

Company Directive

STANDARD TECHNIQUE: CA3L/2

Relating to Procedures for Making 33kV Single Core Cable EPR Branch Joints

Policy Summary

This Standard Technique document contains all the approved 33kV cold applied Branch Joints for EPR and XLPE Pb sheath cables. It shall be implemented in conjunction with the appropriate General Requirements in ST: CA3C/2.

Only materials stated in this ST are approved for use on WPD's 33kV Underground Cable System unless the Policy Manager, Avonbank, has granted prior permission.

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 new document contains the Branch jointing procedures for EPR, and XLPE Pb sheath single core 33kV cables used on the WPD 33kV underground cable network.

Main Changes

This is a new document.

Impact of Changes

All current 33kV Jointers throughout the company will need to undertake a short conversion course prior to using the new cold applied jointing system there will then be a phased change from the existing jointing systems over to the new harmonized cold applied jointing system.

Implementation Actions

There will be a structured approach to the phased change-over to the new harmonized cold applied jointing system where the old jointing system being used until all current 33kV Jointers in a Depot have been trained and the stores of that particular Depot are purged of the old jointing system.

A short period of formal training will be required.

Implementation Timetable

Once existing 33kV Jointers have been on the conversion course then 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: CA3L/2 Relating to Procedures for Making 33kV Single core EPR Cable Branch Joints.

This Standard Technique document contains all the approved 33kV cold applied Branch Joints for Single core EPR cables. It shall be implemented in conjunction with the appropriate General Requirements in ST: CA3C/1, including: -

1. General Cleanliness and Accident Prevention.
2. Joint Bay Preparation.
3. General Jointing Procedures – Dead Cables.

If the need arises to undertake a Branch configuration (i.e. non-standard) not covered within the Standard Technique the Policy Manager, Avonbank, is to be consulted.

Cable sizes shown are the maximum for the individual joint, cable sizes below the maximum and there combinations are accommodated and are provided for in the relevant Jointing Procedure, this is particularly evident for transitional jointing.

Where 240mm² EPR is to be found, then for material selection and installation data use 300mm² EPR; but for the electrical purposes i.e. loadings, ratings etc. then the 240mm² EPR shall be treated as 185mm² EPR. Likewise where 150mm² EPR is to be found, then for material selection and installation data use 185mm² EPR.

Resin encapsulated joints must not be broken down.

Any reference to single core EPR cable equally applies to single core XLPE cable.

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ST CA3L/2 PROCEDURES FOR MAKING 33kV SINGLE CORE CABLE BRANCH JOINTS

JOINTING PROCEDURE 7.201

185/300/400mm² EPR CWS SINGLE CORE 33KV BRANCH JOINT.

(This Jointing Procedure covers cable sizes up to and including 400mm²)

**This procedure is to be read in conjunction with the appropriate
General Requirements ST: CA3C/2 Section 6
of the 33kV Jointing Manual**

JOINTING PROCEDURE 7.101

JOINT KIT REFERENCES

CABLE SIZE	JOINT KIT REFERENCES
To	Branch
185 EPR	SB 3301
300 EPR	SB 3302
400 EPR	SB 3303

Note: - The jointing materials for 150mm² EPR will be as for 185mm² EPR and 240mm² EPR will be as 300mm² EPR. Any reference to EPR equally applies to XLPE.

NOTE: - DO NOT USE STANDARD SIZE 3 PFISTERER INNER CONE SEPARABLE CONNECTORS FOR THE BRANCH JOINT. SPECIAL PHOSPHOR BRONZE OUTER BODIES ARE REQUIRED; THESE HAVE A 10 TO 12 WEEK LEAD TIME.

Note 2: - To complete this termination bespoke Pfisterer tooling is required.

This jointing procedure is only to be used on cables with outside diameter > 58 mm namely:-

Cable Type - EPR CWS	Outside Diameter of cable.
185mm ²	42.5mm
300mm ²	47.5mm
400mm ²	50.8mm

JOINTING PROCEDURE 7.101

JOINT KIT MATERIALS (for a three phase joint)

KIT REF	BASE MODULE	SIZE MODULES			BRANCH MODULE	STEELWORK FRAME	ELLIS PATENT ATLAS CABLE CLEATS			TUBE SBT
	Size 3	185mm ²	300mm ²	400mm ²	CONNEX T- Joint	33kV Steelwork Bracket	185mm ²	300mm ²	400mm ²	WCSM 90/25 x 250
SB 3301	3	9	9	9	3	1	9			9
SB 3302	3	9	9	9	3	1		9		9
SB 3303	3	9	9	9	3	1			9	9

ADDITIONAL ITEMS FOR EACH JOINT

PVC tape
 Scotch 70
 Tinned copper wire 16 swg
 Tinned copper wire 20 swg
 De-Solvit 1000 FD
 De-Solvit 1000
 Workhorse dry wipes
 Emery cloth
 5313 Water block tape
 Cable ties
 Sealing putty
 Aluminium oxide cloth 320 grit
 Aluminium oxide cloth 400 grit

Note: - Individual material item numbers (E 5) are to be found in Section 4 of the 33kV Jointing Manual.

JOINTING PROCEDURE 7.201

Actions

General Requirements (ST: CA3C/2)

Refer to Drawings **JP3D 7.201.1, 7.201.2, 7201.3 and 7.201.4** whilst undertaking this Jointing Procedure.

- | | | |
|----|---|----|
| 1. | The joint bay needs to be prepared as per JP3D 7.201 and the whole base of the joint bay shall be covered by 600mm by 600mm paving stones thus providing a flat, level and solid base for the joint to sit on. | -- |
| 2. | At each corner of the joint bay drive the standard copper clad steel earth rods these earth rods shall be interconnected with 70mm ² HDC. The 70mm ² HDC shall be cad-welded to each earth rod, as shown in JP3D 7.201.2. On the long axis of the joint bay a 70mm ² HDC shall be cad-welded to each interconnecting 70mm ² HDC to provide two earth tails to connect to the steel work and to the branch joint bodies. | -- |
| 3. | In the middle of the paving stone base, laid in action 1 position the branch joint steelwork base and fix to the paving stones. | -- |
| 4. | Mount the Pfisterer size 3 branch joint bodies into the steelwork frame. | -- |
| 5. | Earth the steelwork frame to the 70mm ² HDC. | -- |
| 6. | Identify and mark core phasing clear of termination position. | -- |
| 7. | Set and align cores into their termination positions. | 6 |
| 8. | Clean each oversheath for a distance of 2m. | -- |

EPR CABLE - Preparation

- | | | |
|-----|--|----|
| 9. | Apply a temporary earth continuity bond clear of termination position. | 11 |
| 10. | Park a mastic lined heat shrink tube next to temporary earth continuity bond of each core. | -- |
| 11. | Park heat shrink tube and pre-assembled bell assembly over cable. | -- |
| 12. | Set and mark cores into their required positions refer to JP3D 7.201.5. | 6 |
| 13. | Cut each core to allow sufficient length of copper wire screen to terminate to its connection point to earth refer to JP3D 7.409.1 | -- |

JOINTING PROCEDURE 7.201 – Continued

Actions	General Requirements (ST: CA3C/2)
14. From the reference mark previously applied in 8, place a further mark 45mm towards the cable end ,this will be the datum line reference mark for the installation of the connector refer to JP3D 7.409.5.	--
This mark becomes the datum line for the procedure.	
15. Remove oversheaths refer to JP3D 7.409.6.	15
16. From the datum line measure 160mm and mark the position refer to JP3D 7.409.6	--
17. From the datum line measure 270mm and mark the position refer to JP3D 7.409.6	--
18. Abrade oversheath measured in 17; refer to JP3D 7.409.6.	16
19. Degrease the abraded area of 18.	39
20. Apply a turn of mastic tape 187mm from datum line applied in 8, around oversheaths refer to JP3D 7.409.7.	--
21. Apply on layer of Scotch 88 tape at each of the three points (I, II, III) shown in JP3D 7.409.7 allow the Scotch 88 tape to hang loosely do not tear.	--
22. At the datum line cut equalization tape from screen wires.	--
23. Straighten copper screen wires and bend back over oversheath termination ensure copper screen wires are spaced evenly into mastic tape applied in action 21 refer to JP3D 7.409.7.	--
NOTE: - Ensure screen wires DO NOT CROSS EACH OTHER.	
24. Fix the copper screen wires in place on the oversheath with the Scotch 88 applied in 17 refer to JP3D 7.409.7.	--
25. Tap the screen wires tight to the oversheath using a soft hammer.	--
26. Remove the water swelling tape to the oversheath termination.	--

JOINTING PROCEDURE 7.201 – Continued

Actions	General Requirements (ST: CA3C/2)
27. Place a mark 235mm from the oversheath termination and cut the cable refer to JP3D 7.409.8.	24
NOTE: - The conductor shall be cut by hacksaw only.	
EASI-STRIP Semi-Con only	
28. From the datum line measure 20mm onto the semi-con remove the semi-con refer to JP3D 7.409.8.	24
29. From the datum line measure 40mm onto the EPR insulation apply a mark. Using 150 grit Al. oxide tape roughen the insulation - refer to JP3D 7.409.8.	--
30. At the 40mm mark applied in 24, using Scotch 88 tape adhesive side up for 40mm onto the EPR insulation.	--
31. Using a new and clean Workhorse wipe apply the dry graphite (Pfisterer part number No. 003 010 011) to the roughened EPR insulation.	--
32. Remove protective Scotch 88 tape applied in 25 then proceed to step 36.	--
FULLY BONDED Semi-Con only	
33. Apply the stop ring against the oversheath termination.	--
34. Set spacer on the bonded stripping tool to 40 mm.	--
35. On a spare piece of cable set the stripping tool to ensure that there is only a minimum of XLPE insulation removed by the stripping tool.	24
36. Remove the bonded screen down to 40mm from the datum mark.	24
37. Remove peeled-off semi-conducting layer.	--
38. Remove stop ring.	--

JOINTING PROCEDURE 7.201 – Continued

Actions	General Requirements (ST: CA3C/2)
39. Check the diameters over the semi-con and the phase insulation diameter using the enclosed tape DL = Diameter of conducting layer Di = Diameter of insulation	--
40. Determine difference between DL and Di: - DL – Di < 2,0 mm => standard semi-con screen continue with step no.29. DL – Di > 2,0 mm => thick conductor screen. Continue with step no. 27 and 28	--
Completing the Termination	
41. Stretch a length of semi-con tape to obtain approximately a third of its original width, covering 15mm of the semi-con/insulation and apply 3 layers keeping close to the copper screen wires at the oversheath termination refer to JP3D 7.409.9.	--
Note: - To prepare the tape take the end and pull to allow the tape to break this will form a thin tapered end, on finishing press on the tape and pull to allow the tape to break, press the thin tapered end down to secure.	
42. From the oversheath termination position apply a mark to the EPR insulation at 133mm.	--
43. Remove the phase insulation to the mark applied in 42.	27
44. Apply Scotch 88 tape to protect the conductor refer to JP3D 7.409.6.	--
45. Apply 3mm chamfer to the phase insulation.	28
46. Degrease the phase insulation ONLY.	39
47. Apply thin and even coat of Pfisterer-MV special grease (part no. 558 228 011) to EPR insulation.	--
48. Apply thin and even coat of Pfisterer-MV special grease (part no 558 228 011) to inside of stress cone.	--

JOINTING PROCEDURE 7.201 – Continued

Actions	General Requirements (ST: CA3C/2)
49. Push the stress cone straight without twisting onto the EPR insulation until 10 mm of the insulation protrudes.	--
50. Remove any excess grease.	--
51. Remove Scotch 88 tape applied in 38 from end of conductor.	--
52. Push thrust piece onto conductor with rounded side facing the stress cone.	--
Note: - Ensure the round surface edge of the thrust piece and the conductor hole recess is facing towards the cable to allow the insulation to fit into the recess, and the rounded edge to fit into the stress cone end recess.	
53. Push tension cone onto conductor against the thrust piece.	--
Note: - Check the conductor does not protrude beyond the end of the end of the tension cone.	
54. Push contact ring onto tension cone.	--
55. Fix contact ring on the tension cone using the size 3 impact head. The contact ring must no longer be able to be turned.	--
Note: - The impact head is to be hit only with the palm of the hand. DO NOT USE ANY FORM OF TOOL.	
56. Push the retaining ring of the compression head toward the rear.	--
57. Position the half sleeves of the compression head behind the thrust piece.	--
Note: - Do not damage the stress cone.	
58. Press half sleeves together and push retaining ring forward.	--
59. Turn adjusting ring of manual compression tool clockwise until the thrust piece of the compression head rests against the contact ring.	--

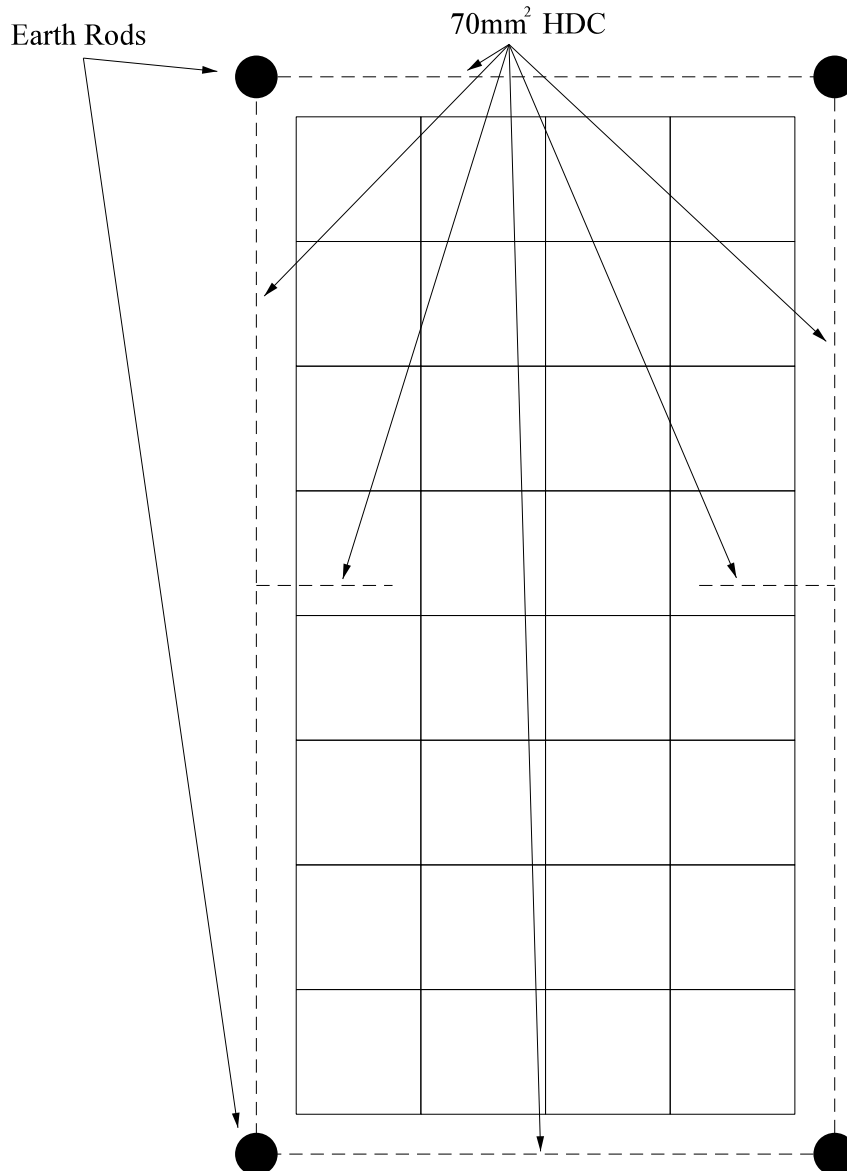
JOINTING PROCEDURE 7.201 – Continued

Actions	General Requirements (ST: CA3C/2)
60. Press contact ring onto tension cone, using the hydraulic compression tool, until the tool releases.	--
61. On completion of the compression operation, push the stress cone, without twisting back towards the thrust piece until the stress cone and thrust piece meet.	--
62. Take the voltage tap lead out of the bottom of the bell assembly and lay along alongside the oversheath in line with the copper screen wires refer to JP3D 7.409.11.	--
Note: - The voltage tap lead is to be inline and not wrapped around the copper screen wires	
63. Push the bell assembly up the cable until it meets the stress cone refer to JP3D 7.409.9	--
64. Clean the internal bushing and the stress cone with DeSolvit 1000FD	--
65. Lightly lubricate the two components with the silicon grease supplied to facilitate installation refer to JP3D 7.409.11.	--
Note: - Only the silicon grease supplied within the termination kit by the manufacturer is to be used.	
66. Insert the separable connector into the bushing. Ensure the reference line on the plastic inner sleeve of the bell assemble is parallel with the face of the metal flange of the bushing.	--
Note: - Ensure the fixing screws on the bell assembly are lined up with the threaded holes of the bushing well.	
67. Tighten the fixing screws alternately in stages to complete clamping to a torque 15Nm refer to JP3D 7.409.12.	--
68. Fit and secure the voltage tap lead with PVC tape to the outer sheath.	--
Note: - The voltage tap lead is to be inline and not wrapped around the copper screen wires	

JOINTING PROCEDURE 7.201 – Continued


Actions	General Requirements (ST: CA3C/2)
69. Ensure the bell assembly is fitted and secure, position the heat shrink tube on the bell assembly and shrink into place at the point shown in refer to JP3D 7.409.12.	44
Note: - Start shrinking at the bell and shrinking down towards the cable.	
70. Connect the earth lead to the bell assembly and connect to earth stud/bar refer to JP3D 7.409.12.	--
71. Connect the voltage tap earth lead from the bell assembly to the system earth refer to JP3D 7.409.12.	--
CAUTION: - THE VOLTGE TAP EARTH LEAD MUST AT ALL TIMES BE CONNECTED TO EARTH EITHER DIRECTLY TO THE EARTH BAR OR VIA A VOLTAGE TAP INDICATOR LAMP.	
72. Apply relevant phase identification tape to the cable oversheath refer to JP3D 7.409.12.	--
73. Remove temporary earth continuity bond applied in 5 and reseal oversheaths with heat shrink tubes applied in 6.	44
74. Fit and secure cables into cable cleats refer to JP3D 7.409.13.	--

All dimensions in mm



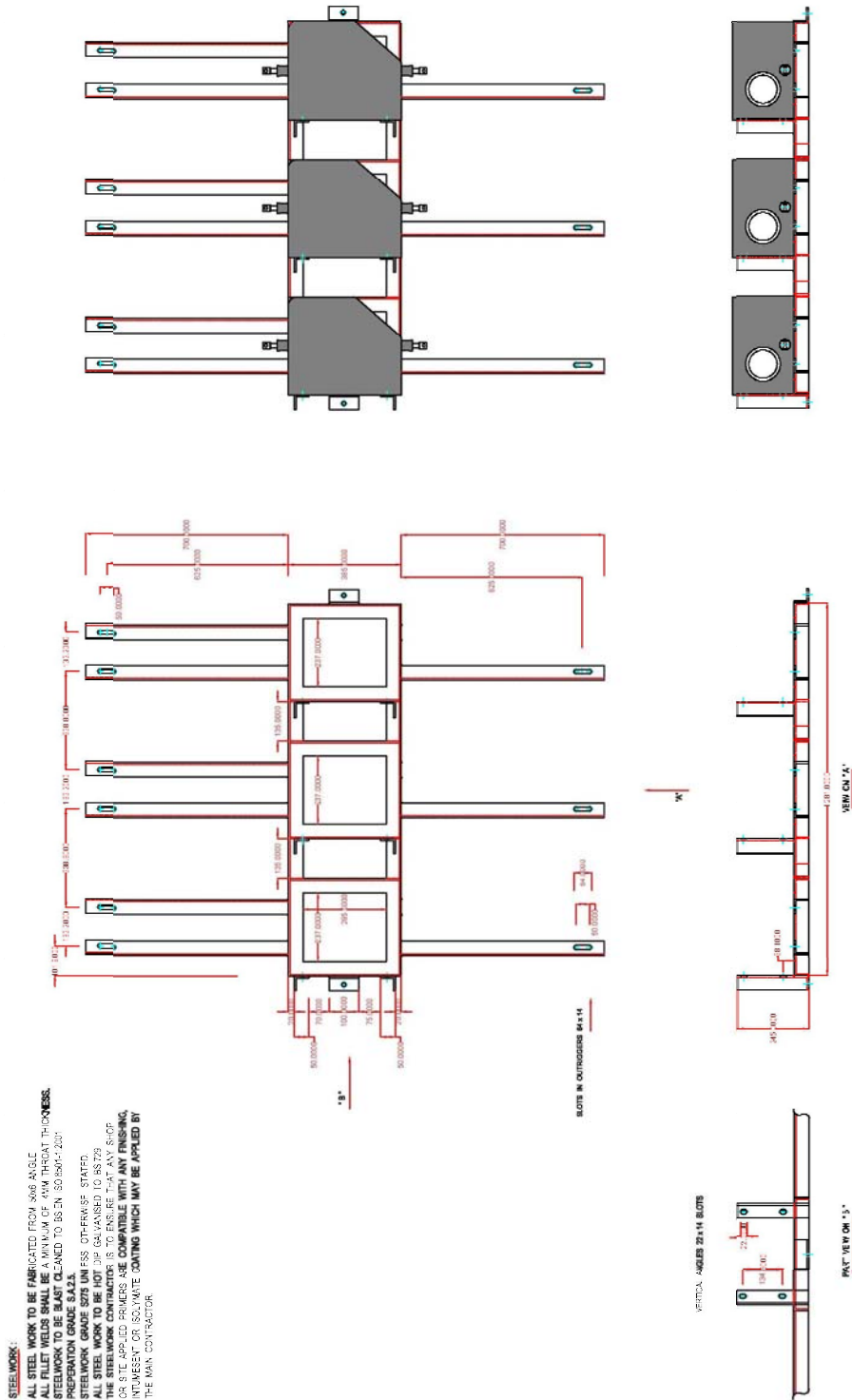
The Earth Rods And 70mm² HDC Shell Be Installed In Native Earth

The 600mm By 600mm Paving Stones shell Be Laid On 3mm To Dust Of Crushed Limestone Or Granite dust. Thus Providing Flat, Level And Solid Base For The Joint To Sit On

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	01/17			
Checked				<div>Title 33kV BRANCH JOINT BAY GENERAL ARRANGEMENT AND LAYOUT SHOWING EARTH ROD POSITIONS AND 70mm² HDC EARTH WIRE</div> <div>Drg. No. JP3D 7.201.1</div> <div>Rev No</div>	
Approved					
SCALE		N.T.S.			

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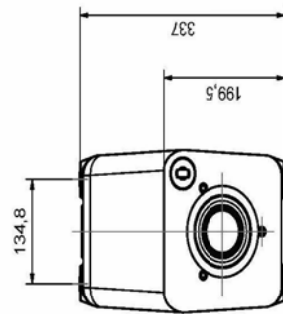
All dimensions in mm



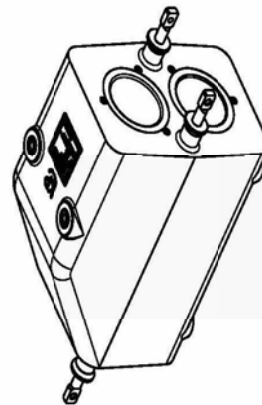
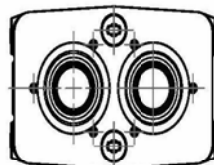
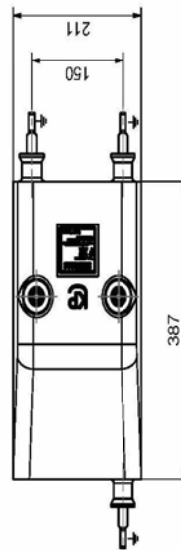
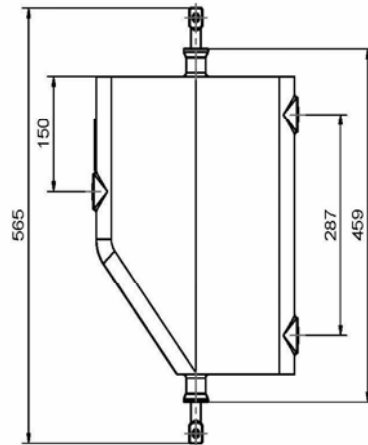
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ORIGINAL	ISSUE	DATE	WESTERN POWER DISTRIBUTION Design Department. Avonbank, Feeder Road, Bristol BS2 0TB Tel: 0117 933 2000 Fax: 0117 933 2001.		
Drawn	RJB	03/16	Title GENERAL ARRANGEMENT DRAWING SHOWING THE STEEL WORK AND THE 33kV JOINT BODIES FITTED TO THE STEEL WORK		
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Approved					
SCALE N.T.S.			Drg. No. JP3D 7.201.2		Rev No

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All dimensions in mm



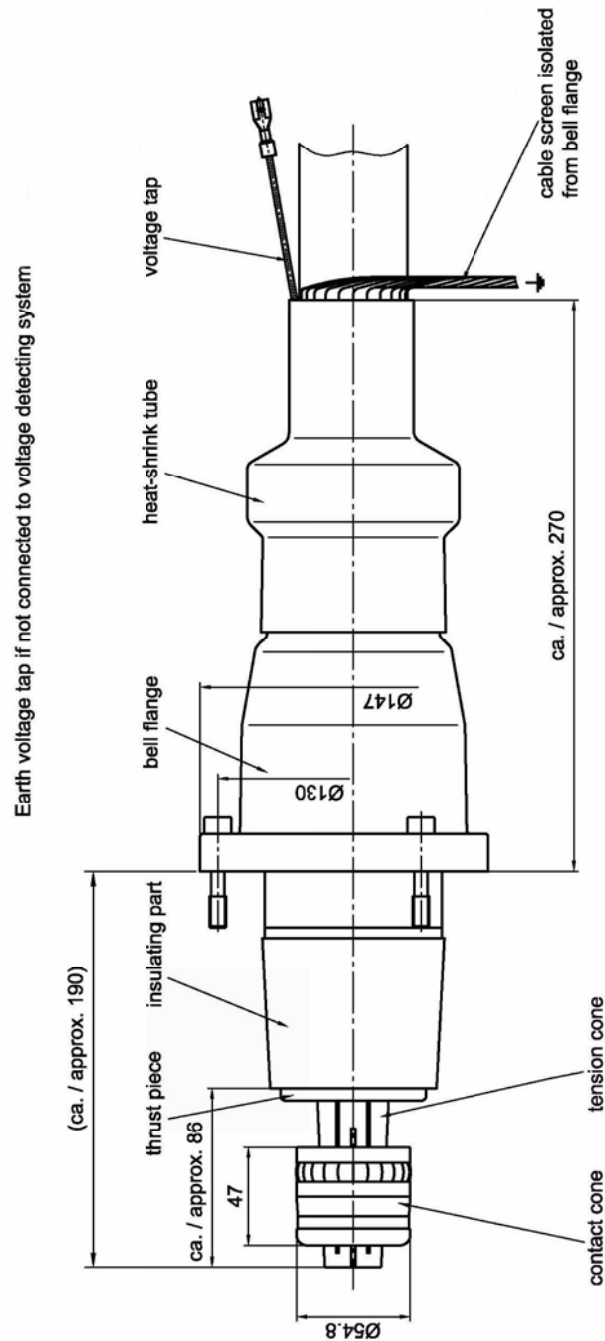
The inner surface of the bushing and the cone from insulating part of the connector must be cleaned and greased with MV-special grease (must be ordered separately with the article number 558 228-008)




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SCALE		N.T.S.		Title	
				GENERAL ARRANGEMENT OF THE BRANCH JOINT BODY	
				Drg. No. JP3D 7.201.3	
				Rev No	

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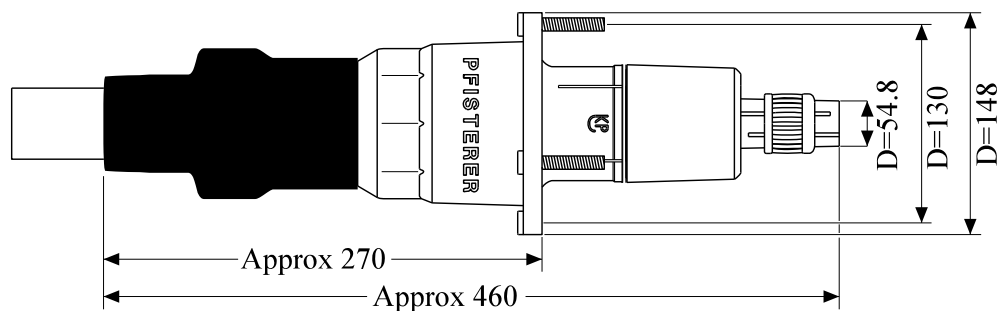
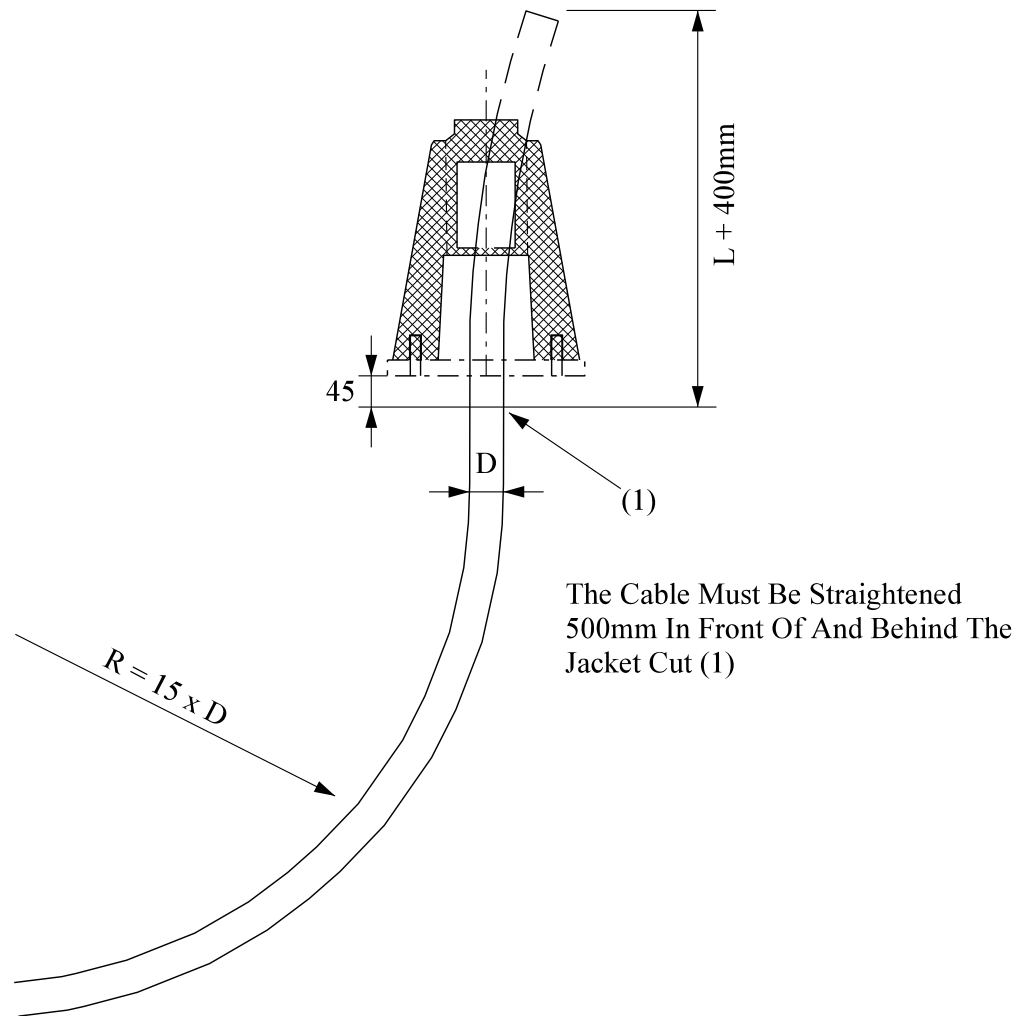
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Approved				Title	
SCALE		N.T.S.		GENERAL ARRANGEMENT	
				OF THE PHOSPHOR BRONZE SIZE 3	
				INNER CONE SEPARABLE CONNECTOR	
				Drg. No.	
				JP3D 7.201.4	
				Rev No	

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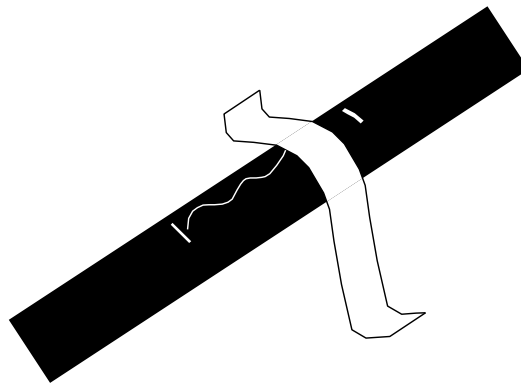
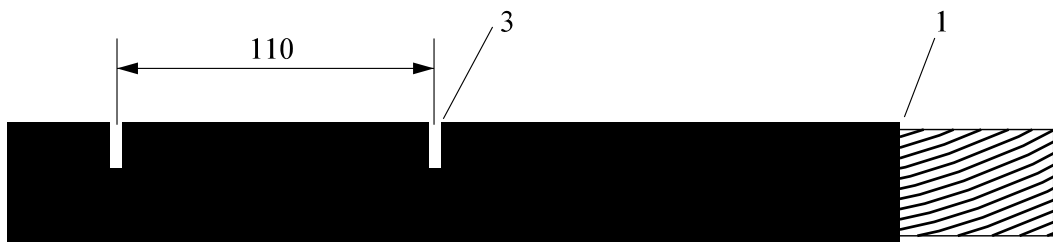
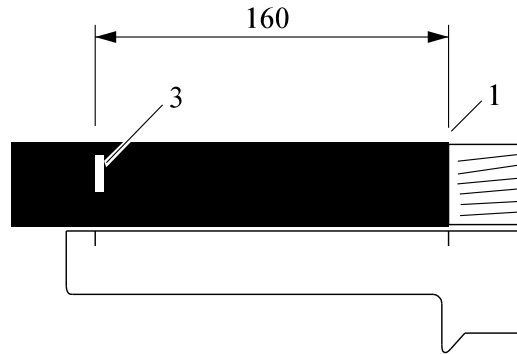
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				CABLE SET UP AND DIMENSIONS OF SIZE 3	
				Drg. No. JP3D 7.201.6	
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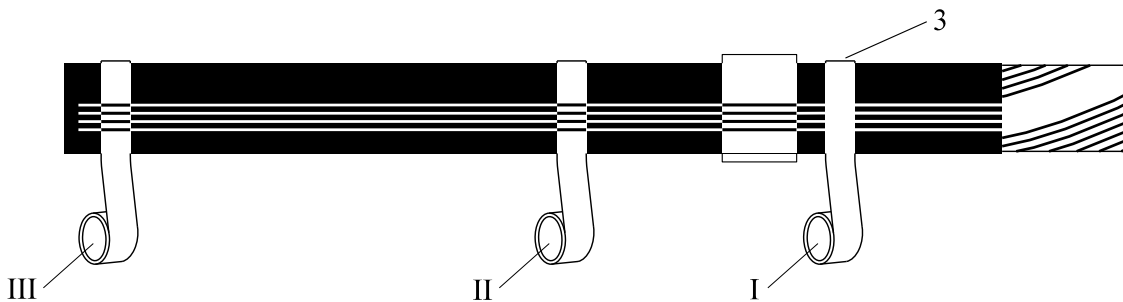
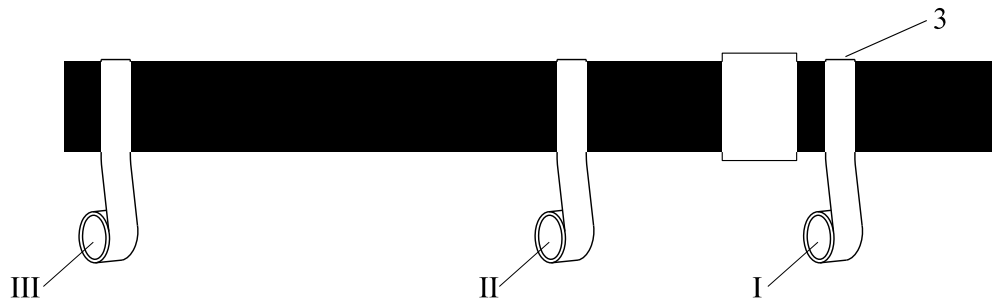
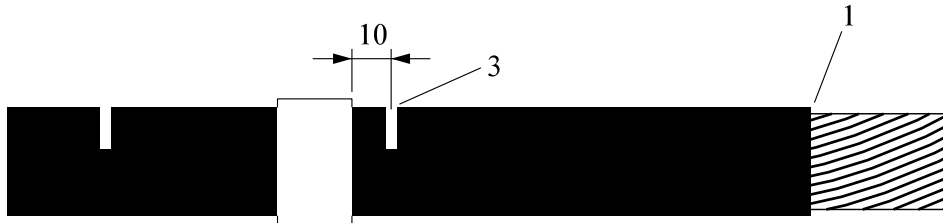
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SCALE		N.T.S.		Title	
				SIZE 3 CABLE PREPARATION A	
				Drg. No. JP3D 7.201.7	
				Rev No	

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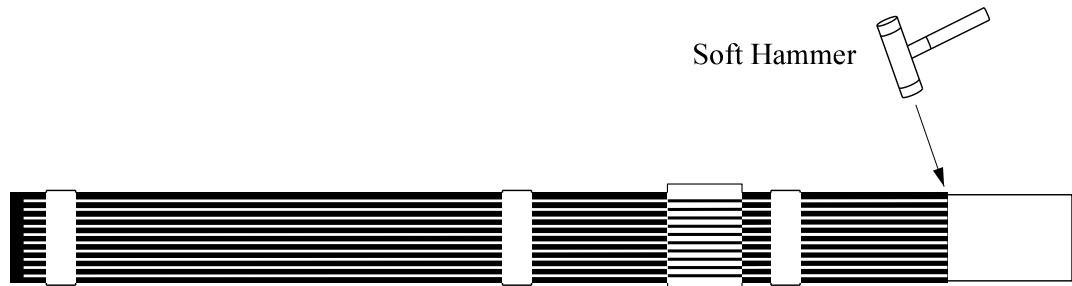
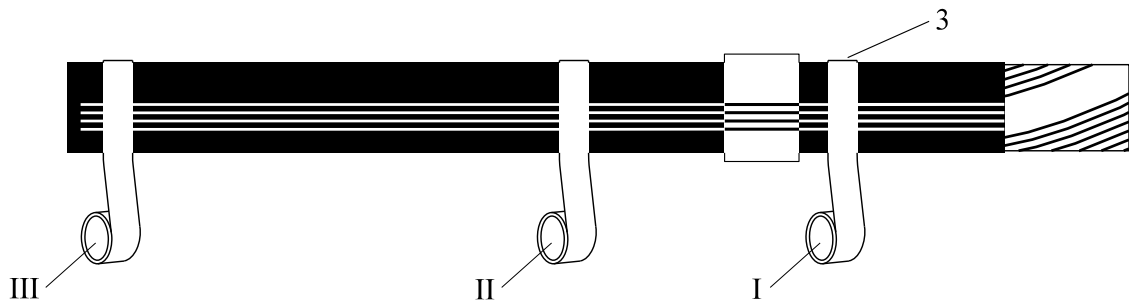
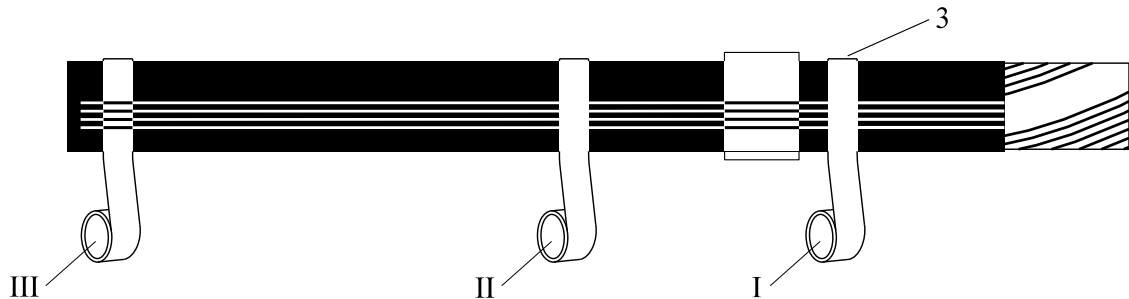
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Drawn	RJB	01/17					
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				SIZE 3 CABLE PREPARATION B		JP3D 7.201.8	

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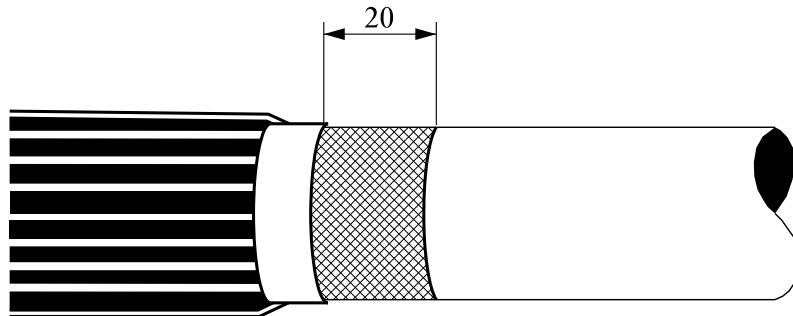
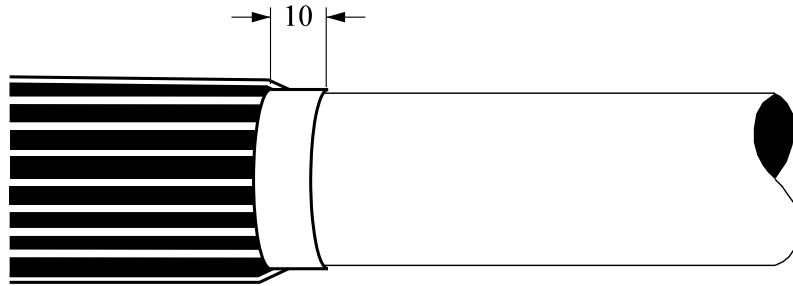
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Drawn	RJB	01/17			
Checked				Title	
Approved					
SCALE		N.T.S.		SIZE 3 CABLE PREPARATION C	
				Drg. No. JP3D 7.201.9	
				Rev No	

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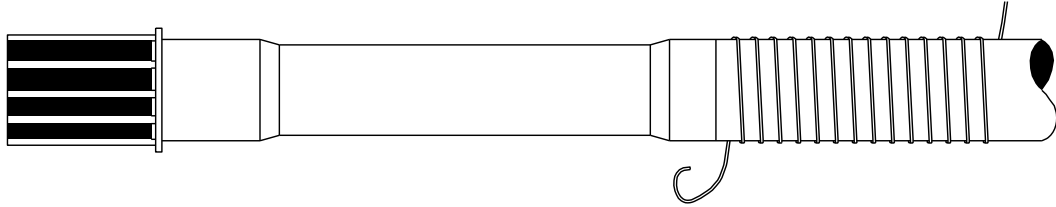
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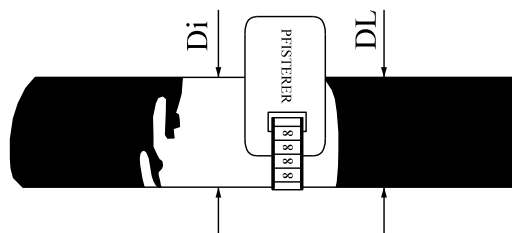
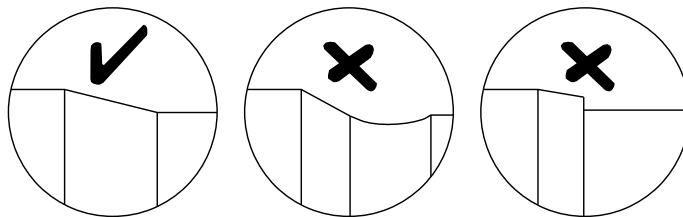
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Drawn	RJB	01/17				
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SCALE	N.T.S.		Title EASI - STRIP SEMI - CONDUCTOR PREPARATION			Drg. No. JP3D 7.201.10
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All dimensions in mm



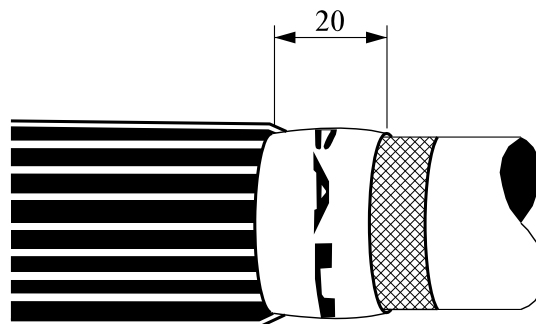
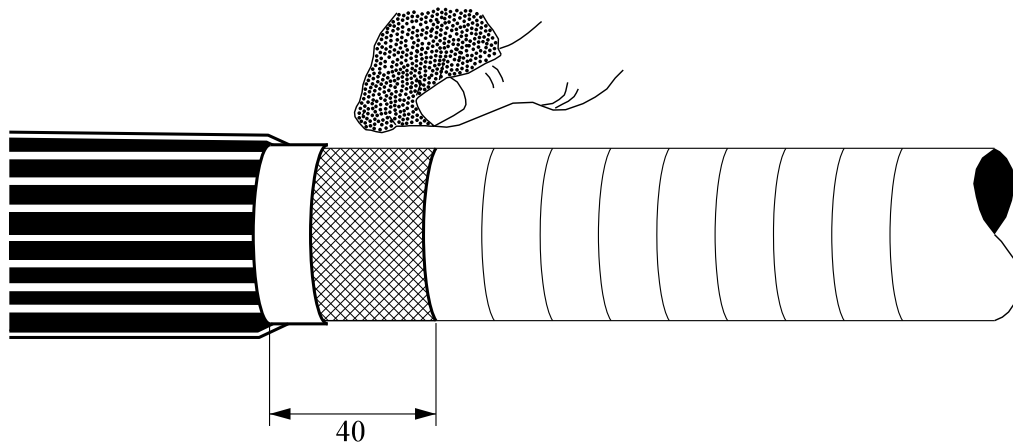
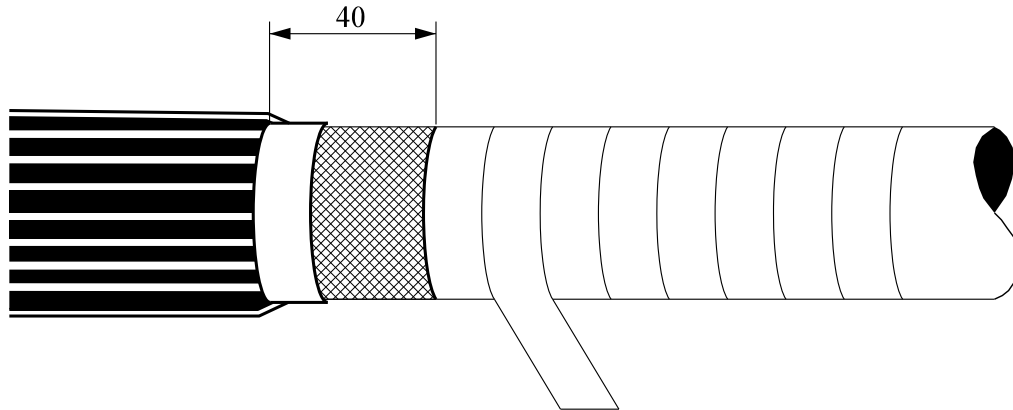
The Transition From The Stripped
Wires To The Conducting Layer
Must Be Smooth



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Drawn	RJB	01/17			
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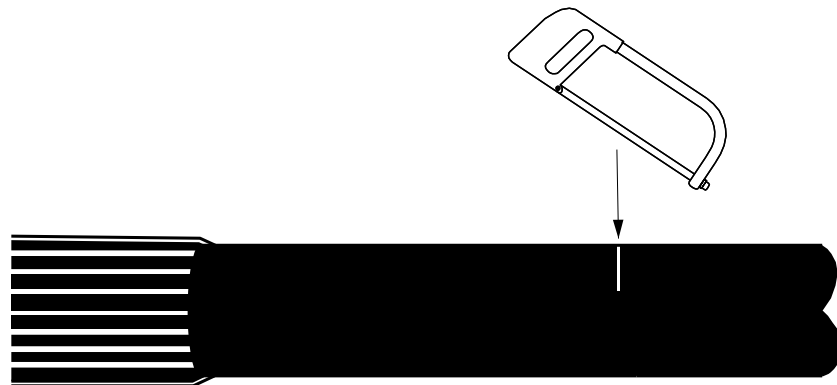
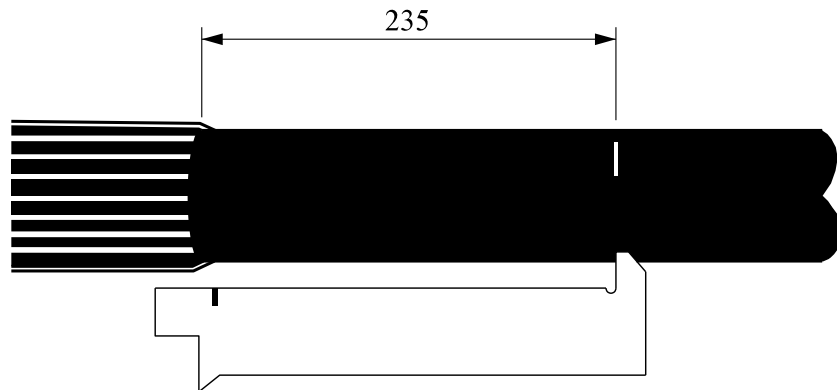
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Drawn	RJB	01/17			
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SCALE		N.T.S.		Title	
				EASI STRIP SEMI-CON PREPARATION	
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				Rev No	

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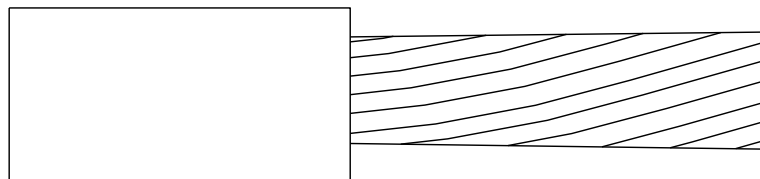
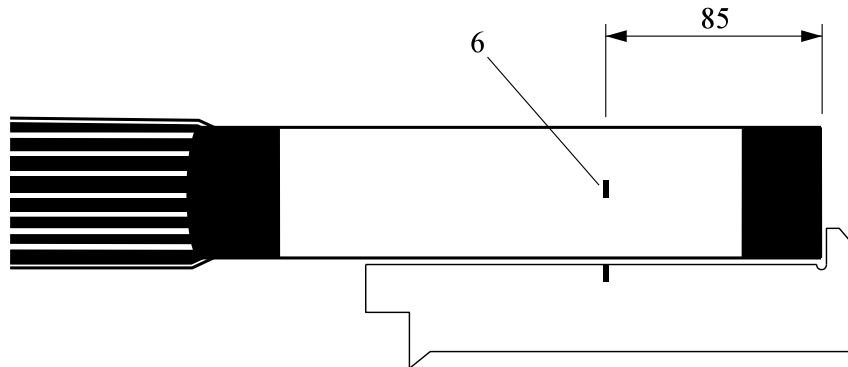
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			CUTTING CORES TO LENGTH			JP3D 7.201.13	
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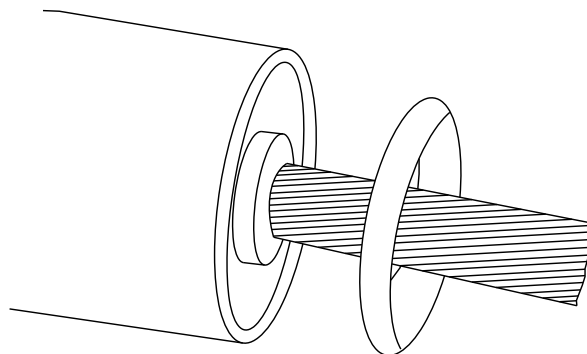
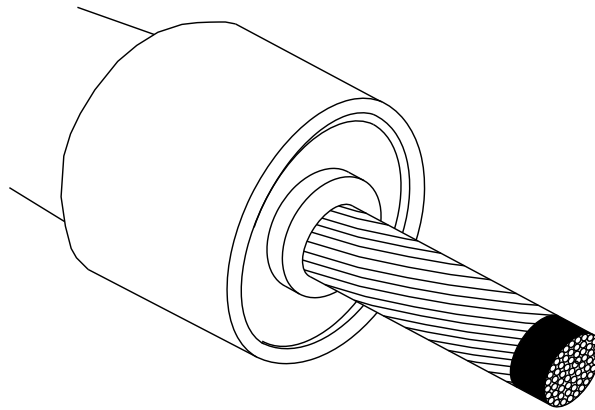
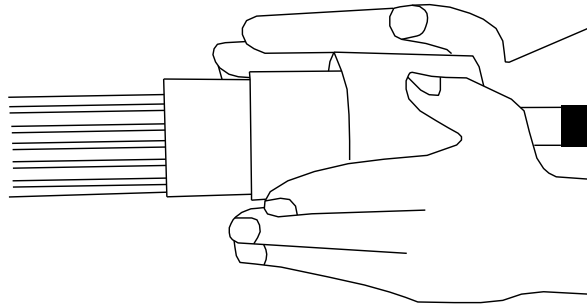
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SCALE N.T.S.			Title REMOVAL OF PHASE INSULATION			Drg. No. JP3D 7.201.14
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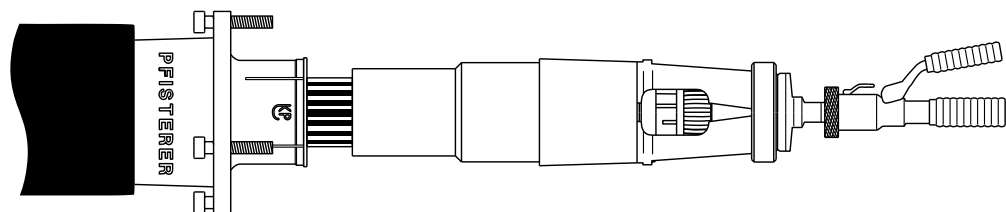
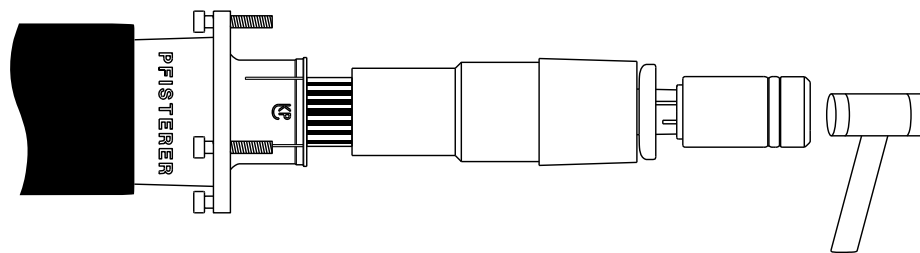
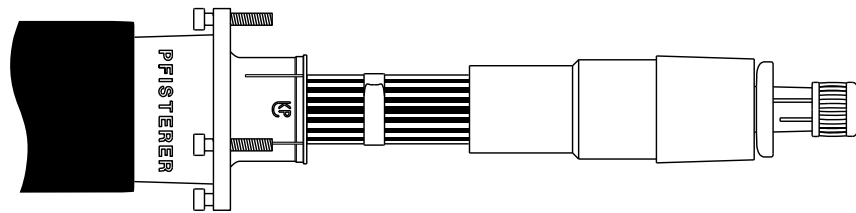
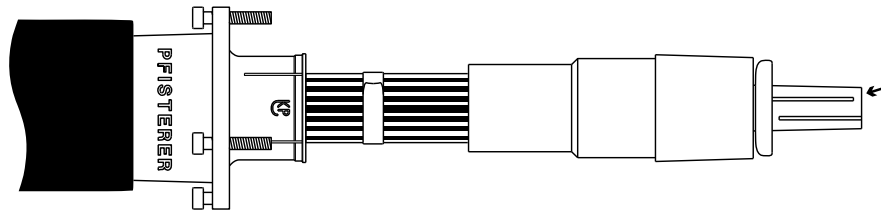
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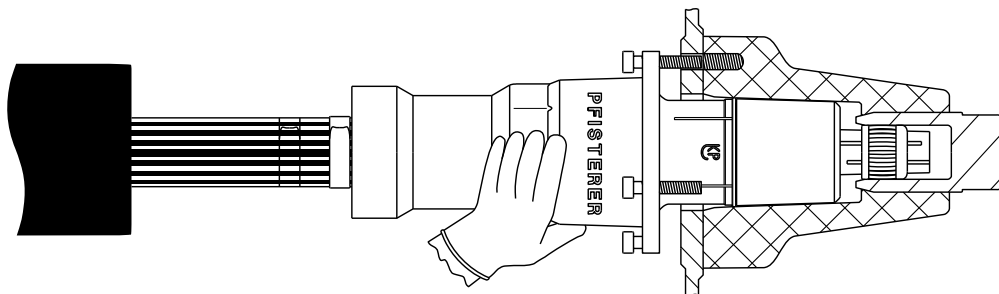
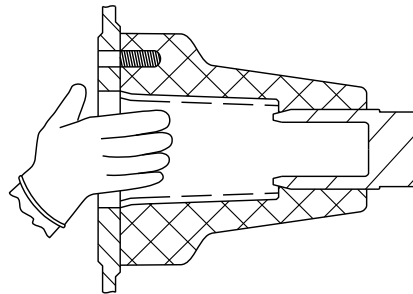
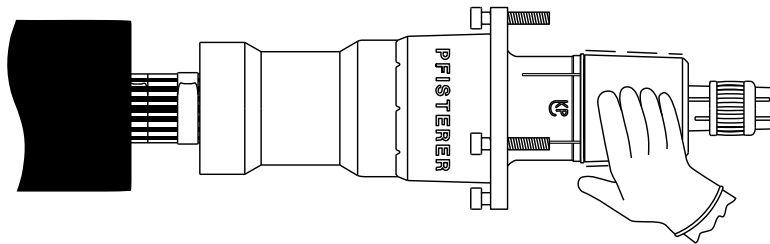
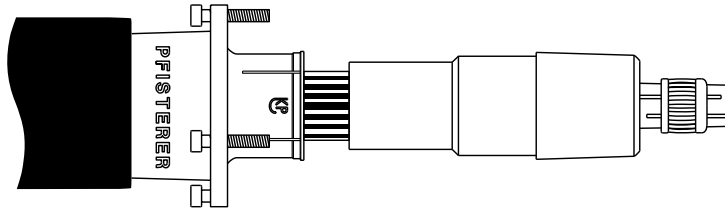
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SCALE		N.T.S.		Title		Drg. No.		Rev No
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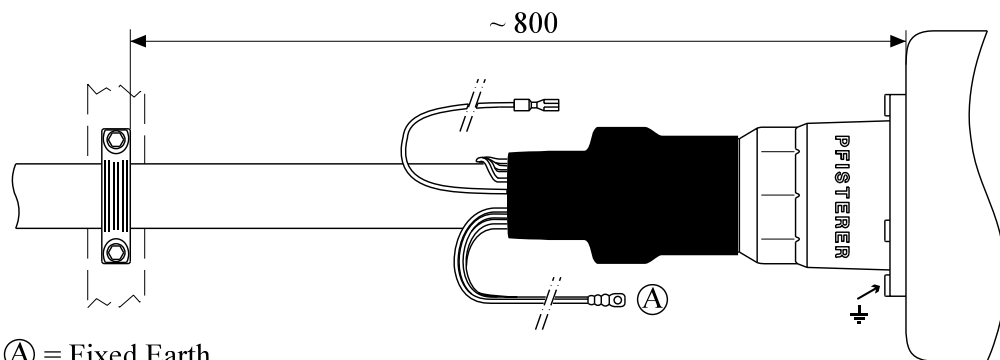
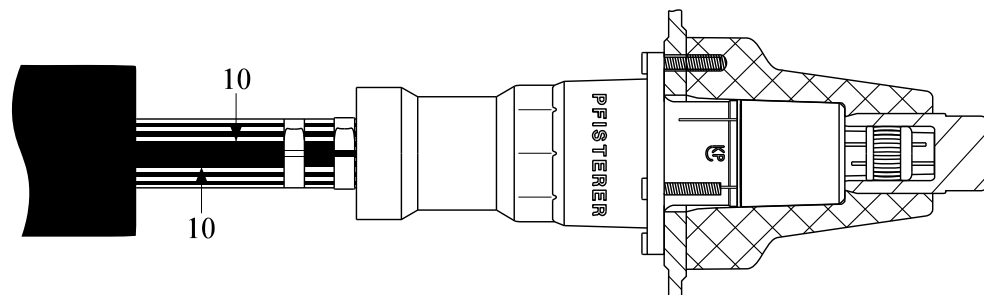
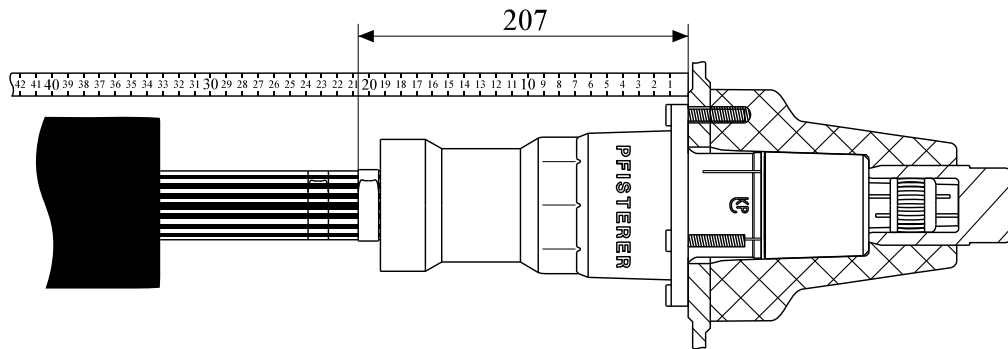
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				INSERTION OF SIZE 3 INTO BRANCH JOINT BODY	
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Ⓐ = Fixed Earth

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SCALE	N.T.S.		Title HEAT SHRINK OUTER TUBE ONTO HOUSING AND CLEATING OF CABLE			Drg. No. JP3D 7.201.18 Rev No

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APPENDIX A

SUPERSEDED DOCUMENTATION

This Standard Technique document ST:CA3L/2 supersedes ST:CA3L/1 dated July 2001 which should now be withdrawn.

APPENDIX B

ASSOCIATED DOCUMENTATION

ST: CA3A, ST: CA3C/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

This Standard Technique shall be communicated to all relevant WPD engineers and site staff at the next Team Briefing by the Team Manager. All existing 33kV Jointers will require re-training to the cold applied techniques once trained then they will be able to use the new cold applied jointing system.

Independent Connection Providers (ICPs) shall follow the requirements of ST: CA2L/1 or of this document (ST: CA2L/2) for a period of up to 3 months from the issue of this document. After this date, all jointing works shall comply with ST: CA2L/2.

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

Branch jointing procedures for the 33kV jointing manual.