of the box through the entry hole in the gland/base plate or box side.
- 1.3 Pass the white nylon bush over the stud and locate over the red nylon bush.
- 1.4 Pass a flat washer, locking washer and nut over the stud and tighten into place.

Note: - The white nylon washer is to be within the cable box.

All dimensions in mm



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GENERAL REQUIREMENT 54

CABLE GLANDS

General

Cable glands were traditionally used for retaining hot compounds, resisting moisture and providing an earth continuity path between switchgear / transformer and cable.

Modern cable glands used with EPR cable provide sealing only, whether dry or cold pour compound filled boxes, they do not provide an earth continuity path within the system.

They may be of the compression (gripper) type or the more traditional type of gland used as a “stuffing” method.

The gland/base plate must be constructed of a material, which will prevent the setting up of circulating currents therefore causing possible derating of the cables.

54.1 Gland/Base Plates

For single core entry as opposed to trefoil the gland/base plate must be of a non-ferrous metal such as brass, aluminium or stainless steel, alternatively the gland/base plate may be split through the cable entry centres and insulation material placed between to maintain the split.

54.2 Compression Glands (Gripper)

Compression on gripper glands may be used for dry or cold pour compound filled cable boxes, they are constructed from Polyamide PA6 material for cable sizes of 95/185/300mm² EPR the maximum torque that can be applied to both the locking nut and gland fixing thread is 7.5Nm. The gland is capable of operating between –20°C and +90°C continuously.

For 630mm² EPR the glands are constructed of brass and are for dry boxes only.

54.3 Stuffing Glands

A stuffing gland for single core entry as opposed to trefoil must be manufactured from brass or aluminium, ferrous metals i.e. steel must not be used due to the setting up of circulating currents therefore derating the cable.

For trefoil configurations the gland may be made of steel.

All stuffing glands will require a heat shrink breakout or heat shrink sealing sleeve to provide a complete seal on dry boxes, for cold pour compound filled boxes these will also require filling with “Lovifit” glue.

GENERAL REQUIREMENT 55

SEALING OF CABLE GLANDS – DRY BOXES

Before commencing the level of PPE required for this operation shall be as the matrix given in General Requirement 3, also your attention is drawn to the Use of Solvents General Requirement 1.

General

To provide a complete cable entry seal with dry cable box terminations the cable gland may be sealed using either a heat shrink breakout or a mastic lined sealing sleeve.

Alternatively if the gland/base plate provides single cable entry as opposed to trefoil formation then a compression “gripper” gland may be used; one must ensure that the gland/base plate conforms to General Requirement 53.

Method of Installation

Refer to Drawing GR3D 6.55.1 whilst undertaking this General Requirement.

55.1 Stuffing Gland – Heat Shrink Breakout

- 1.1 Clean and degrease cable gland and cable oversheath with an approved degreaser.
- 1.2 Slide the gland assembly up to its final position and mark the cores at the gland base, lower the gland away from the build-up area.
- 1.3 Apply build up tape to centralise the cores within the gland.
- 1.4 Position and fix the gland assembly into its final position.
- 1.5 Position the breakout over the gland ensure the base of the breakout skirt is abutting the gland flange or gland/base plate.
- 1.6 Start shrinking from the breakout skirt towards the cable.

Note: - Due to the possibility of the breakout sliding down the gland, allow the breakout skirt to cool before proceeding onto the cable.

- 1.7 Carefully brush flame the complete breakout to ensure a release of the internal adhesive coating and a complete seal.

55.2 Stuffing Gland – Mastic Lined Heat Shrink Sleeve

- 2.1 Clean and degrease cable gland and cable oversheath with an approved degreaser.
- 2.2 Slide the gland assembly up into its final position mark the cores at the gland base, lower the gland away from the build-up area.
- 2.3 Cut three lengths of Scotchfil putty tape and press the midpoints together to form a Y piece of double thickness – Fig 1.
- 2.4 Separate the three cores and place the Y piece between the cores. The lower edge of the Y piece is to be in line with the mark made at the gland end.
- 2.5 Mould each end of the Y piece between the cores to form a uniform shape of the three cores and Scotchfil putty – Fig 2.
- 2.6 Apply Scotchfil putty under very light tension around the cores to build up to the internal diameter of the gland, directly over the previously applied Y piece – Fig 3.
- 2.7 Apply two turns of Scotch 88 tape under light tension over the Scotchfil putty applied in 6.
- 2.8 Position and fix the gland assembly into its final position.
- 2.9 Position the mastic lined tube over the gland ensuring equal overlap onto the cores and gland – Fig 4.
- 2.10 Start shrinking from the gland towards the cable.

Note: -Due to the possibility of the mastic lined sleeve sliding down the gland, allow the gland end of the mastic lined sleeve to cool before proceeding onto the cable.

- 2.11 Carefully brush flame the complete mastic lined sleeve to ensure a release of the internal mastic coating and a complete seal.

55.3 Compression Gland (Gripper)

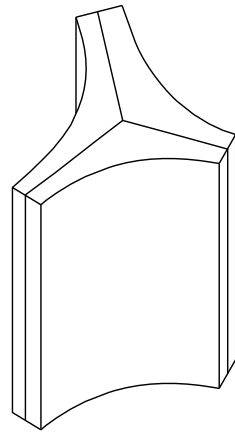
- 3.1 Remove the gland/base plate locking nut from the gland assembly, release the lower nut of the gland assembly so releasing the pressure on the rubber-sealing ring.

Check and ensure the rubber ‘O’ sealing ring is in place over the threads of the gland assembly.
- 3.2 Before the cable oversheath is removed slide a gland assembly over each cable followed by the gland/base plate and gland/base plate-clamping nut.
- 3.3 Complete the termination as per the jointing procedure to a point where the gland/base plate has been fixed to the cable box.
- 3.4 Slide the gland assembly up and into the cable entry hole, locate the gland/base plate locking nut and seals.

- 3.5 Tighten the gland assembly-locking nut ensuring compression of the rubber-sealing ring.
- 3.6 Ensure all gland assembly and gland/base plate-locking nuts are tight before closure of the cable box.

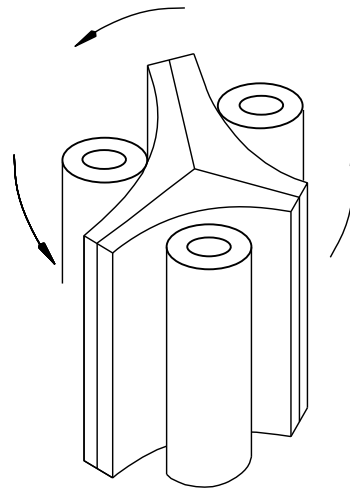
Note: -For 630mm² EPR compound filled cable boxes a non-ferrous “stuffing gland” is to be used as per General Requirement 53.

All dimensions in mm



Scotchfil 'Y' Piece

Fig 1



'Y' Piece Applied To Cores

Fig 2

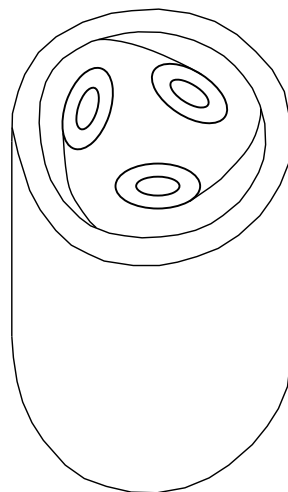


Fig 3

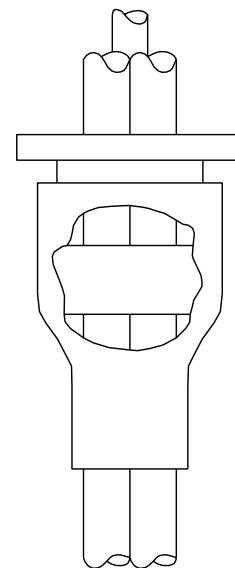


Fig 4

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GENERAL REQUIREMENT 56

SEALING OF CABLE GLANDS – COMPOUND BOXES

Before commencing the level of PPE required for this operation shall be as the matrix given in General Requirement 3, also your attention is drawn to the Use of Solvents General Requirement 1.

General

To provide a complete cable entry seal with cold pour compound filled cable box terminations the cable gland may be sealed using either a traditional cable gland (stuffing) or a compression “gripper” gland.

Either method being acceptable for 185/300/400mm² EPR/XLPE cable, 630mm² EPR will require a stuffing gland and will be dependent on the cable box being used whether existing or replaced with new.

It must be noted that where single entry of each cable is provided the base plate must conform to General Requirement 53.

Method of Installation

Refer to Drawing GR3D 6.56.1 whilst undertaking this General Requirement.

56.1 Cable Gland (Single or Trefoil Configuration)

- 1.1 Clean and degrease cable gland and cable oversheaths with an approved degreaser.
- 1.2 Slide the gland/base plate assembly up into its final position and mark the cable(s) at the gland top and base, lower the gland assembly away from the marked area.
- 1.3 Clean and abrade the cable oversheath(s) between the marks placed in 1.2, use an approved degreaser.
- 1.4 Apply build up tape to centralise the cable(s) within the gland.
- 1.5 Position and fix the gland assembly into its final position.
- 1.6 Position the breakout or mastic lined sealing sleeve over the gland ensure the base of the breakout skirt or edge of the mastic lined sealing sleeve is abutting the gland flange.
- 1.7 Start shrinking from the breakout skirt or mastic lined sealing sleeve towards the cable.

Note: - Due to the possibility of the breakout or mastic lined sealing sleeve sliding down the gland whilst shrinking, allow the breakout skirt or gland of the mastic lined sealing sleeve to cool before proceeding onto the cable(s).

- 1.8 Ensure a gap is formed between the cable(s) and gland, and fill with “Lovifit” glue.

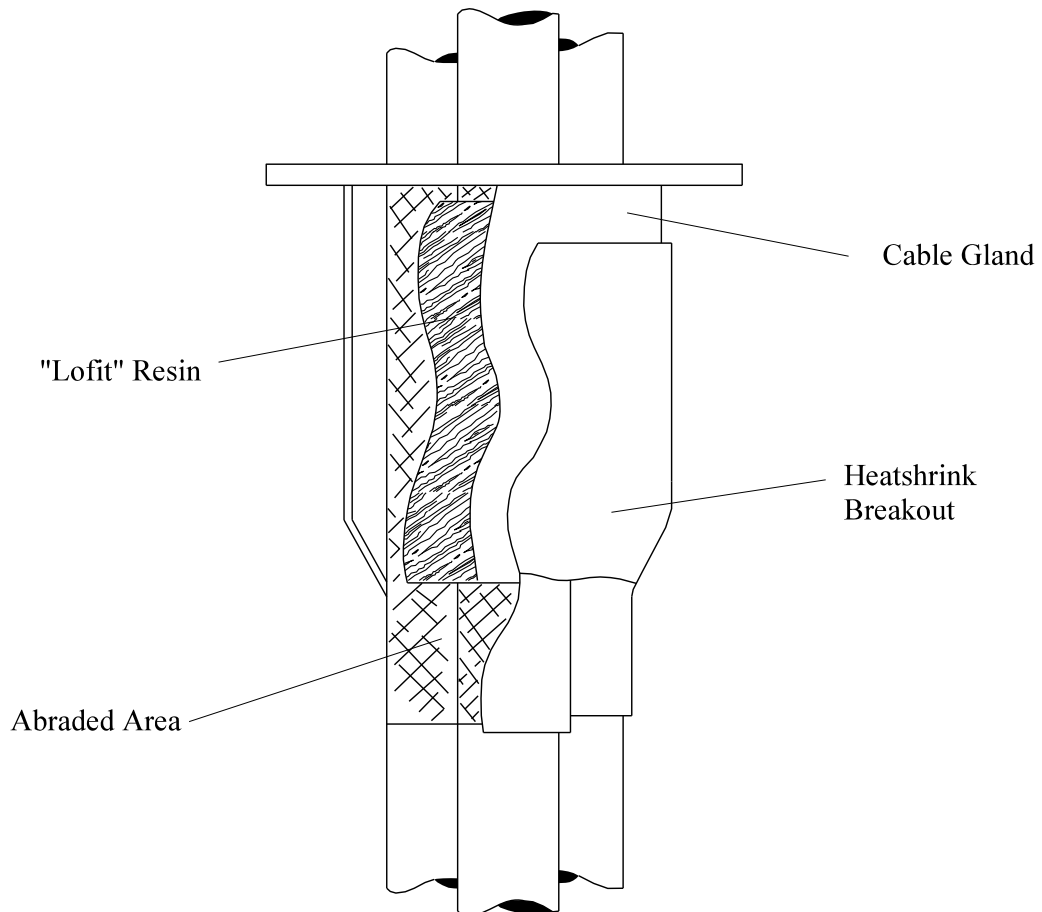
56.2 Compression Glands (Gripper)

- 2.1 Remove the base plate-locking nut from the gland assembly; release the lower nut of the gland assembly so releasing the pressure on the rubber-sealing ring.


Check and ensure the rubber ‘O’ sealing ring is in place over the threads of the gland assembly.

- 2.2 Before the cable oversheath is removed slide a gland assembly over each cable followed by the gland/base plate and gland/base plate-clamping nut.
- 2.3 Complete the termination as per the jointing procedure to a point where the gland/base plate has been fixed to the cable box.
- 2.4 Slide the gland assembly up and into the cable entry hole locate the gland/base plate locking nut and seals.
- 2.5 Tighten the gland assembly-locking nut ensuring compression of the rubber-sealing ring.
- 2.6 Check and ensure the rubber ‘O’ sealing ring is in place over the threads of the gland assembly.
- 2.7 Ensure all gland assembly and gland/base plate-locking nuts are tight before closure of the cable box.

All dimensions in mm



Note:- For A Single Core Cable The Breakout Will Be Replaced With A Mastic Lined Sealing Sleeve

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GENERAL REQUIREMENT 57

INSTALLATION OF THE INTERFACE C (M) 430-TB/G SEPARABLE CONNECTORS

Before commencing the level of PPE required for this operation shall be as the matrix given General Requirement 3, also your attention is drawn to the Use of Solvents.

General

The Nexans separable connector is a fully shielded and insulated separable tee connector termination for connecting underground cable to transformers or switchgear used mainly in primary substations by WPD. The connectors are made of a terpolymer of ethylene, propylene and a nonconjugated diene. This hydrocarbon-based elastomer has all the advantages of general purpose rubbers but its performance excels in electrical strength and resistance to environmental conditions.

These devices are NOT designed to make and break load and are designed as a screen break separable connector. The terminal connector uses shear bolt technology and it is essential that the right separable connector is used on the requisite cable as these terminations are known as interference fit that is they have been designed for a specific cable size only. All 185mm² 33kV Euromold separable connectors have a designation (M) 430TB/G- then the cable size – then the mechanical connector size.

Notes: - Do not allow hydrocarbon oils or solvents to contaminate the EPDM rubber, in the event of contamination, immediately wipe the surface clean with a dry cloth.

Only use the Euromold silicon grease used with the Euromold separable connectors.

Silicone SG high viscosity grease has been chosen for both its lubrication and dielectric properties. It is used as a lubricant when installing all pre-moulded rubber accessories and epoxy bushings as well on the insulation of dry cables. Silicone SG grease displays a high level of long-term lubricating stability avoiding any ageing effects (e.g. the risk of sticking). It also offers excellent dielectric properties assuring good performance at high voltage interfaces. In addition the grease contributes to making interfaces watertight. It is completely compatible with all pre-moulded rubber accessories as well as with polymeric insulated cables. Use of this grease has proved to be of value in the installation of accessories in series and for operations such as greasing interfaces after disconnection.

Method of Installation

57.1 Interface C Separable Connectors

- 1.1 Prepare the EPR cable to the appropriate dimension. Clean the conductor insulation, wiping towards the semi-conducting screen using an approved degreaser.
- 1.2 Apply a thin coating of Euromold silicon grease to the insulation.
- 1.3 Clean the separable connector cable entrance and lubricate with Euromold silicon grease.

- 1.4 Place the separable connector on the cable with a twisting motion, pushing separable connector onto the cable until palm of the end termination connector is aligned in the separable connector.
- 1.5 Push the first connector on to the bushing.
- 1.6 Insert the first 400TCS clamping screw into the threaded hole of the bushing.
- 1.7 Use a torque wrench with a 22 mm socket tighten exerting 50 Nm.
- 1.8 Clean and lubricate the female interface of the separable connector, and the male interface of the 400BIPA basic insulating plug.
- 1.9 Insert the BIPA into the separable connector, engage the threads and hand tighten.
- 1.10 Using a 24mm socket tighten the BIPA to 30Nm.
- 1.11 Clean the inner surface of the voltage diction cap and place on the surge diverter. Push down hard until the cap “snaps” into place.
- 1.12 Ensure the separable connector is earthed.
- 1.13 After completion the connector installation, cables should be appropriately clamped to protect against dynamic short circuit forces.

Warning: - A connector/bushing or connector/connector mated combination should not be allowed to carry the full weight of the cable. Therefore it is necessary to correctly clamp; using Ellis Patents two bolt Atlas cable clamps; the cables as close as possible to the connectors to remove the weight of the cable/s from the equipment bushing.

Otherwise the weight of the cable and separable connector will apply a bending moment to the equipment bushing interface which will lead to the bolt cross threading!

GENERAL REQUIREMENT 58

INSTALLATION OF THE INTERFACE C (M) 440-TB/G SEPARABLE CONNECTORS

Before commencing the level of PPE required for this operation shall be as the matrix given General Requirement 3, also your attention is drawn to the Use of Solvents.

General

The Nexans separable connector is a fully shielded and insulated separable tee connector termination for connecting underground cable to transformers or switchgear used mainly in primary substations by WPD. The connectors are made of a terpolymer of ethylene, propylene and a nonconjugated diene. This hydrocarbon-based elastomer has all the advantages of general purpose rubbers but its performance excels in electrical strength and resistance to environmental conditions.

These devices are NOT designed to make and break load and are designed as a screen break separable connector. The terminal connector uses shear bolt technology and it is essential that the right separable connector is used on the requisite cable as these terminations are known as interference fit that is they have been designed for a specific cable size only. All 300, 400 and 630mm² 33kV Euromold separable connectors have a designation (M) 440TB/G- then the cable size – then the mechanical connector size.

Notes: - Do not allow hydrocarbon oils or solvents to contaminate the EPDM rubber, in the event of contamination, immediately wipe the surface clean with a dry cloth.

Only use the Euromold silicon grease used with the Euromold T connectors.

Silicone SG high viscosity grease has been chosen for both its lubrication and dielectric properties. It is used as a lubricant when installing all pre-moulded rubber accessories and epoxy bushings as well on the insulation of dry cables. Silicone SG grease displays a high level of long-term lubricating stability avoiding any ageing effects (e.g. the risk of sticking). It also offers excellent dielectric properties assuring good performance at high voltage interfaces. In addition the grease contributes to making interfaces watertight. It is completely compatible with all pre-moulded rubber accessories as well as with polymeric insulated cables. Use of this grease has proved to be of value in the installation of accessories in series and for operations such as greasing interfaces after disconnection.

Method of Installation

58.1 Interface C Separable Connectors

- 1.1 Prepare the EPR cable to the appropriate dimension. Clean the conductor insulation, wiping towards the semi-conducting screen using an approved degreaser.
- 1.2 Apply a thin coating of Euromold silicon grease to the insulation.
- 1.3 Clean the separable connector cable entrance and lubricate with Euromold silicon grease.

- 1.4 Place the separable connector on the cable with a twisting motion, pushing separable connector onto the cable until palm of the end termination connector is aligned in the separable connector.
- 1.5 Push the first connector on to the bushing.
- 1.6 Insert the first 400TCS clamping screw into the threaded hole of the bushing.
- 1.7 Use a torque wrench with a 22 mm socket tighten exerting 50 Nm.
- 1.8 Clean and lubricate the female interface of the separable connector, and the male interface of the 400BIPA basic insulating plug.
- 1.9 Insert the BIPA into the separable connector, engage the threads and hand tighten.
- 1.10 Using a 24mm socket tighten the BIPA to 50Nm.
- 1.11 Clean the inner surface of the voltage diction cap and place on the surge diverter. Push down hard until the cap “snaps” into place.
- 1.12 Ensure the separable connector is earthed.
- 1.13 After completion the connector installation, cables should be appropriately clamped to protect against dynamic short circuit forces.

Warning: - A connector/bushing or connector/connector mated combination should not be allowed to carry the full weight of the cable. Therefore it is necessary to correctly clamp the cables as close as possible to the connectors to remove the weight of the cable/s from the equipment bushing.

GENERAL REQUIREMENT 59

INSTALLATION OF THE INTERFACE C (M) 440-TB/G MULTIPLE CABLE ARRANGEMENT

Before commencing the level of PPE required for this operation shall be as the matrix given General Requirement 3, also your attention is drawn to the Use of Solvents.

General

The Euromold separable connector is a fully shielded and insulated separable tee connector termination for connecting underground cable to transformers or switchgear used mainly in primary substations by WPD. The connectors are made of a terpolymer of ethylene, propylene and a nonconjugated diene. This hydrocarbon-based elastomer has all the advantages of general purpose rubbers but its performance excels in electrical strength and resistance to environmental conditions.

Notes: - Do not allow hydrocarbon oils or solvents to contaminate the EPDM rubber, in the event of contamination, immediately wipe the surface clean with a dry cloth.

Only use the Euromold silicon grease used with the Euromold separable connectors.

Silicone SG high viscosity grease has been chosen for both its lubrication and dielectric properties. It is used as a lubricant when installing all pre-moulded rubber accessories and epoxy bushings as well on the insulation of dry cables. Silicone SG grease displays a high level of long-term lubricating stability avoiding any ageing effects (e.g. the risk of sticking). It also offers excellent dielectric properties assuring good performance at high voltage interfaces. In addition the grease contributes to making interfaces watertight. It is completely compatible with all pre-moulded rubber accessories as well as with polymeric insulated cables. Use of this grease has proved to be of value in the installation of accessories in series and for operations such as greasing interfaces after disconnection.

59.1 Methodology

- 1.1 Clean the conductor insulation, wiping towards the semi-conducting screen using an approved degreaser.
- 1.2 Apply a thin coating of Euromold silicon grease to the insulation.
- 1.3 Clean the T connector cable entrance and lubricate with Euromold silicon grease.
- 1.4 Push the first connector on to the bushing.
- 1.5 Insert the first 400TCS clamping screw into the threaded hole of the bushing.
- 1.6 Use a torque wrench with a 22 mm socket tighten exerting 50 Nm.
- 1.7 Clean and lightly lubricate both, connector interface and connecting plug interface.
- 1.8 Push the connecting plug into the connector, engage the threads and hand tighten.

- 1.9 Use a torque wrench with a 10mm Allen key and tighten to 50 Nm
- 1.10 Clean and lightly lubricate both, the second connector and the connecting plug interface. Push the 2nd connector on to the connecting plug.
- 1.11 Insert the second 400TCS clamping screw in to the threaded hole of the connecting plug.
- 1.12 Using a 22 mm socket torque to 50 Nm.
- 1.13 Clean and lubricate the female interface of the T connector, and the male interface of the 400BIPA basic insulating plug.
- 1.14 Insert the BIPA into the separable connector, engage the threads and hand tighten.
- 1.15 Using a 24mm socket tighten the BIPA to 50Nm.
- 1.16 Clean the inner surface of the voltage diction cap and place on the surge diverter. Push down hard until the cap “snaps” into place.
- 1.17 Ensure the separable connectors are earthed.
- 1.18 After completion the connector installation, cables should be appropriately clamped to protect against dynamic short circuit forces.

Warning: - A connector/bushing or connector/connector mated combination should not be allowed to carry the full weight of the cable. Therefore it is necessary to correctly clamp the cables as close as possible to the connectors to remove the weight of the cable/s from the equipment bushing.

GENERAL REQUIREMENT 60

INSTALLATION OF THE INTERFACE C SURGE DIVERTER CONNECTORS

Before commencing the level of PPE required for this operation shall be as the matrix given General Requirement 3, also your attention is drawn to the Use of Solvents.

General

The Nexans separable connector is a fully shielded and insulated separable tee connector termination for connecting underground cable to transformers or switchgear used mainly in primary substations by WPD. The connectors are made of a terpolymer of ethylene, propylene and a nonconjugated diene. This hydrocarbon-based elastomer has all the advantages of general purpose rubbers but its performance excels in electrical strength and resistance to environmental conditions.

Notes: - Provided the Interface C surge diverter is always fitted to the equipment bushing interface, the surge diverter can accept both the (M)430-TB and the (M)440-TB/G separable connectors.

Do not allow hydrocarbon oils or solvents to contaminate the EPDM rubber, in the event of contamination, immediately wipe the surface clean with a dry cloth.

Ensure that the Maximum Continuous Operating Voltage (MCOV) of the 33kV system does not exceed the MCOV rating of the surge diverter, i.e. Cornwall use a different MCOV rating due to the use of Peterson coils on the 33kV network, so make sure you have the right surge diverter!

Handle the surge diverter with care; avoid dropping or knocking the surge diverter as this could damage the internal components of the surge diverter.

Only use the Euromold silicon grease used with the Euromold surge diverters.

Silicone SG high viscosity grease has been chosen for both its lubrication and dielectric properties. It is used as a lubricant when installing all pre-moulded rubber accessories and epoxy bushings as well on the insulation of dry cables. Silicone SG grease displays a high level of long-term lubricating stability avoiding any ageing effects (e.g. the risk of sticking). It also offers excellent dielectric properties assuring good performance at high voltage interfaces. In addition the grease contributes to making interfaces watertight. It is completely compatible with all pre-moulded rubber accessories as well as with polymeric insulated cables. Use of this grease has proved to be of value in the installation of accessories in series and for operations such as greasing interfaces after disconnection.

60.1 Methodology

Always ensure that the surge diverter is fitted adjacent the switchgear or plant to which the C type equipment interface is fitted to, as this will provide a degree of protection against accidental damage to the surge diverter.

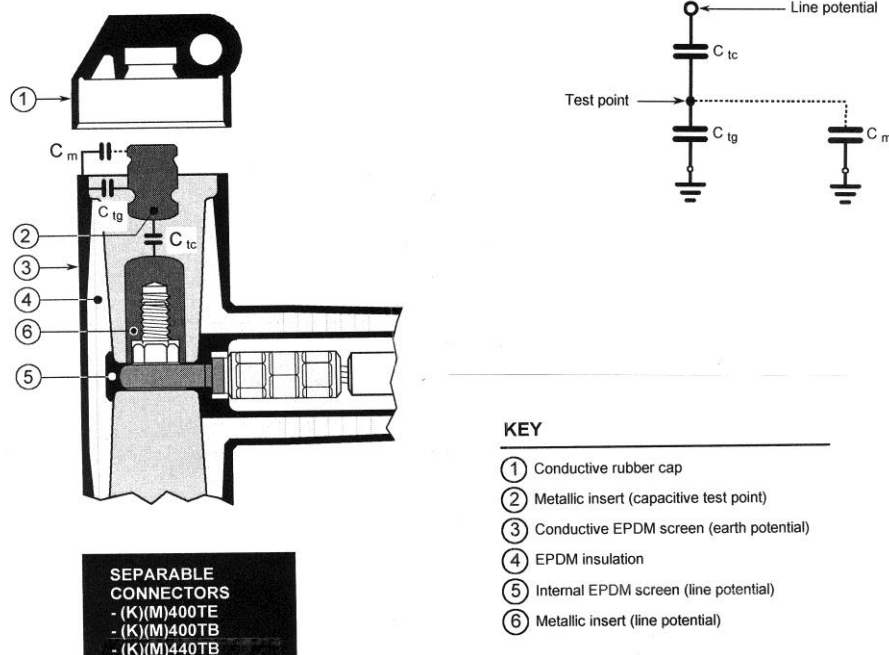
- 1.1 Clean and lubricate the female interface of the surge diverter, and the male interface of the equipment bushing.
- 1.2 Push the surge diverter home on to the equipment bushing.
- 1.3 Remove the protective cap from the surge diverter interface.
- 1.4 Insert the contact rod into the metal rod insert hole of the surge diverter.
- 1.5 Ensure the body of the surge diverter is positioned vertically and that the earth terminal side is pointing downwards. Using the 10mm hex Allen key torque the contact rod to 50Nm.
- 1.6 Clean and lubricate the male interface of the surge diverter and the female interface of the T connector.
- 1.7 Push the T connector home onto the surge diverter.
- 1.8 Insert the 40TCS clamping screw into the threaded hole of the contact rod.
- 1.9 Using a 22mm socket tighten the clamping screw to 50Nm.
- 1.10 Clean and lubricate the female interface of the T connector, and the male interface of the 400BIPA basic insulating plug.
- 1.11 Insert the BIPA into the T connector, engage the threads and hand tighten.
- 1.12 Using a 24mm socket tighten the BIPA to 50Nm.
- 1.13 Clean the inner surface of the voltage detection cap and place on the surge diverter. Push down hard until the cap “snaps” into place.
- 1.14 Ensure the T connector is earthed and connect the earth braid of the surge diverter to the system earth.

Warning: - A bushing/surge diverter/connector or bushing/surge diverter/connector/connector mated combination should not be allowed to carry the full weight of the cable. Therefore it is necessary to correctly clamp the cables as close as possible to the connectors to remove the weight of the cable/s from the equipment bushing, thus preventing cross threading of the copper clamping screw.

GENERAL REQUIREMENT 61

CAPACITIVE TESTING OF THE INTERFACE C (M) 430-TB/G or (M) 440-TB/G SEPARABLE CONNECTORS

The connectors manufactured by EUROMOLD are provided with a capacitive test point. This enables a local check to be made to confirm that the product is de-energised prior to disconnection.



The capacitive test point consists of a metallic insert moulded into the insulation and electrically connected to a convenient external terminal. Under normal operating circumstances this terminal is earthed by its conductive rubber cap. The cap must be removed prior to testing. When applying the test device you are effectively establishing a capacitive potential divider, the components of which are: -

$C_{tc} = 1.5$ to 3 Pico farads between test point and line connections.

$C_{tg} = 5$ to 8 Pico farads between test point and earthed conductive screen.

$C_m = 15$ Pico farads representing the approximate capacity of the detection apparatus.

The voltage available at the test point is directly proportional to the line voltage depending on the capacitance ratio.

The following ratio is typical: -

$$\frac{V_{measure}}{V_{phase / earth}} = \frac{C_{tc}}{(C_{tc} + C_{tg} + C_m)} = \frac{1}{14}$$

Although relatively high voltages can be present on the test point after removing the conductive cap, the overall available energy is minimal and any potential would disappear instantaneously if touched by an operator or other personnel. The current transfer would be a fraction of a micro ampere and imperceptible to human touch.

Before commencing the level of PPE required for this operation shall be as the matrix given in [General Requirement 3](#).

Using the Approved Edgcumbe high voltage indicator, the following tests shall be carried out using an approved HV indicator:-

The HV indicator will indicate when connected between phases and earth. **The HV indicator shall be proved before and after use.**

When carrying out any voltage checking on separable connectors the conductive rubber cap, marked as (1) on the figure shown on page 172. Once the rubber cap has been removed the following test should be carried out: -

- (a) The separable connector shall be confirmed live or dead by testing with the HV indicator from earth to phase L1, L2 and L3 and then between phases.
- (b) If required when energising a dead cable the HV indicator can be connected between earth to phase L1, L2 and L3 and then between phases.

GENERAL REQUIREMENT 62

USE OF EPR CABLE IN EXISTING COMPOUND FILLED CABLE BOXES

Before commencing the level of PPE required for this operation shall be as the matrix given in General Requirement 3, also your attention is drawn to the Use of Solvents General Requirement 1.

General

When there is a need to replace H Cable, HSL, or PILC cables installed in existing compound filled cable boxes with new EPR / XLPE cable the following will need to be addressed.

A minimum of 300mm for 185/300mm² and 350mm for 630mm² between the gland/base plate to connection point must be achieved; if this is not obtainable an extension of the cable box should be considered. The minimum clearance phase to phase clearance in a Lovisil filled cable box is 125mm, and the minimum phase to earth clearance in a Lovisil filled cable box is 100mm.

Consideration should be given to new replacement box, which can be obtained from Webster Wilkinson who will manufacture to the existing box; insulators can be fitted if required.

62.1 Method of Installation

- 1.1 Remove the compound from the cable box gently melting out with infrared lamps, release and remove the existing cable.
- 1.2 Remove the gland/base plate from the gland removing any traces of compound, once clean roughen the gland internally with emery cloth.
- 1.3 Clean the compound from the internals of the box; gland/base plate and cover ensuring all are as clean as possible.
- 1.4 Replace all existing gaskets with new.
- 1.5 Drill and fit an earth stud to the box side.
- 1.6 Check insulators are free from chips, cracks, and complete termination to the relevant Jointing Procedure.

GENERAL REQUIREMENT 63

PRIOR TO ENERGIZATION OF ALL CABLE CIRCUITS

General

In compliance with the ESQC Regulations 2-03 no cable circuit shall be energized unless the following minimum conditions have been met: -

On building sites where cable has been laid and an additional cable will be required to be laid in the near future, then the minimum which will be acceptable prior to the cable being energized, is the cables are covered with 75mm of crushed limestone or granite dust, (3mm to dust) with marker tape laid on top of the crushed limestone or granite dust, as per ST: NC2H – Relating to Inspection and Recording.

Where joint holes have been dug and the cables exposed the minimum requirement shall be that the joint hole shall be signed and guarded as per that laid out in ST: HS14D.

Where the cable has been laid up to a pole, the minimum requirement shall be that the cable and pole shall signed and guarded as per that laid out in ST: HS14D.

GENERAL REQUIREMENT 64

SEALING OF CABLE ENDS

Before commencing the level of PPE required for this operation shall be as the matrix given in General Requirement 3, also your attention is drawn to the Use of Solvents General Requirement 1.

General

The capping of cable ends is very important especially with paper-insulated cables, to prevent the ingress of moisture. With more modern polymeric insulating materials the need to prevent moisture is to allow the resin to seal effectively, prevent the corrosion of aluminium conductors as well as to prevent the overall deterioration of the cable over time.

There are three methods of capping cables: -

Cold Shrink Cap

Heat Shrink Cap

Denso Tape – temporary sealing only i.e. 24 hrs.

64.1 Cold Shrink Cap

The cold shrink cap being the most commonly used and can be applied to all cable types. Before preparing and applying, a cap of the correct size must be selected; caps are range taking to suit variable cable diameters and to ensure a good moisture seal the selection is most important.

Methods of Application

PVC or MDPE Oversheathed Cables – Drawing GR3D 6.64.1

1. Select correct cap to suit cable diameter, ensure the cap is coated internally with sealant and not pin-holed.
2. Clean and degrease PVC/MDPE oversheath – Fig 1.
3. Slide the cap onto the cable pushing well onto the cable end.
4. Pull the spiral out of the cold shrink cap in an anti-clockwise direction until the cold shrink cap is fully shrunk onto the cable.

64.2 Heat Shrink Cap

Methods of Installation

Refer to Drawing GR3D 6.64.1 and 6.64.2 whilst undertaking this General Requirement.

PVC/MDPE Oversheathed Cables

Refer to Drawing GR3D 6.64.1.

- 2.1 Select correct cap to suit cable diameter, ensure the cap is coated internally with sealant and not pin holed.
- 2.2 Clean and degrease PVC/MDPE oversheath with an approved degreaser – Fig 1.
- 2.3 Abrade the PVC oversheath to the length of the cap, abrading is to be undertaken circumferentially ensuring all glossing of the sheath is removed. General Requirement 15.
- 2.4 Clean the abraded area thoroughly with an approved degreaser – Fig 1.
- 2.5 Slide the cap onto the cable pushing well onto the cable end – Fig 2.
- 2.6 Using a soft blue flame start shrinking from the closed end of the cap and work towards the open end. Ensure the flame is worked evenly round the cap, ensuring enough heat is given to melt the sealant coating – Fig 3.
- 2.7 Once the cap has fully shrunk into position a ring of sealant will be seen around the cable sheath at the cap end – Fig 4.

PILCSTA/PILCSWA Cables

Refer to Drawing GR3D 6.64.2. The cable must be prepared down to the lead sheath; the cap must not be placed over the outer serving etc.

- 2.8 Select correct cap to suit cable diameter, ensure the cap is coated internally with sealant and not pin holed.
- 2.9 Mark outer serving the length of the cap plus 50mm from the cable end, apply a wire binder to the cable at this point – Fig 1.
- 2.10 Remove outer serving, armour and bedding General Requirement 11.
- 2.11 Thoroughly clean the lead sheath from all traces of bitumen with an approved degreaser.
- 2.12 Ensure any sharp edges at the end of the lead sheath are removed with a file.
- 2.13 Clean the lead sheath with an approved degreaser and abrade the lead sheath circumferentially up to the termination of the outer serving etc. using file card – Fig 1.
- 2.14 Clean the abraded area with an approved degreaser.
- 2.15 Slide the cap onto the cable pushing well onto the cable end.

- 2.16 Using a soft blue flame starting shrinking from the closed end of the cap and work towards the open end. Ensure the flame is worked evenly around the cap, ensuring enough heat is given to melt the sealant coating – Fig 2.
- 2.17 Once the cap has fully shrunk into position a ring of sealant will be seen around the cable sheath at the cap end – Fig 3.
- 2.18 Apply two half lap layers of “88” black PVC tape covering the end of the outer serving, armour termination, lead sheath and finishing on the heat shrink cap – Fig 4.

64.3 Denso Tape

Denso tape is to be used for temporary sealing i.e. 24 hours, it can be applied to all cable types as follows: -

PVC/MDPE Oversheathed Cables – applied direct without any special preparation.

PILCSTA/PILCSWA Cables – cables are to be prepared as for heat shrink cap method and the Denso tape must be applied direct to the cleaned lead sheath.

Method of Application

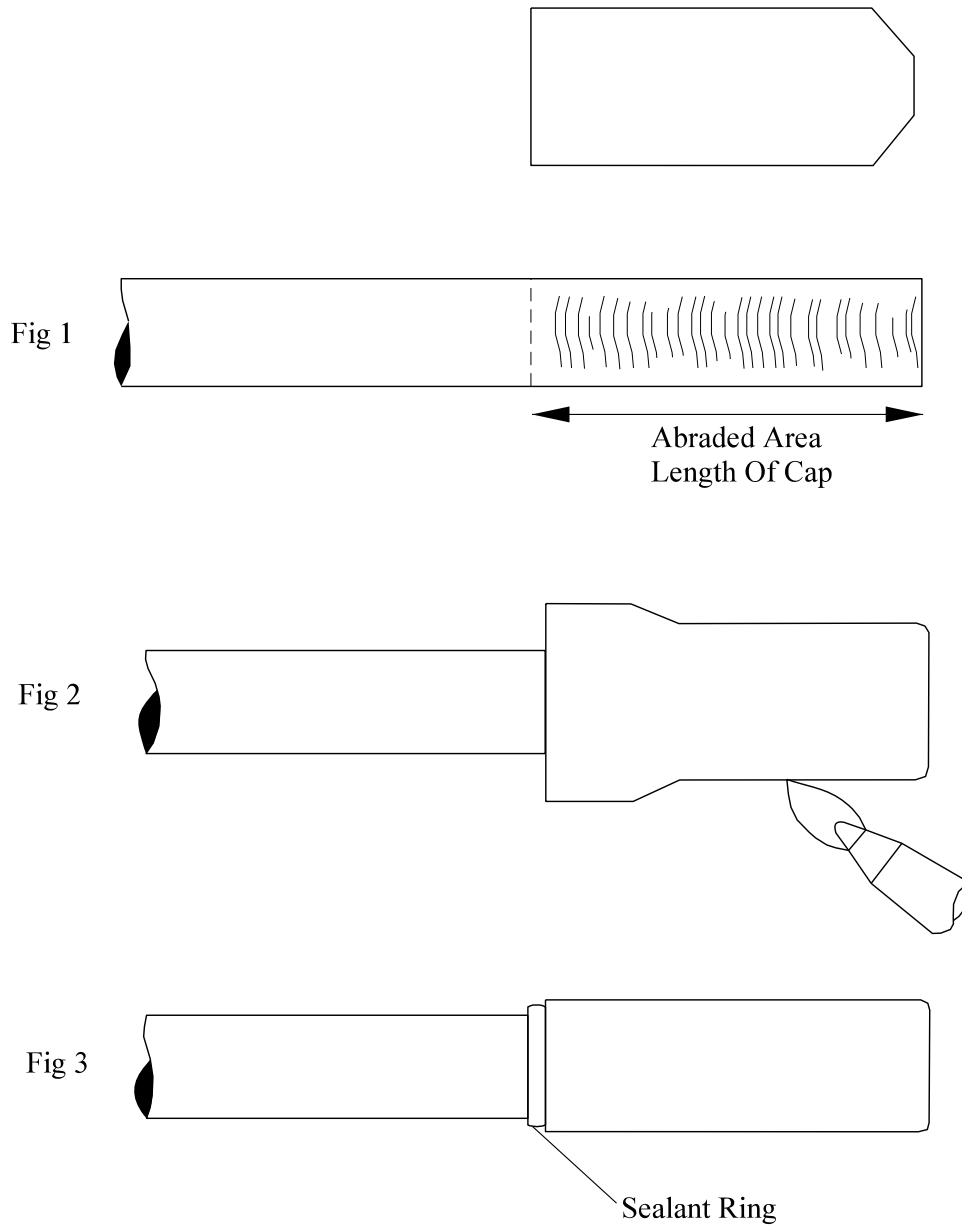
Disposable gloves are to be worn when applying.


The tape is to be applied with a minimum of two half lapped layers, as each layer is applied the paste within the tape must be worked well through the tape.

Starting on the cable sheath a minimum of a width and one half of the tape from the cable end, wrap towards the cable end, with a criss-cross action apply the required layers across the cable end returning to the start point.

Cut the tape and ensure the paste is worked well into the taped end.

All dimensions in mm



Rev No	Drawn	Chk'd	App'd	Date	Revision
ORIGINAL ISSUE		DATE		<div>WESTERN POWER DISTRIBUTION Design Department. Avonbank,Feeder Road,Bristol BS2 0TB Tel: 0117 933 2000 Fax: 0117 933 2001.</div> <div>WESTERN POWER DISTRIBUTION</div>	
Drawn	RJB	11/16			
Checked					
Approved					
SCALE		N.T.S.		Title	
				SEALING OF CABLE ENDS - PVC/MDPE SHEATHED CABLES	
				Drg. No. GR3D 6.64.1	
				Rev No	

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All dimensions in mm

Fig 1

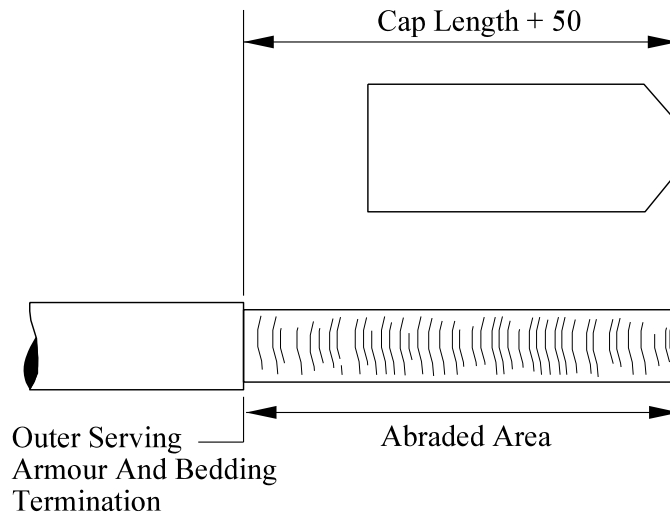


Fig 2

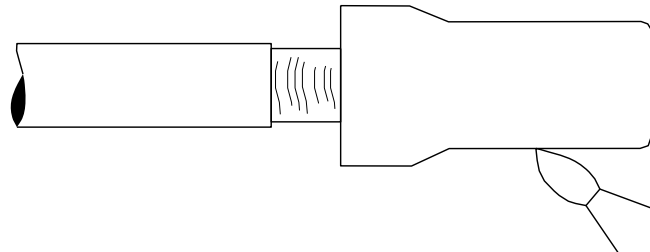


Fig 3

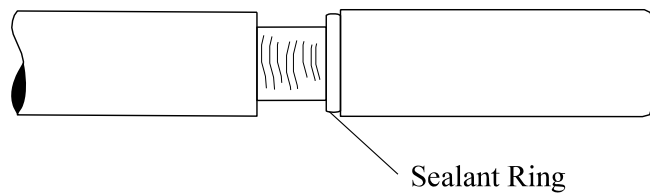
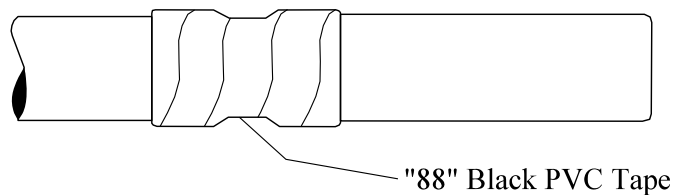



Fig 4



Rev No	Drawn	Chk'd	App'd	Date	Revision	
ORIGINAL	ISSUE	DATE	WESTERN POWER DISTRIBUTION Design Department. Avonbank, Feeder Road, Bristol BS2 0TB Tel: 0117 933 2000 Fax: 0117 933 2001.			 WESTERN POWER DISTRIBUTION
Drawn	RJB	11/16				
Checked						
Approved						
SCALE	N.T.S.		Title SEALING OF CABLE ENDS - PILCSTA / PILCSWA CABLES			Drg. No. GR3D 6.64.2
						Rev No

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GENERAL REQUIREMENT NO. 65

IZUMI SB-3UK SHEARBOLT TOOL.

This tool is the **ONLY APPROVED shearbolt tool** designed for use by WPD Jointing staff that is undertaking jointing activities, which use mechanical connectors containing shearbolts. The following jointing activities are included: -

Live and dead LV Mains jointing, dead 33kV jointing and dead 33kV jointing.

Note: - The Izumi Shearbolt tool is not to be used on the B&H MSIP connector.

65.1 Components

The tool comes with the following items: -

Izumi SB-3UK shearbolt tool.

Nickel Cadmium (Ni-Cd) 14.4V battery.

Izumi CH-70DC charger.

Rubber battery shroud.

Plastic toolbox.

65.2 Batteries

It will take approximately 6 to 8 charging and discharging cycles to build up to the maximum power in new batteries. A battery should give anything between 400 and 600 cycles, typically 12 to 18 months if cycled on a daily basis. The sign of a battery coming to the end of its life would be the battery going flat after very little use, because it does not hold its charge.

Ni Cad cells are prone to building up a memory if not fully discharged on a regular basis. In effect, this means that if your battery is only 50% flat and you charge it repeatedly, the battery registers the 50% charge state as being its flat state and will thus only give you 50% of its capacity. **All batteries must be completely discharged by normal use before re-charge to get the most out of them.**

Charger Model	Charging Time	Remarks
CH-25EMC 220/240V		Refresh function: - By pressing discharge switch to avoid battery memory effect, the Charger will discharge battery and recharge automatically. For fully charged batteries, time required: - BP-70E & EI = 10 Hrs.
	BP-70R 1.2Ah - 15 Minutes	
	BP-70I 1.2Ah with LED - 15 Minutes	
	# BP- 70E 2Ah - 20 Minutes	
	BP-70EI 2Ah with LED - 20 Minutes	
	BP-250RI 4Ah - 45 Minutes	
	Inverters are now available to enable use in vehicle.	
* CH-70DC 12 V	BP-70R 1.2Ah - 60 Minutes	Power source: - 12 / 24V DC car / vehicle battery Connected to cigarette lighter.
	BP-70I 1.2Ah with LED - 60 Minutes	
	* BP- 70E 2Ah - 90 Minutes	
	BP-70EI 2Ah with LED - 90 Minutes	
	BP-250RI 4Ah - 180 Minutes	

*** Standard issue with W.P.D. tools.**

65.3 Operation

Battery Charging: -

1. Connect the battery charger plug to the supply.
2. Insert battery pack into the charger.
3. Charging takes approx. 20 to 90mins depending on the charger used.

Battery Insertion

1. To insert the battery into the tool body, insure battery is facing in the correct direction, and then push the charged battery firmly into place until a click is heard.
2. After inserting a battery, check that it is securely in place by gently pulling on the battery. Do not press the locking latch while pulling the battery.

Speed Control

1. The trigger has a built-in variable speed control. As the trigger is pressed the speed increases gradually to a maximum when fully depressed.
2. The drive rotates when the trigger is pressed and stops when the trigger is released.
3. To reverse the drive, move the reverse switch (on side of tool) to position "R" and press the trigger as before.

Shearing the Bolts

1. Place the mechanical connector onto the conductor in accordance with the manufacturer's recommendations and "finger-tighten" all bolts.
2. Fit the right size socket for the shear bolts on the mechanical connector to the ½" drive shaft of the tool.
3. Check that the forward/reverse switch on the side of the tool is in the forward position "F".
4. Place the socket over the first shear bolt and press the trigger until the shearbolt shears, release the trigger.
5. Repeat on all bolts in the sequence of the manufacturer's recommendations until all shearbolts have sheared.

65.4 Precautions

Never use the tool to place the shearbolts in the mechanical connector, **always** use fingers and make sure the shearbolt is not cross threaded. Prior to shearing make sure that the tool is in forward rotation before placing the socket over the shearbolt.

Do not drop the tool. Dropping the tool may damage the internal gears and result in the tool not functioning correctly.

Always store in the case provided when not in use.

Before commencing the level of PPE required for this operation shall be as the matrix given in General Requirement 3, your attention is drawn to the use of **Ear Defenders**.

GENERAL REQUIREMENT NO. 66

GATHERING OF INFORMATION FOR OFGEM ON THE WPD UNDERGROUND CABLE NETWORK

As part of the DNO license that WPD has there is an obligation to provide detailed information to the regulator – Ofgem, on the state of the underground cable network.

The documents detailed below will provide the various types of information requested by Ofgem, it is incumbent on the Jointers to provide this information to the Mapping Centres in the East Midlands, West Midlands, South West and South Wales.

The various documents are: -

Asset Risk Management;

Commissioning and CBRM Report;

Fault Repair Commissioning and CBRM, ARM Report;

Legacy Assets;

MC Regulatory Reporting;

When a cable is opened, either as part of planned work or as a result of a fault, the Jointer shall record the condition of the cable on the relevant form/s by clicking on the link provided below:-

<\\EXODCS01\\mapwork\\FORMS\\Asset Risk Management.doc>

<\\EXODCS01\\mapwork\\FORMS\\Commissioning and CBRM Report.dot>

<\\EXODCS01\\mapwork\\FORMS\\Embedded Network Mapping Centre Memo.doc>

\\EXODCS01\\mapwork\\FORMS\\Fault Repair Commissioning and CBRM_ARM Report.dot

<\\EXODCS01\\mapwork\\FORMS\\Legacy Assets.docx>

<\\EXODCS01\\mapwork\\FORMS\\LV or HV Mains Work Instruction.docx>

<\\EXODCS01\\mapwork\\FORMS\\MC Regulatory Reporting.doc>

<\\EXODCS01\\mapwork\\FORMS\\Midlands Network Services East New Development Form.doc>

<\\EXODCS01\\mapwork\\FORMS\\Midlands Network Services West New Development Form.doc>

<\\EXODCS01\\mapwork\\FORMS\\SWest New Development Form .doc>

\\EXODCS01\\mapwork\\FORMS\\Work Instruction Service Information_ARM.dot

The document/s shall be attached to a suitably scaled map from EMU to act as a location plan for the jointing work undertaken, as already required for recording purposes.

The paperwork will be forwarded to the Mapping Centre at Exeter (South West), Lamby Way (South Wales) and Mapping Centre Tipton (Midlands) via the established method.

APPENDIX A

SUPERSEDED DOCUMENTATION

This Standard Technique ST: CA3C/2 is a total rewrite of document ST: CA3C/1 and replaces that document.

APPENDIX B

ASSOCIATED DOCUMENTATION

ST: CA3A, ST: CA3C/2, ST: CA3L/2, ST: CA3M/2, ST: CA3N/2, ST: CA3O, ST: CA3S, ST: CA3V, ST: CA7D.

APPENDIX C

IMPACT ON COMPANY POLICY

Change from heat shrink and cold shrink technology jointing to cold applied jointing technology. All existing 33kV Jointers will require re-training to the cold shrink techniques.

APPENDIX D

IMPLEMENTATION OF POLICY

For WPD staff Team Managers shall ensure that all relevant 33kV Jointing staff are provided with a copy of the current 33kV Jointing Manual of which this Standard Technique forms a major part and it is implemented in South Wales and the South West implemented with immediate effect. Managers shall ensure that all staff involved in the design, installation, maintenance and operation of the 33kV system are familiar with, and follow, the requirements of this document.

Where any difficulty is encountered in the application of this Standard Technique the author shall be notified who will determine whether a variation is appropriate.

APPENDIX E

KEY WORDS

Installation details on 33kV accessories.