Network Standard

NETWORK		
	Document No	: NW000-S0089
	Amendment No	: 6
	Approved By	: Manager AEP&S
	Approval Date	: 17/01/2020

Minor amendments approved – 09/06/2026

NW000-S0089 **NS129 11KV JOINTS AND TERMINATIONS - PAPER INSULATED LEAD COVERED CABLES**



ISSUE

For issue to all Ausgrid and Accredited Service Providers' staff involved with high voltage cable jointing work, and is for reference by field, technical and engineering staff.

Ausgrid maintains a copy of this and other Network Standards together with updates and amendments on www.ausgrid.com.au.

Where this standard is issued as a controlled document replacing an earlier edition, remove and destroy the superseded document.

DISCLAIMER

As Ausgrid's standards are subject to ongoing review, the information contained in this document may be amended by Ausgrid at any time. It is possible that conflict may exist between standard documents. In this event, the most recent standard shall prevail.

This document has been developed using information available from field and other sources and is suitable for most situations encountered in Ausgrid. Particular conditions, projects or localities may require special or different practices. It is the responsibility of the local manager, supervisor, assured quality contractor and the individuals involved to make sure that a safe system of work is employed and that statutory requirements are met.

Ausgrid disclaims any and all liability to any person or persons for any procedure, process or any other thing done or not done, as a result of this Standard.

All design work, and the associated supply of materials and equipment, must be undertaken in accordance with and consideration of relevant legislative and regulatory requirements, latest revision of Ausgrid's Network Standards and specifications and Australian Standards. Designs submitted shall be declared as fit for purpose. Where the designer wishes to include a variation to a network standard or an alternative material or equipment to that currently approved the designer must obtain authorisation from the Network Standard owner before incorporating a variation to a Network Standard in a design.

External designers including those authorised as Accredited Service Providers will seek approval through the approved process as outlined in NS181 Approval of Materials and Equipment and Network Standard Variations. Seeking approval will ensure Network Standards are appropriately updated and that a consistent interpretation of the legislative framework is employed.

Notes: 1. Compliance with this Network Standard does not automatically satisfy the requirements of a Designer Safety Report. The designer must comply with the provisions of the Workplace Health and Safety Regulation 2017 (NSW - Part 6.2 Duties of designer of structure and person who commissions construction work) which requires the designer to provide a written safety report to the person who commissioned the design. This report must be provided to Ausgrid in all instances, including where the design was commissioned by or on behalf of a person who proposes to connect premises to Ausgrid's network, and will form part of the Designer Safety Report which must also be presented to Ausgrid. Further information is provided in Network Standard (NS) 212 Integrated Support Requirements for Ausgrid Network Assets.

2. Where the procedural requirements of this document conflict with contestable project procedures, the contestable project procedures shall take precedent for the whole project or part thereof which is classified as contestable. Any external contact with Ausgrid for contestable works projects is to be made via the Ausgrid officer responsible for facilitating the contestable project. The Contestable Ausgrid officer will liaise with Ausgrid internal departments and specialists as necessary to fulfil the requirements of this standard. All other technical aspects of this document which are not procedural in nature shall apply to contestable works projects.

INTERPRETATION

In the event that any user of this Standard considers that any of its provisions is uncertain, ambiguous or otherwise in need of interpretation, the user should request Ausgrid to clarify the provision. Ausgrid's interpretation shall then apply as though it was included in the Standard, and is final and binding. No correspondence will be entered into with any person disputing the meaning of the provision published in the Standard or the accuracy of Ausgrid's interpretation.

KEYPOINTS

This standard has a summary of content labelled "KEYPOINTS FOR THIS STANDARD". The inclusion or omission of items in this summary does not signify any specific importance or criticality to the items described. It is meant to simply provide the reader with a quick assessment of some of the major issues addressed by the standard. To fully appreciate the content and the requirements of the standard it must be read in its entirety.

AMENDMENTS TO THIS STANDARD

Where there are changes to this standard from the previously approved version, any previous shading is removed and the newly affected paragraphs are shaded with a grey background. Where the document changes exceed 25% of the document content, any grey background in the document is to be removed and the following words should be shown below the title block on the right hand side of the page in bold and italic, for example, Supersedes – document details (for example, "Supersedes Document Type (Category) Document No. Amendment No.").

KEY POINTS OF THIS STANDARD

Scope and Risks Addressed

This network standard specifies Ausgrid's construction requirements for making joints and terminations on 11,000 Volts paper insulated lead cables. The standard is limited to the scope identified below and provides controls for associated risks as listed below:

- ☐ Applies to 11kV joints, Underground to Overhead (UGOH) connections, terminations for distribution transformers, indoor and outdoor terminations, and taped terminations in compound-filled end boxes.
- ☐ Only the approved construction standards currently in use are detailed in this document.
- ☐ Any deviations from this standard must be submitted to Ausgrid for approval prior to being implemented.
- ☐ Only personnel trained and assessed as being competent in the installation of PILC joints and terminations can install the joints and terminations detailed in this network standard.
- ☐ Construction details for joints, terminations, and UGOH connections which are not covered in this standard shall be sought from Ausgrid when required.

Where to for more information?

Section 1, 2

Responsibilities and Requirements

The details of this section identify the respective responsibilities of Clients, Accredited Service Providers (ASPs), and Ausgrid Representatives. In addition, the following detail is included:

- ☐ All materials and equipment used for construction of Ausgrid's assets are to be free from asbestos
- ☐ All electrical works will be conducted in compliance with Ausgrid's Electrical Safety Rules
- ☐ Working in confined spaces,
- ☐ Admittance to Ausgrid premises
- ☐ Installers of products detailed in this standard must be trained and assessed as competent in the installation of each product they will be installing
- ☐ Some items are exempt from the product specific training requirement
- ☐ Contractors and Accredited Service Providers must only use approved products on the network. Alternative products shall be submitted to Ausgrid for approval.

Where to for more information?

Section 5, 6, 7

Tools and Forms

None

Joints, Terminations and UGOHs

This network standard includes the following product installation details:

- ☐ UGOHs
- ☐ Suburban type transformer cable termination (HV1-20)
- ☐ Cable termination for distribution transformer endbox
- ☐ Indoor terminations (HV1-41 for single core cables, HV1-43 for multicore cables)
- ☐ Outdoor terminations (HV1-42 for single core cables, HV1-44 for multicore cables)
- ☐ Transformer heatshrink terminations (HV1-28)
- ☐ Single-core termination in compound filled endboxes (HV1-1)
- ☐ Pot end heatshrink termination single core PILC (HV1-35)
- ☐ Pot end heatshrink termination multicore PILC (HV1-36)
- ☐ Straight through joint single core PILC (HV2-2)
- ☐ Straight through joint up to 300mm^2 multicore PILC (HV2-3)
- ☐ Straight through joint 300mm^2 to 500mm^2 multicore PILC (HV2-4)
- ☐ Three-to-one heatshrink joint paper insulated cables (HV2-5)
- ☐ Stub tee joint screened and belted paper insulated multicore cables (HV2-72)

Where to for more information?

Section 8 - 21

Tools and Forms

Various Figures and Tables as appropriate

Joints, Terminations and UGOHs (cont.d)

- ☐ Lay-on tee joint for screened and belted paper insulated cable (HV3-1)
- ☐ Cold pour resin tee joints for PILC cables (HV3-31)

Where to for more information?

Section 22, 23

Tools and Forms

Various Tables as appropriate

Network Standard
NS129
11kV Joints and Terminations - Paper Insulated Lead Covered Cables

Contents

1.0 PURPOSE 7

2.0 SCOPE 7

3.0 REFERENCES 7
- 3.1 General 7
- 3.2 Ausgrid documents 7
- 3.3 Other standards and documents 8
- 3.4 Acts and regulations 8

4.0 DEFINITIONS 8

5.0 SAFETY REQUIREMENTS 9
- 5.1 Lead exposure 9
- 5.2 Asbestos 9

6.0 GENERAL INFORMATION AND REQUIREMENTS 9
- 6.1 Clients 9
- 6.2 Accredited service providers 9
- 6.3 Ausgrid representatives 10
- 6.4 Electrical safety rules 10
- 6.5 Confined spaces 10
- 6.6 Admittance to Ausgrid premises 10
- 6.7 Stainless steel bolts and set-screws – lubrication of threads 11
- 6.8 Commissioning of joints 11
- 6.9 Field book recordings 11

7.0 PRODUCT SPECIFIC TRAINING 11

8.0 CONSTRUCTION OF UNDERGROUND TO OVERHEAD (UGOH) CABLE TERMINATIONS 11
- 8.1 Requirements 11
- 8.2 Animal proofing of UGOHs 12
- 8.3 Sub-transmission poles and UGOHs 12

9.0 GLAND ENTRY TRANSFORMER CABLE TERMINATION (HV1-20) 13
- 9.1 Gland isolation for gland entry transformer terminations 14
  - 9.1.1 Gland isolation installation 14

10.0 CABLE TERMINATION FOR DISTRIBUTION TRANSFORMER ENDBOX 15

11.0 INDOOR TERMINATIONS (HV1-41 FOR SINGLE CORE CABLES, HV1-43 FOR MULTICORE CABLES) 16
- 11.1 Introduction 16
- 11.2 Approved termination kits 16
- 11.3 Cable lugs 16
- 11.4 Requirements 17
- 11.5 Earth fault indicator (EFI) CT support bracket 18

12.0 OUTDOOR TERMINATIONS (HV1-42 FOR SINGLE CORE CABLES, HV1-44 FOR MULTICORE CABLES) 19
12.1 Introduction 19
12.2 Approved termination kits 19
12.3 Cable lugs 20
12.4 Requirements 20

13.0 TRANSFORMER HEATSHRINK TERMINATION SINGLE-CORE, PAPER-INSULATED CABLES (HV1-28) 21
13.1 Introduction 21
13.2 Approved transformer termination kits 21
13.3 Cable lugs 21
13.4 Requirements 21

14.0 SINGLE CORE TERMINATION IN COMPOUND FILLED ENDBOXES (HV1-1) 23
14.1 Introduction 23
14.2 Paper insulation and insulating tapes 24
14.3 Stress cones 24

15.0 POT END (LIVE END SEAL) SINGLE-CORE, PAPER-INSULATED CABLES (HV1-35) 25
15.1 Introduction 25
15.2 Using pot ends (live end seals) 25
15.3 Approved pot end kits 25
15.4 Requirements 25

16.0 POT END (LIVE END SEAL) MULTICORE, PAPER-INSULATED CABLES (HV1-36) 27
16.1 Introduction 27
16.2 Using pot ends (live end seals) 27
16.3 Approved pot end kits 27
16.4 Requirements 27

17.0 STRAIGHT THROUGH JOINT SINGLE-CORE, PAPER-INSULATED CABLES (HV2-2) 29
17.1 Introduction 29
17.2 Approved joint kits 29
17.3 Core connectors 29
17.4 Earth continuity 30
17.5 Requirements 30

18.0 STRAIGHT THROUGH JOINT UP TO 300MM^2 MULTICORE, PAPER-INSULATED CABLES (HV2-3) 31
18.1 Introduction 31
18.2 Approved joint kits 31
18.3 Core connectors 32
18.4 Earth continuity 32
18.5 Requirements 32

19.0 STRAIGHT THROUGH JOINT MULTICORE, PAPER-INSULATED CABLES 300MM^2 TO 500MM^2 (HV2-4) 34
19.1 Introduction 34
19.2 Approved joint kits 34
19.3 Core connectors 34
19.4 Earth continuity 35
19.5 Requirements 35

20.0 THREE-TO-ONE JOINT PAPER-INSULATED CABLES (HV2-5) 36
20.1 Introduction 36
20.2 Approved joint kits 36

20.3 Core connectors 37
20.4 Earth continuity 37
20.5 Requirements 38

21.0 STUB TEE JOINT SCREENED AND BELTED PAPER INSULATED MULTICORE CABLES (HV2-72) 39
21.1 Introduction 39
21.2 Core connectors 39
21.3 Paper insulation and insulating tapes 39
21.4 Stress cones 40
21.5 Earth continuity 40
21.6 Stripping dimensions 41
21.7 Troughing-in of completed joints 41

22.0 COLD POUR RESIN STUB TEE JOINTS FOR PILC CABLES (HV2-73) 46
22.1 Introduction 46
22.2 Requirements 47

23.0 LAY-ON TEE JOINTS FOR SCREENED AND BELTED PAPER INSULATED CABLES (HV3-1) 48
23.1 Introduction 48
23.2 Core connectors 48
23.3 Paper insulation and insulating tapes 48
23.4 Stress cones 49
23.5 Earth continuity 50
23.6 Stripping dimensions 50
23.7 Troughing-in of completed joints 50

24.0 COLD POUR RESIN TEE JOINTS FOR PILC CABLES (HV3-31) 56
24.1 Introduction 56
24.2 Requirements 57

25.0 STORES AND MATERIALS 57

26.0 CABLE DESCRIPTION CODES 57

27.0 RECORDKEEPING 58

28.0 AUTHORITIES AND RESPONSIBILITIES 58

29.0 DOCUMENT CONTROL 58

1.0 PURPOSE

This Network Standard specifies Ausgrid's construction requirements for high voltage (11,000 volts) paper insulated lead covered (PILC) cable joints, Underground to Overhead (UGOH) connections, terminations for distribution transformers, indoor and outdoor terminations, and taped terminations in compound-filled end boxes.

This document also specifies the construction requirements and joint kit details for the following 11kV joints on paper insulated lead covered (PILC) cables:-

- straight through joints for single core and multicore
- three-to-one joints
- tee joints
- stub tee joints
- pot ends for single core and multicore.

2.0 SCOPE

Although there are many types of high voltage (HV) PILC cable joints, terminations and UGOH connections on Ausgrid's reticulation system, only the approved construction standards currently in use are detailed in this document.

The requirements of this standard must always be adhered to. Any deviations from this standard must be submitted to Ausgrid for approval prior to being implemented.

In general, Ausgrid's current policy provides for the contestability of customer connections, recoverable works and some system augmentations. Work on Ausgrid's supply system can only be performed by accredited and authorised persons.

Only personnel who have been trained and assessed as being competent in the installation of PILC joints and terminations can install the joints and terminations mentioned in this Network Standard.

This Network Standard shall be read in conjunction with NS130 and NS100. A detailed cable nomenclature is shown in NS100 External Annexure C.

Construction details for joints, terminations, and UGOH connections which are not covered in this standard shall be sought from Ausgrid as required.

3.0 REFERENCES

3.1 General

All work covered in this document shall conform to all relevant Legislation, Standards, Codes of Practice and Network Standards. Current Network Standards are available on Ausgrid's Internet site at www.ausgrid.com.au.

3.2 Ausgrid documents

- Customer Installation Safety Plan
- Electrical Safety Rules
- Electricity Network Safety Management System Manual
- ES 4 Accredited Service Provider Authorisation
- NS001 Glossary of Terms
- NS100 Field Recording of Network Assets
- NS100 External Annexure C
- NS114 Electrical Design and Construction Standards for Chamber Type Substations
- NS130 Laying Underground Cables up to and Including 11kV

- NS161 Specification for Testing of Underground Cables
- NS181 Approval of Materials and Equipment and Network Standard Variations
- NS181 Approved Material List (AML)
- NS212 Integrated Support Requirements for Ausgrid Network Assets
- NS260 Sub-Transmission Feeder Earthing
- Public Electrical Safety Awareness Plan

3.3 Other standards and documents

- AS 2865 Confined Spaces
- EA 18 Guide to the Training of Personnel Working on or near Electricity Works
- ENA Doc 001-2019 National Electricity Network Safety Code
- ISSC 14 Guide to Electrical Worker's Safety Equipment

3.4 Acts and regulations

- Electricity Supply (General) Regulation 2014
- Electricity Supply (Safety and Network Management) Regulation 2014
- Work Health and Safety Act 2011
- Work Health and Safety Regulation 2017

4.0 DEFINITIONS

Refer to NS001 Glossary of Terms.

5.0 SAFETY REQUIREMENTS

5.1 Lead exposure

When working with lead during the cable jointing process, the persons performing the works are to comply with the requirements listed in Section 7.2 of the Work Health and Safety (WHS) Regulation. To minimise the risk of exposure to lead the controls associated with site control, personal hygiene and the use of personnel protective equipment must be implemented.

Any lead waste from the jointing process must be disposed of through a waste facility licenced to receive Hazardous Waste.

5.2 Asbestos

All materials and equipment used for construction of Ausgrid's assets are to be free from asbestos and or asbestos related products. Suppliers are expected to comply with the Work Health and Safety Act 2011 together with the Work Health and Safety Regulation 2017 and confirm in writing that all products supplied to Ausgrid contain no asbestos related materials, refer to NS211.

6.0 GENERAL INFORMATION AND REQUIREMENTS

6.1 Clients

It is the responsibility of clients to ensure that only appropriately accredited and authorised personnel are engaged on projects involving Ausgrid's transmission and distribution network.

6.2 Accredited service providers

Accredited Service Providers are responsible for ensuring the safety of their employees and the public in general whilst carrying out contestable work. It is essential that Authorised Work (as defined in ES 4) is performed in a safe manner and to no less a standard than as specified in Ausgrid's:

- Bushfire Risk Management Plan,
- Customer Installation Safety Plan,
- Electrical Safety Rules,
- Electricity Network Safety Management System Manual,
- Public Electrical Safety Awareness Plan,
- Public Lighting Management Plan,
- Tree Safety Management Plan,
- Relevant Network Standards.

As well as any relevant Act, Regulation and SafeWork NSW requirements applicable at the time. The conditions stated as a requirement of accreditation under the NSW 'Accredited Service Provider Scheme' must be adhered to.

Other relevant safety guidelines are also available from the Energy Networks Association (ENA) such as:

- ISSC 14 - Guide to Electrical Worker's Safety Equipment,
- EA 18 - Guide to the Training of Personnel Working on or near Electricity Works,
- ENA Doc 024-2009 National Guideline for Management of Tools and Equipment Used in the Electricity Supply Industry.

Accredited Service Providers must also ensure that their employees' accreditations and authorisations are current at all times.

6.3 Ausgrid representatives

A representative will be appointed by Ausgrid to facilitate each stage of the project as the single point of contact for all aspects of that stage. The representative will also be responsible for organising the necessary audits to ensure compliance with approved construction standards.

Audits will be carried out either progressively or at the completion of the work, depending on the specific requirements of each project.

6.4 Electrical safety rules

All authorised personnel will be required to be appropriately trained for the work concerned, and will need to have a thorough knowledge of the applicable parts of Ausgrid's Electrical Safety Rules. Level 1 Accredited Service Providers shall have a full understanding of the procedures and documentation associated with Equipping Permits and high and low voltage access permits before they commence work on any part of Ausgrid's reticulation system.

Ausgrid's Electrical Safety Rules are designed to ensure compliance with statutory requirements which apply to all works on high voltage and low voltage electrical apparatus or near exposed high voltage conductors. They apply to persons who enter electrical stations or generating stations. They also apply to people employed by electricity supply authorities, customers taking supply at high voltage, electrical contractors and Accredited Service Providers working on electrical apparatus, and to any other employee or person, including visitors.

The requirements of the relevant sections of Ausgrid's Electrical Safety Rules shall be applied when conducting works associated with this Network Standard.

6.5 Confined spaces

Entry to and work in a confined space must comply with the Work Health and Safety Regulation 2017 and the requirements of the Australian Standard AS 2865 – Confined Spaces.

Some examples (the list is not exhaustive) of confined spaces within Ausgrid are:

- underground substations with air intake grates in the vehicle carriageway
- a joint-hole with a cover or tarpaulin which is not open on more than one side
- roofed cable pits, cable vaults and tunnels
- jointing chambers where entry is through a manhole or door
- open-topped spaces which do not have good natural ventilation and where a person is working head and shoulders below ground level
- transformer tanks.

6.6 Admittance to Ausgrid premises

Admission to Ausgrid's premises is granted to Accredited Service Providers only under Ausgrid's supervision and at the Accredited Service Providers' cost under the following conditions:

- Ausgrid does not hold itself responsible to the Accredited Service Provider or anyone claiming through the Accredited Service Provider in respect of any loss, damage or injury which may be suffered or received during or arising from their presence upon Ausgrid's premises or any part thereof or any other premises or works connected therewith.
- The Accredited Service Provider accepts all risks involved in making any visit to the said premises and works whether there are concealed dangers or otherwise and whether such dangers are known to Ausgrid or not.
- Ausgrid does not guarantee that the premises or works are free from concealed dangers or risks.
- Ausgrid shall not be liable for or be bound by any of the liabilities or duties to or by which it would otherwise be liable or bound under the law relating to the liability and/or responsibility of an owner or occupier of premises to or in relation to licensees and/or invitees.

- Accredited Service Providers agree to safeguard any person who may accompany them or be under their control or direction and shall acquaint any such person with the terms upon which admission is granted by Ausgrid to its premises or work sites.

6.7 Stainless steel bolts and set-screws – lubrication of threads

Before installation of each stainless steel bolt or set-screw, the thread shall be lubricated with specially formulated anti-seize grease containing nickel which is available on Ausgrid stockcode 177212. Equivalent anti-seize grease containing nickel may be used but must be submitted to Ausgrid for approval first. Care shall be exercised to prevent the anti-seize grease from contaminating the interface of the electrical contact surfaces. Any excess of anti-seize grease shall be removed using a clean dry cloth after the bolt or set-screw has been installed.

6.8 Commissioning of joints

Before commissioning of joints the requirements mentioned in NS130 must be met.

In addition, taped joints as detailed in Sections 21.0 and 22.0 of this Network Standard shall not be commissioned before the joint filling and troughing-in compounds have set.

All completed joints and associated cable installations shall be tested prior to commissioning in accordance with the requirements of NS161.

6.9 Field book recordings

Information regarding the construction, modification, repair, and/or retirement of Ausgrid's network assets must be recorded in accordance with NS100. These records must be submitted to the Data Maintenance team in accordance with NS100.

7.0 PRODUCT SPECIFIC TRAINING

Installation of product on Ausgrid's network by installers who have not been product specific trained and deemed competent is not permissible. It is a mandatory requirement that installers of products detailed in this Network Standard are trained, assessed and deemed competent in the installation of each product they will be installing. The training shall be product specific and be conducted by the product manufacturer, authorised product agent or a registered training organisation.

Product agents and registered training organisations not suitability qualified to deliver the training will not be acceptable. The training provider shall provide the installer with evidence that the training has been satisfactorily completed. Ausgrid may request installers to produce evidence of product specific training.

The following items are exempt from product specific training:

- TE Connectivity Insulating Bushing Boot Part No RCAB 4110, (stockcode 178421).
- TE Connectivity Insulating Bushing Boot Part No RCAB 4120, (stockcode 177136).
- ABB Inline Insulation Boot for ABB Safelink Part No TB-A-EA, (stockcode 180423).

8.0 CONSTRUCTION OF UNDERGROUND TO OVERHEAD (UGOH) CABLE TERMINATIONS

8.1 Requirements

This specification provides the requirements for the construction of 11kV underground-to-overhead (UGOH) paper insulated lead covered (PILC) cable terminations. This specification shall be read in conjunction with the installation instruction included in the outdoor termination kits.

There are two types of 11kV underground-to-overhead (UGOH) cable terminations, they are single core and multicore. The single core cable termination is used for terminating 500 mm^2 multicore cables by constructing a three-to-one joint approximately 3 metres away from the foot of the UGOH pole; or when a UGOH termination is to be constructed within 25 metres of the substation it is supplying. The multicore cable termination is for terminating multicore cables less than 500 mm^2.

The construction of pole mounted 11kV underground-to-overhead (UGOH) cable terminations must be completed to the requirements of Ausgrid Drawing 160354 11kV Underground to Overhead (UGOH) Construction.

The cables must be erected on the side of the pole away from oncoming traffic (except where there are problems such as a driveway or underground obstructions).

Where the overhead conductors and underground cables are on opposite sides of the UGOH structure, the Alternative HV Overhead Arrangement detailed in Ausgrid Drawing 160354 shall be used. Where any other arrangement is proposed for specific site conditions, approval must be sought from Ausgrid. Approval may be given for the individual project if no alternative designs in accordance with Ausgrid Drawing 160354 are possible.

Under no circumstances shall the cable be wrapped 180° from one side of the pole to the other. Rotation from one face to another through 90° will only be allowed following approval from Ausgrid if no alternative options exist. This may require taller poles to ensure the minimum bending radius of the cable is not compromised.

The cable shall not be bent tighter than the manufacturer's specified minimum internal bending radius, while it is being set in position.

The erection and termination of the cable on the pole shall be completed together wherever possible to minimise the number of outages required. Where it is intended to terminate the UGOH cable at a later date, the cable shall:

- Be cut long enough to allow construction of the termination at the correct height. This would normally require the cable to extend 300mm above the UGOH support bracket. Above ground joints on UGOH cables are not allowed.
- Be shorted and sealed in accordance with the requirements of NS130.
- Be securely saddled to the pole. The cable shall not be coiled or excessively bent - refer to the manufacturer's specification for minimum internal bending radius.
- Be protected from physical damage or vandalism by installing two lengths of steel cable covers as per Ausgrid Drawing 160354.
- Have sufficient electrical clearance from the overhead mains if these mains are intended to be energised before the cable termination is completed.

Where the UGOH cable has been terminated onto the termination plate but is not to be immediately connected to the overhead mains, the UGOH cable must be short circuited and earthed. Insulated black cable of not less than 25mm^2 copper, lugged with M12 stud hole lugs is to be used. These connections are to be made between the top of the termination plates and the surge arrester earth bar.

Where an earth fault indicator (EFI) is required to be installed on UGOH cable, the pole must be appropriately dressed to suit the current transformer (CT) before the cable is erected on the pole. Refer to Ausgrid Drawing 31318 for details on the installation of an Earth Fault Indicator.

The earth down lead must be kept clear of all metalwork, braces, coach screws, etc, on the pole.

Where alterations to an existing UGOH pole construction is proposed as part of contestable design works, Ausgrid shall first be consulted to undertake a technical assessment to determine the suitability of the proposed UGOH alterations.

8.2 Animal proofing of UGOHs

Animal proofing of UGOHs shall be done in accordance with Ausgrid Drawing 160354. For old porcelain surge arresters without covers, a suitable cover is available on stockcode 176942.

8.3 Sub-transmission poles and UGOHs

11kV UGOHs must never be constructed on concrete or steel poles which also carry sub-transmission (i.e. 33kV, 66kV or 132kV) mains. This is due to the transferred voltage and earth potential rise hazards associated with faults on the sub-transmission mains which may affect the 11kV mains. Refer to Clause 7.6.2 of NS260 for requirements associated with timber poles. The requirements of Clause 7.6.2 also applies to 11kV UGOHs due to the interconnected nature of 11kV and LV earthing systems.

9.0 GLAND ENTRY TRANSFORMER CABLE TERMINATION (HV1-20)

Note: Heatshrink glands must not be used on gland entry transformers, as there are no suitable heatshrink glands currently available for an oil vapour environment. Brass glands must be used, in accordance with the following diagram.

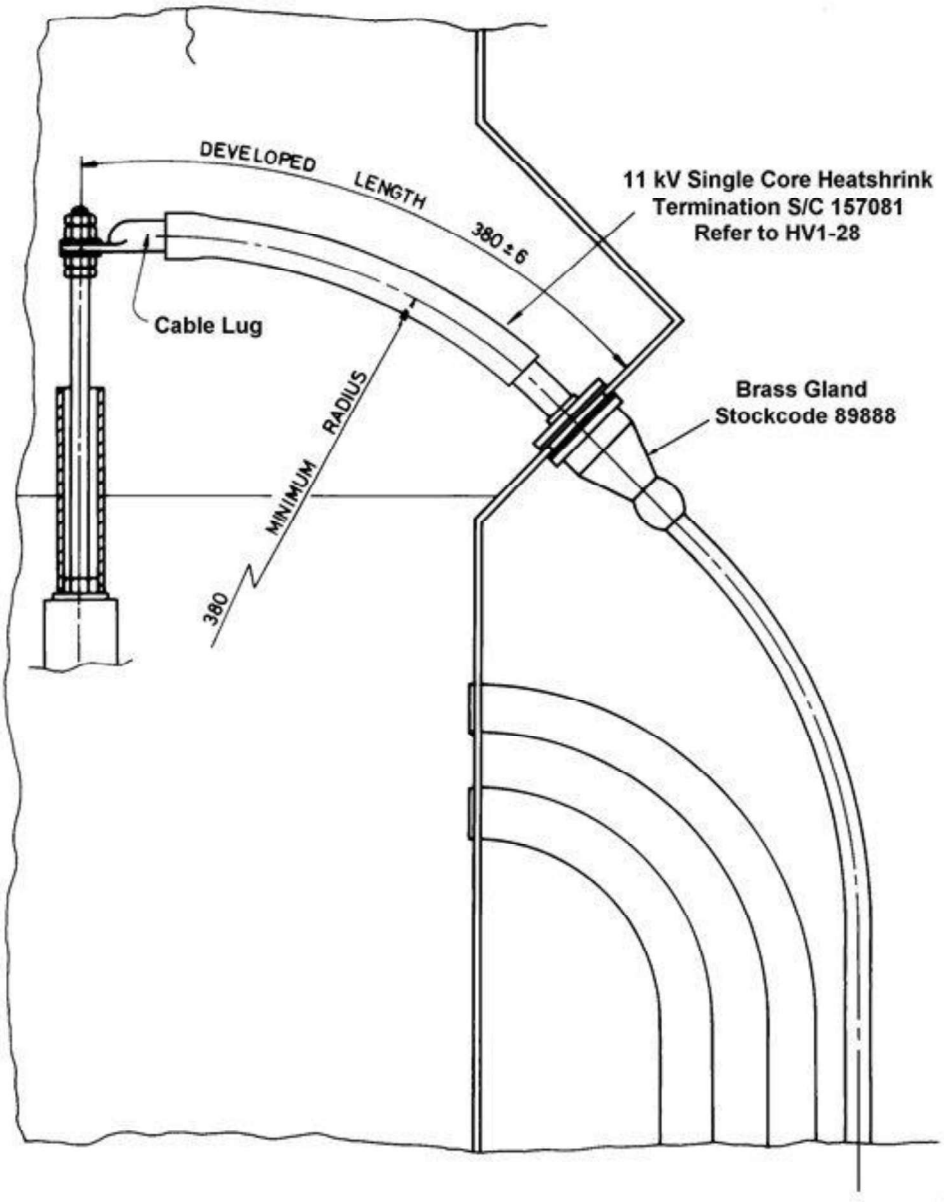


Figure 1 Gland entry transformer cable terminations

9.1 Gland isolation for gland entry transformer terminations

All new terminations on gland entry transformers shall provide gland isolation.

Gland isolation kits are available on stockcode 91835 and brass glands are available on stockcode 89888.

Note: The gland isolation kit will cater for only one gland.

By ordering (1) X 91835 and (1) X 89888 the components depicted below will be supplied.

9.1.1 Gland isolation installation

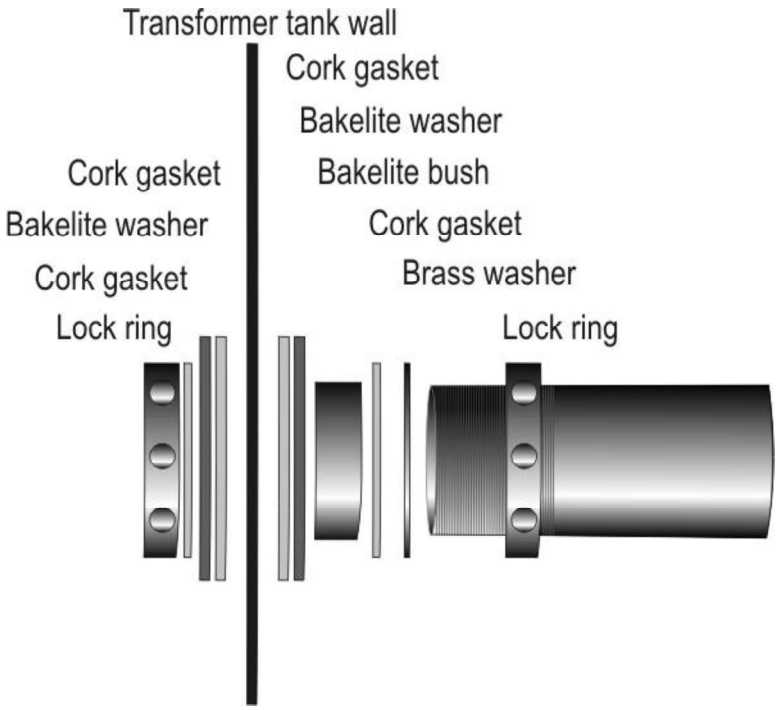


Figure 2 Gland isolation for gland entry transformer terminations

10.0 CABLE TERMINATION FOR DISTRIBUTION TRANSFORMER ENDBOX

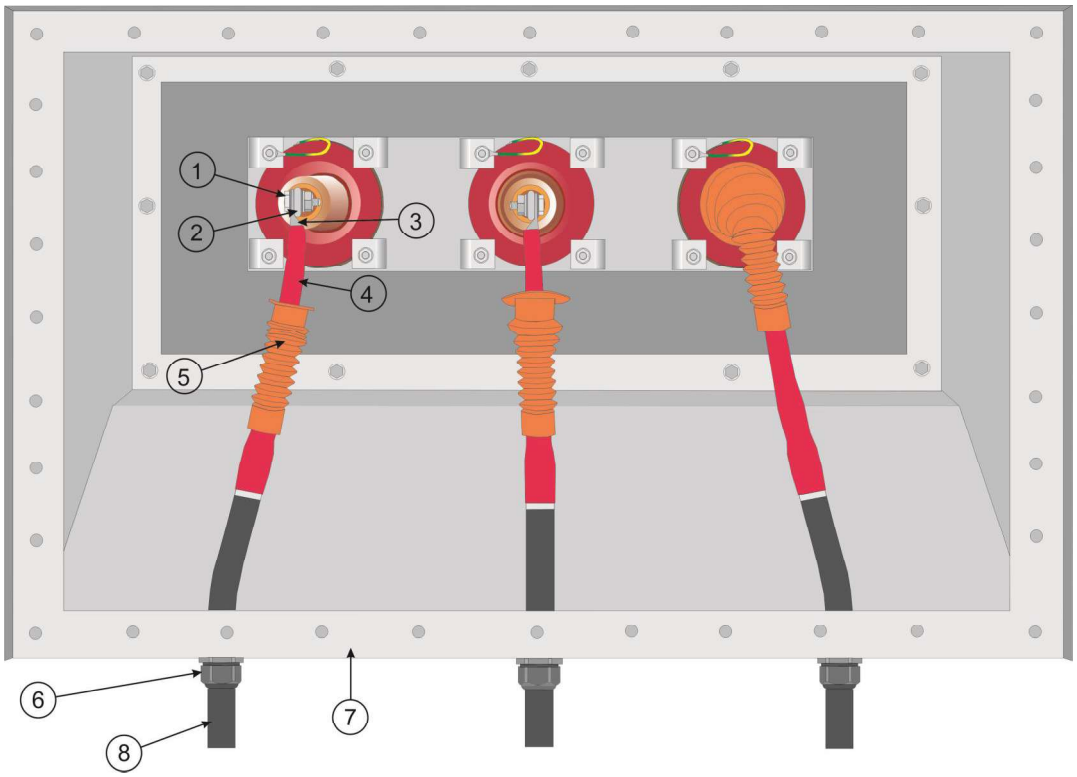


Figure 3 Distribution Transformer Cable Termination

Table 1 – Material List for Distribution Transformer Endbox Cable Termination

Item	Description	Qty	Stockcode
1	M12 x 30mm stainless steel bolt, M12 stainless steel nut, 2 x M12 stainless steel flat washers, M12 stainless steel spring washer	3	175911
2	Universal screw lug	3	180401
3	95mm^2 Phase core lug	3	175531
4	95mm^2 Single Core Termination kit	1	175341
5	Insulating Sleeve (kit contains three sleeves)	1	177136
6	Cable glands	3	118125
7	Transformer endbox	1	181253
8	95mm^2 Single Core PILC Cable	As required	1313

Notes: Cable glands are to be installed before making the actual termination. Insulating sleeve shall be installed in accordance with installation instruction EPP-0757-8/00. Prior to terminating the transformer tails, ensure that the universal screw and lock nut are tight.

11.0 INDOOR TERMINATIONS (HV1-41 FOR SINGLE CORE CABLES, HV1-43 FOR MULTICORE CABLES)

11.1 Introduction

This specification provides the requirements for constructing pressure sealing terminations on indoor 11kV single core and multicore paper insulated, screened, metal sheathed, polymeric oversheathed armoured and unarmoured cables.

The design of this termination is such that it is capable of withstanding high internal pressures.

11.2 Approved termination kits

Ausgrid's stockcodes of approved indoor pressure sealing cable terminations are provided in the table below.

Table 2 – Approved indoor cable termination kits

Kit Description	Stockcode
3 x single core indoor heatshrink termination kit (including earthing) suitable for 11kV 95mm² - 194mm² paper insulated, screened, lead sheathed, polymeric oversheathed cables	185028
3 x single core indoor heatshrink termination kit (including earthing) suitable for 11kV 240mm² - 323mm² paper insulated, screened, lead sheathed, polymeric oversheathed cables	185029
3 x single core indoor heatshrink termination kit suitable for 11kV 400mm² - 630mm² paper insulated, screened, lead sheathed, polymeric oversheathed cables (refer to note below regarding earthing)	Buy in from TE Connectivity Part No EPKT-SY393
3 x single core indoor heatshrink termination kit suitable for 11kV 645mm² (1inch²) - 1000mm² paper insulated, screened, lead sheathed, polymeric oversheathed cables (refer to note below regarding earthing)	Buy in from TE Connectivity Part No EPKT-SY394
Multicore indoor heatshrink termination kit (including earthing) suitable for 11kV 95mm² - 194mm² paper insulated, screened, lead sheathed, polymeric oversheathed armoured and unarmoured cables	H102178
Multicore indoor heatshrink termination kit (including earthing) suitable for 11kV 240mm² - 300mm² paper insulated, screened, lead sheathed, polymeric oversheathed armoured and unarmoured cables	H109413

Note: Where earthing kits are required for transformer tails or bus-tie cables, buy-in from TE Connectivity Part No SMOE-SY395 and specify the earth braid length required.

11.3 Cable lugs

The lugs shall be of the compression lug type and must have sealed palms and barrels (except for the cable entry end). Compression lugs must be installed in strict compliance with the manufacture's recommendations for crimping dies, and the number and position of crimps.

Ausgrid's stockcodes of approved lugs are provided in the table below.

Table 3 – Ausgrid approved lugs

	Stockcode of Crimp Lugs for Indoor Terminations	
Cable Size	**Copper Cables**	**Aluminium Cables**
95 mm²	175531	H102442
185 mm²	175532	57927
240 mm²	175533	H107706
300 mm²	175534	57687
630 mm²	182156	-
1000 mm²	182154	-

11.4 Requirements

The following requirements must be satisfied when constructing indoor pressure sealing terminations:

- The cables must not be bent tighter than the manufacturers' specified minimum internal bending radius during the termination process or after they have been set in position.
- The termination shall be constructed in accordance with the installation instruction supplied in the termination kit.
- The termination kit contents and the prepared cable ends must be kept free of foreign matter, and must not be damaged during the termination process.
- No jagged edges shall be left on terminated screen papers.
- All components involved in the termination (including cable components) which will come into contact with either mastic tape or adhesive sealants must be thoroughly cleaned prior to the application of such sealing agents. Cleaning must only be done using lint-free cloth.
- Heatshrink tubings must be properly and evenly shrunk, free of voids, and must not be damaged due to overheating. Heatshrink components with adhesive sealant coatings must provide effective sealing against moisture ingress when installed.

11.5 Earth fault indicator (EFI) CT support bracket

Some of the designs for indoor heatshrink terminations utilised wiped copper bangles for earthing of the cable sheaths. These bangles were also used to support EFI CTs where appropriate. The single core termination design incorporates the use of roll springs and copper braids for earthing, but is not suitable for supporting the EFI CTs. To support the EFI CT, a cable mounting bracket is installed on each of the outer single core cables, with the EFI CT resting on top of the mounting brackets (refer to Figure 4 below). The cable mounting brackets are available on stockcode 177066 for 95 mm^2 PILC cables, and stockcode 177067 for 185 mm^2 to 300 mm^2 PILC cables.

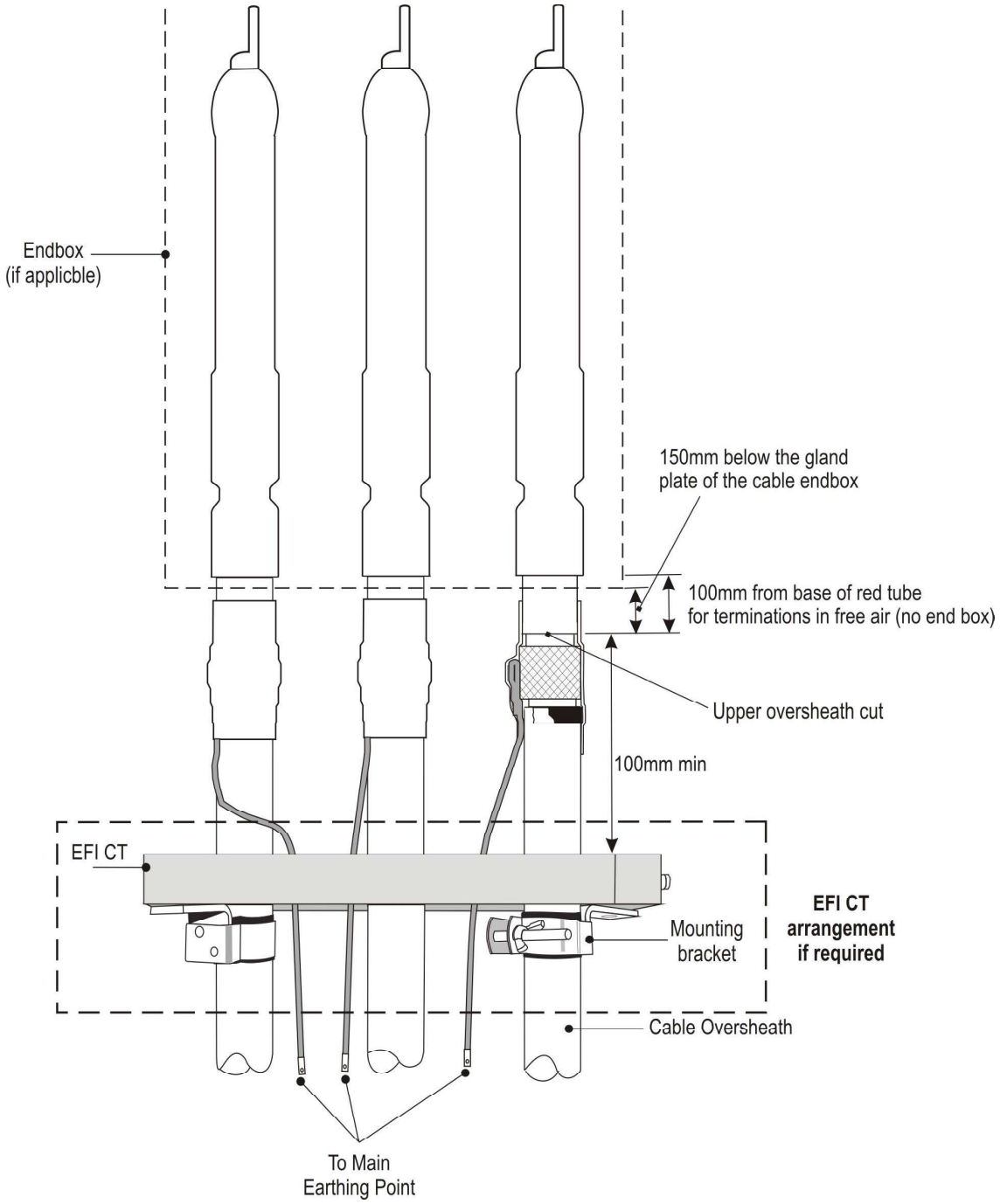


Figure 4 EFI CT Arrangement If Required

12.0 OUTDOOR TERMINATIONS (HV1-42 FOR SINGLE CORE CABLES, HV1-44 FOR MULTICORE CABLES)

12.1 Introduction

This specification provides the requirements for constructing pressure sealing terminations on outdoor 11kV single core and multicore paper insulated, screened, metal sheathed, polymeric oversheathed armoured and unarmoured cables. This specification shall be read in conjunction with Section 8 (Construction of Underground to Overhead (UGOH) PILC Cable Terminations).

The design of this termination is such that it is capable of withstanding high internal pressures.

12.2 Approved termination kits

Ausgrid's stockcodes of approved outdoor pressure sealing cable terminations are provided in the table below.

Table 4 – Approved outdoor cable termination kits

Kit Description	Stockcode
3 x single core outdoor heatshrink termination kit (including earthing) suitable for 11kV 95mm² - 194mm² paper insulated, screened, lead sheathed, polymeric oversheathed cables	185030
3 x single core outdoor heatshrink termination kit (including earthing) suitable for 11kV 240mm² - 323mm² paper insulated, screened, lead sheathed, polymeric oversheathed cables	185031
3 x single core outdoor heatshrink termination kit suitable for 11kV 400mm² - 630mm² paper insulated, screened, lead sheathed, polymeric oversheathed cables (refer to note below regarding earthing)	Buy in from TE Connectivity Part No EPKT-SY390
3 x single core outdoor heatshrink termination kit suitable for 11kV 645mm² (1inch²) - 1000mm² paper insulated, screened, lead sheathed, polymeric oversheathed cables (refer to note below regarding earthing)	Buy in from TE Connectivity Part No EPKT-SY391
Multicore outdoor heatshrink termination kit (including earthing) suitable for 11kV 35mm² - 70mm² paper insulated, screened, lead sheathed, polymeric oversheathed armoured and unarmoured cables	H95679
Multicore outdoor heatshrink termination kit (including earthing) suitable for 11kV 95mm² - 194mm² paper insulated, screened, lead sheathed, polymeric oversheathed armoured and unarmoured cables	H95687
Multicore outdoor heatshrink termination kit (including earthing) suitable for 11kV 240mm² - 300 mm² paper insulated, screened, lead sheathed, polymeric oversheathed armoured and unarmoured cables	H109439

Note: Where earthing kits are required for transformer tails or bus-tie cables, buy-in from TE Connectivity Part No SMOE-SY395 and specify the earth braid length required.

12.3 Cable lugs

The lugs shall be of the compression lug type and must have sealed palms and barrels (except for the cable entry end). Compression lugs must be installed in accordance with the manufacture's recommendations for crimping dies, number of crimps and position of crimps.

Ausgrid's stockcodes of approved lugs are provided in the table below.

Table 5 – Ausgrid approved lugs

	Stockcode of Crimp Lugs for Outdoor Terminations	
Cable Size	**Copper Cables**	**Aluminium Cables**
95 mm²	151050	H102442
185 mm²	90183	57927
240 mm²	See Note 1	H107706
300 mm²	57695	57687
630 mm²	182156	-
1000 mm²	182154	-

Note:
1. Buy in from TE Connectivity Part No H16036 or from Legend Power Systems Part No CAL240LB-12.

12.4 Requirements

The following requirements must be satisfied when constructing outdoor pressure sealing terminations:

- The cables must not be bent tighter than the manufacturers' specified minimum internal bending radius during the termination process or after they have been set in position.
- The termination shall be constructed in accordance with the installation instruction supplied in the termination kit.
- The termination kit contents and the prepared cable ends must be kept free of foreign matter, and must not be damaged during the termination process.
- No jagged edges shall be left on terminated screen papers.
- All components involved in the termination (including cable components) which will come into contact with either mastic tape or adhesive sealants must be thoroughly cleaned prior to the application of such sealing agents. Cleaning must only be done using lint-free cloth.
- Heatshrink tubings must be properly and evenly shrunk, free of voids, and must not be damaged due to overheating. Heatshrink components with adhesive sealant coatings must provide effective sealing against moisture ingress when installed.
- The earth braids used on outdoor terminations must be covered.

13.0 TRANSFORMER HEATSHRINK TERMINATION SINGLE-CORE, PAPER-INSULATED CABLES (HV1-28)

13.1 Introduction

This specification provides the details for heatshrink terminations on 11kV 95mm^2, single-core, paper-insulated, metal-sheathed cables.

The termination is suitable for installation above the oil inside the tank of gland-entry transformers.

13.2 Approved transformer termination kits

Currently, the only approved supplier of heatshrink termination kits suitable for this application is TE Connectivity, in accordance with the technical kit specification for the stockcode listed below. Other termination kit designs or other suppliers for similar designs must not be used unless specifically approved by Ausgrid.

Table 6 – Single core transformer termination kits

Kit Description	Kit Stockcode
3 x single core cable heatshrink terminations suitable for 95mm^2 screened paper insulated cables	157081

13.3 Cable lugs

The lugs shall be of the compression lug type and must have sealed palms and barrels (except for the cable entry end). The barrels of the lugs must be long enough to allow the outer heatshrink tubing of the termination to overlap them by a minimum of 50mm. Compression lugs must be installed in accordance with the manufacture's recommendations for crimping dies, number of crimps and position of crimps.

Table 7 – Ausgrid approved lugs

Cable Size	Stockcode of Crimp Lugs for Copper Cables
95mm^2	151050

13.4 Requirements

The following requirements must be satisfied when constructing heatshrink cable terminations inside transformer tanks:

- The termination shall be constructed in accordance with the installation instruction supplied in the kit.
- The termination kit contents and the prepared cable ends must be kept free of foreign matter, and must not be damaged during the termination process.
- The transformer oil must not be contaminated with foreign matter during the termination process.
- The cables and their individual cores must not be bent tighter than the manufacturers' specified minimum internal bending radius, either during the termination process or after they have been set in position.
- No jagged edges shall be left on terminated screen papers.
- Lugs must be preheated prior to installation.

- All components involved in the termination (including cable components) which will come into contact with either mastic tape or adhesive sealants must be thoroughly cleaned prior to the application of such sealing agents. Cleaning must only be done using lint-free cloth.
- Heatshrink tubings must be properly and evenly shrunk, free of voids, and must not be damaged due to overheating. Heatshrink components with adhesive sealant coatings must provide effective sealing against moisture ingress when installed.
- The outer heatshrink tubing must overlap the barrel of the lug by a minimum of 50mm.

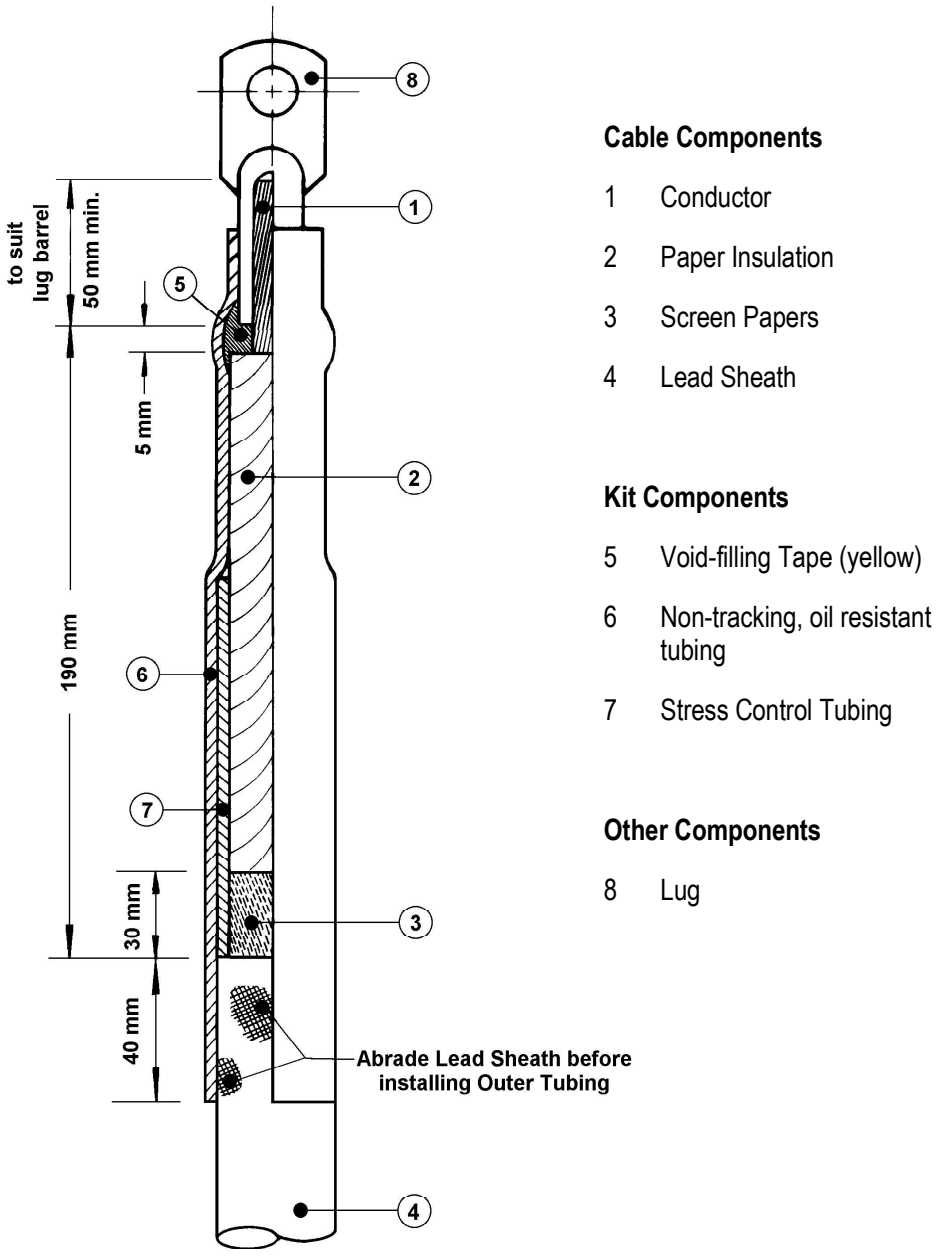


Figure 5 TE Connectivity Heatshrink Termination for Installation Inside Transformer Tanks

This design has been replaced by the installation instruction included in the termination kit and shall be used for reference purposes only.

14.0 SINGLE CORE TERMINATION IN COMPOUND FILLED ENDBOXES (HV1-1)

14.1 Introduction

This specification provides the requirements for constructing taped terminations on single core paper insulated, screened, metal sheathed, polymeric oversheathed cables for installation into a compound filled endbox.

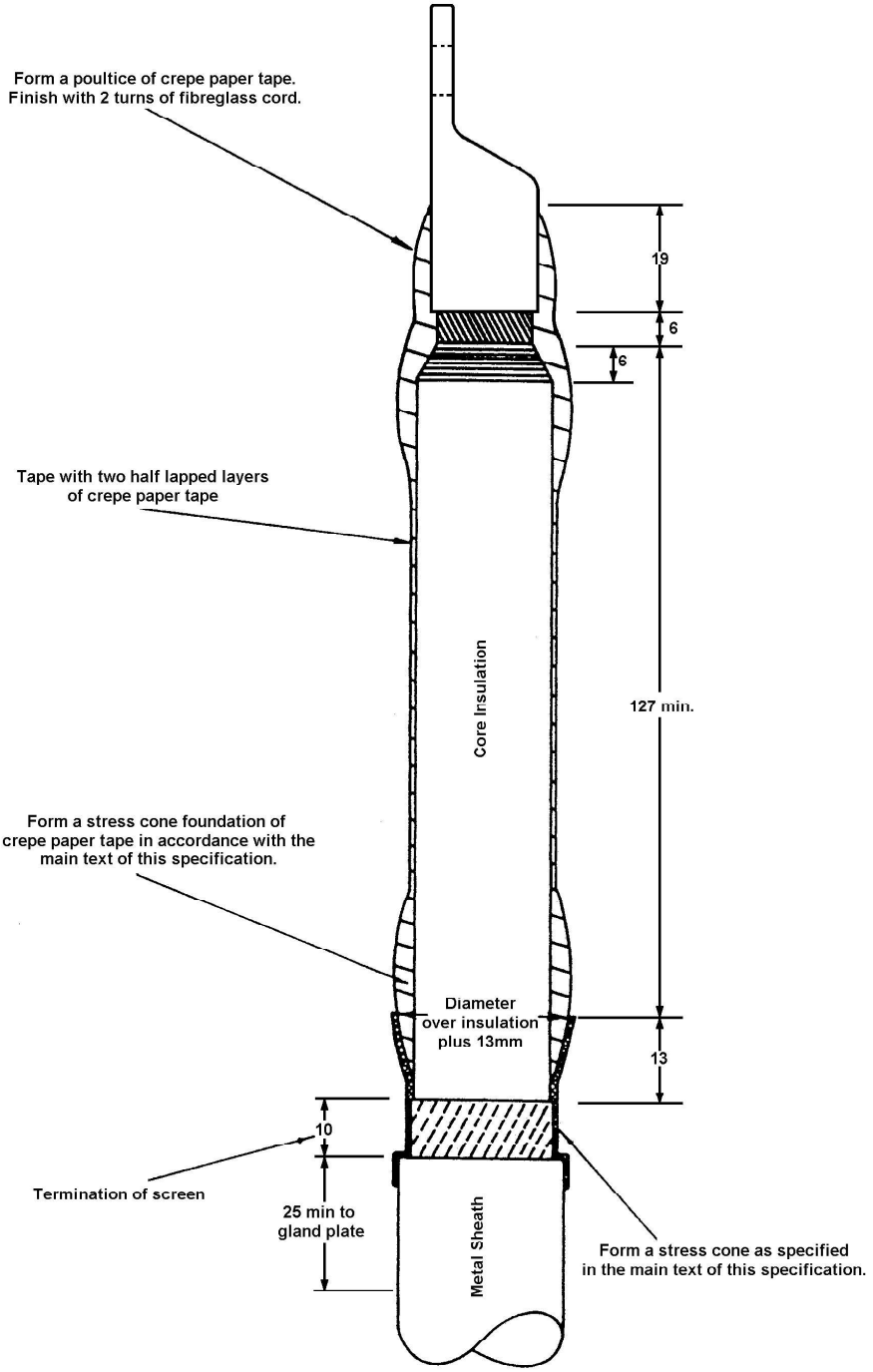


Figure 6 Taped Termination for Installation inside a compound filled end box

14.2 Paper insulation and insulating tapes

The paper insulation must be tapered over a 6 mm length as shown in Figure 6. The full length of exposed paper insulation, including the tapered section, must be free of dust and moisture, and must not be touched with bare hands.

The crepe paper insulating tapes approved by Ausgrid for 11kV terminations are impregnated with rosin/oil compound and packed in sealed tins. Tins of insulating tapes must be examined prior to opening. If a tin is damaged or any compound leakage is evident, the contents must not be used.

Tins must not be opened until the tapes are ready to be used. Insulating tapes must be tested for moisture content before they are used. Tapes which appear to contain any amount of moisture must not be used.

Insulating tapes must be applied with an overlap of approximately 50% either direct from the roll or from a former. Surplus tapes must be discarded - **they must never be used.**

Ausgrid's stockcodes of approved crepe paper insulating tapes are provided in the table below.

Table 8 – Approved crepe paper tapes

Details	Stockcode
Tin of crepe paper rolls each containing: 18 rolls x 50mm wide, 8 rolls x 20mm wide, and 8 rolls x 10mm wide. All rolls are 35mm OD x 3m long	58024
Tin of crepe paper rolls each containing: 25 rolls x 50mm wide, 8 rolls x 20mm wide, and 4 rolls x 10mm wide. All rolls are 35m OD x 3m long	76018

14.3 Stress cones

The construction of the stress cone shall comply with the following requirements:

(a) The screens must be removed to 10mm from the metal sheath cut. Where carbon impregnated paper is used as a screen, the outer layer of paper insulation must also be removed to the metal sheath cut.

(b) Two half lapped layers of crepe paper tape must be applied to the exposed core paper insulation following the same direction of lay as the core paper insulation.

(c) A stress cone foundation must be built using crepe paper tape. The foundation must start at the end of the screen, and must gradually reach a maximum diameter of 13mm larger than the diameter of the core insulation. The maximum diameter must occur 13mm from the end of the screen.

(d) A half lapped layer of tinned copper mesh (25 mm wide, stockcode 67074) must be applied over the stress cone foundation starting onto the metal sheath. The mesh must be stretched to less than half its width while it is being applied.

(e) The tinned copper mesh must be soldered to the metal sheath, and the return spiral must be tack soldered to the stress cone.

(f) Any sharp projections must be smoothed off. Any metal dust resulting from this operation must be carefully removed.

15.0 POT END (LIVE END SEAL) SINGLE-CORE, PAPER-INSULATED CABLES (HV1-35)

15.1 Introduction

This specification provides the requirements for a pot end (live end seal) termination on 11kV, single-core, paper-insulated, screened, metal sheathed, polymeric oversheathed cables.

15.2 Using pot ends (live end seals)

Pot ends (live end seals) shall only be used for maintaining the existing network (e.g. decommissioning a section of 11kV cable) and must not be used on newly installed cables or network extensions such as staged subdivisions.

Where pot ends are to be used, they shall only be installed on cables:-

- where it is possible to visually trace the entire length of cable from the pot end to the source of supply, or;
- where it is possible to visually trace the entire length of cable from the pot end to the tee joint to which the pot ended section of cable is connected. Additionally, it shall be possible to identify the cables connected to the other two legs of the tee joint using cable identification equipment.

When pot ends are to be direct buried, the pot end shall be located as close as practicable to either:

- the source of supply, or
- the tee joint to which the pot ended section of cable is connected.

This requirement is to minimise future civil works for the purposes of cable identification.

If it is intended to join cable to the pot ended section of cable in the future, sufficient cable length shall be left to allow for the pot end to be replaced with a straight through joint.

15.3 Approved pot end kits

Table 9 – Single core pot end kits

Cable Range	Kit Stockcode
95 mm^2 to 194 mm^2	157065
300 mm^2 to 323 mm^2	152124

15.4 Requirements

The following requirements must be satisfied when constructing heatshrink cable pot ends:

- The single core pot end shall be constructed in accordance with the installation instruction supplied in the kit.
- The termination kit contents and the prepared cable ends must be kept free of foreign matter, and must not be damaged during the termination process.
- The cable must not be bent tighter than the manufacturers' specified minimum internal bending radius, either during the termination process or after it has been set in position.
- No jagged edges shall be left on terminated screen papers.

- All components involved in the termination (including cable components) which will come into contact with either mastic tape or adhesive sealants must be thoroughly cleaned prior to the application of these sealing agents. Cleaning must only be done using lint-free cloth.
- Heatshrink tubings must be properly and evenly shrunk, free of voids, and must not be damaged due to overheating. Heatshrink components with adhesive sealant coatings must provide effective sealing against moisture ingress when installed.
- The outer heatshrink tubing must overlap the cable oversheath by a minimum of 100 mm.
- The completed termination must be allowed to cool before applying mechanical load to it.
- The completed joint if direct buried, shall be surrounded in soft bedding material up to a depth of 100mm above the joint. The bedding material must comply with the requirements of NS130.

16.0 POT END (LIVE END SEAL) MULTICORE, PAPER-INSULATED CABLES (HV1-36)

16.1 Introduction

This specification provides the requirements for a pot end (live end seal) termination on 11 kV, multicore, paper-insulated, screened, metal sheathed, polymeric oversheathed armoured and unarmoured cables.

16.2 Using pot ends (live end seals)

Pot ends (live end seals) shall only be used for maintaining the existing network (e.g. decommissioning a section of 11kV cable) and must not be used on newly installed cables or network extensions such as staged subdivisions.

Where pot ends are to be used, they shall only be installed on cables:-

- where it is possible to visually trace the entire length of cable from the pot end to the source of supply, or;
- where it is possible to visually trace the entire length of cable from the pot end to the tee joint to which the pot ended section of cable is connected. Additionally, it shall be possible to identify the cables connected to the other two legs of the tee joint using cable identification equipment.

When pot ends are to be direct buried, the pot end shall be located as close as practicable to either:

- the source of supply, or
- the tee joint to which the pot ended section of cable is connected.

This requirement is to minimise future civil works for the purposes of cable identification.

If it is intended to join cable to the pot ended section of cable in the future, sufficient cable length shall be left to allow for the pot end to be replaced with a straight through joint.

16.3 Approved pot end kits

Table 10 – Multicore pot end kits

Cable Range	Kit Stockcode
95 mm^2 to 194 mm^2	152140
300 mm^2 to 323 mm^2	152157

16.4 Requirements

The following requirements must be satisfied when constructing heatshrink cable pot ends:

- The multicore pot end shall be constructed in accordance with the installation instruction supplied in the kit.
- The termination kit contents and the prepared cable ends must be kept free of foreign matter, and must not be damaged during the termination process.
- The cable cores must not be bent tighter than the manufacturers' specified minimum internal bending radius, either during the termination process or after it has been set in position.
- No jagged edges shall be left on terminated screen papers.

- All components involved in the termination (including cable components) which will come into contact with either mastic tape or adhesive sealants must be thoroughly cleaned prior to the application of these sealing agents. Cleaning must only be done using lint-free cloth.
- Heatshrink tubings must be properly and evenly shrunk, free of voids, and must not be damaged due to overheating. Heatshrink components with adhesive sealant coatings must provide effective sealing against moisture ingress when installed.
- The outer heatshrink tubing must overlap the cable oversheath by a minimum of 100 mm.
- The completed termination must be allowed to cool before applying mechanical load to it.
- The completed joint if direct buried, shall be surrounded in soft bedding material up to a depth of 100mm above the joint. The bedding material must comply with the requirements of NS130.

17.0 STRAIGHT THROUGH JOINT SINGLE-CORE, PAPER-INSULATED CABLES (HV2-2)

17.1 Introduction

This specification provides the requirements for a straight through heatshrink joint on 11kV single-core, paper-insulated, screened, metal-sheathed, polymeric oversheathed cables.

17.2 Approved joint kits

Table 11 – Straight through joint kits for single core cables

Single Core Cable Sizes		Joint Kit Stockcode	Connector Stockcode
95mm^2 Cu	95mm^2 Cu	90316	150268
120mm^2 Cu	120mm^2 Cu	90316	57141
185mm^2 Cu	185mm^2 Cu	90316	150250
300mm^2 Cu	300mm^2 Cu	148155	80929
300mm^2 Al	300mm^2 Al	148155	148320

Table 12 – Joint kit cable range

Cable Range	Kit Stockcode
95mm^2 to 185mm^2	90316
300mm^2	148155

The outer tubing of 300 mm^2 cable joint kits shall be replaced with a reinforced wrap-around sleeve (stockcode 148395) for all joints which are made in pits within the Sydney CBD, and for joints made in pits outside the Sydney CBD where they would be subject to regular disturbance.

17.3 Core connectors

The core connectors used shall be of the compression type and the connector material shall match the conductor material on which it is to be used; i.e. for copper cables the connectors shall be copper, and for aluminium cables the connectors shall be aluminium. For transition joints from copper to aluminium, the connectors shall be of the bi-metal type. For size transition joints the connectors shall match both the transition sizes and the conductor materials. All compression connectors shall be of the blocked type. Compression connectors must be installed in accordance with the manufacturer's recommendations for crimping dies, number of crimps, and position of crimps. Installed connectors shall not diminish either the load current carrying capacity or the fault current carrying capacity of the jointed cables.

17.4 Earth continuity

Joints shall have tinned copper sheath continuity braids installed with earth fault current capacities matching those of the cables being jointed. The minimum cross sectional area of the braids shall be:

- 25mm^2 for 95mm^2, 120 mm^2, and 185 mm^2 cables; and
- 30mm^2 for 300mm^2 cables.

Installed sheath continuity braids shall not limit the earth fault rating of the jointed cables.

17.5 Requirements

The following requirements must be satisfied when constructing heatshrink straight through joints:

- The single core straight through joint shall be constructed in accordance with the installation instruction supplied in the joint kit.
- The joint kit contents and the prepared cable ends must be kept free of foreign matter, and must not be damaged during the jointing process.
- No jagged edges shall be left on terminated screen papers.
- The metal sheath must be belled at the metal sheath cut.
- The cable cores must not be bent tighter than the manufacturers' specified minimum internal bending radius during the jointing process. The completed joint and the first 500mm of each associated cable must be straight when set in position.
- All components involved in the joint (including cable components) which will come into contact with either mastic tape or adhesive sealants must be thoroughly cleaned and degreased prior to the application of these sealing agents. Cleaning must only be done using lint-free cloth.
- Heatshrink tubings must be properly and evenly shrunk, free of voids, and must not be damaged due to overheating. Heatshrink components with adhesive sealant coatings must provide effective sealing against moisture ingress when installed.
- The outer heatshrink tubing (and the reinforced wrap-around sleeve where used) must overlap the cable oversheaths by a minimum of 100 mm each.
- The completed joint must be allowed to cool down before applying mechanical load to it.
- The completed joint if direct buried, shall be surrounded in soft bedding material up to a depth of 100mm above the joint. The bedding material must comply with the requirements of NS130.

18.0 STRAIGHT THROUGH JOINT UP TO 300MM^2 MULTICORE, PAPER-INSULATED CABLES (HV2-3)

18.1 Introduction

This specification provides the requirements for straight through heatshrink joints on 11kV multicore paper insulated, screened, metal sheathed, polymeric oversheathed, armoured and unarmoured cables. The design of the joints covered by this specification is only suitable for cables up to 300 mm^2 in cross sectional area. For joints on 300-500mm^2 cables, refer to the relevant section of this Network Standard.

18.2 Approved joint kits

Table 13 –Straight through joint kits for multicore cables up to 300mm^2

Multicore Cable Sizes				Special Joint Kit Stockcode (See Note 3)	Standard Joint Kit Stockcode (See Note 4)	Connector Stockcode
PILC	Insulation Shim Kit	PILC	Insulation Shim Kit			
50mm^2 Cu	N/A	50mm^2 Cu	N/A	-	H109496	57174
95mm^2 Cu	N/A	95mm^2 Cu	N/A	-	H109496	150268
95mm^2 Cu	See Note 5	300mm^2 Cu	N/A	-	148304	179881
185mm^2 Cu	N/A	185mm^2 Cu	N/A	148312	148304	150250
240mm^2 Al	N/A	240mm^2 Al	N/A	148312	148304	H104844
300mm^2 Cu	N/A	300mm^2 Cu	N/A	148312	148304	80929
300mm^2 Al	N/A	300mm^2 Al	N/A	148312	148304	148320

N/A – Not Applicable, means that insulation shims are not required for that particular cable size.

Table 14 – Joint kit cable range

Cable Range	Kit Stockcode
50mm^2 to 95mm^2	H109496
185mm^2 to 300mm^2	148304
185mm^2 to 300mm^2	148312

Notes:

1. The above kits do not include connectors.
2. Insulation shim kits consist of tubings that are used to build up the diameter of the cable cores to suit the base kit.
3. The special kit has a re-enforced wrap-around outer sleeve for environmental protection in lieu of the standard tubular sleeves. It shall be used in pits and other open space installations where joints are likely to be physically disturbed and/or where they are not given adequate side support.
4. The standard kit has two tubular outer sleeves for environmental protection. It shall be used where joints are intended to be buried, and in open space installations where joints are given adequate side support and where they are not likely to be physically disturbed while in service.
5. For a 95mm^2 multicore to 300mm^2 multicore straight through joint an additional shim kit is required for the 95mm^2 cable in addition to the base kit and is available direct from TE Connectivity by quoting Part No EFSJ-SP4.

18.3 Core connectors

The core connectors used shall be of the compression type and the connector material shall match the conductor material on which it is to be used; i.e. for copper cables the connectors shall be copper, and for aluminium cables the connectors shall be aluminium. For transition joints from copper to aluminium, the connectors shall be of the bi-metal type. For size transition joints the connectors shall match both the transition sizes and the conductor materials. All compression connectors shall be of the blocked type. Compression connectors must be installed in accordance with the manufacturer's recommendations for crimping dies, number of crimps, and position of crimps. Installed connectors shall not diminish either the load current carrying capacity or the fault current carrying capacity of the jointed cables.

18.4 Earth continuity

The metal sheaths of jointed cables shall be made continuous by joining them with tinned copper braids of the appropriate size. The installed braids on each joint shall collectively have a one second earth fault current carrying capacity matching that of the cables being jointed. Where the cables being jointed vary in size, the larger cable shall be used to determine the appropriate size of braids to be used.

The minimum total cross sectional area of the copper braids used shall be:

- 43 mm^2 for 95 mm^2 multicore cables;
- 62 mm^2 for 185 mm^2 multicore cables;
- 72 mm^2 for 240 mm^2 multicore cables; and
- 85 mm^2 for 300 mm^2 multicore cables.

Tinned copper braids shall be attached either by wiping or by means of approved mechanical connectors. Installed sheath continuity braids shall not limit the earth fault rating of the jointed cables.

18.5 Requirements

The following requirements must be satisfied when constructing heatshrink straight through joints:

- The straight through joint shall be constructed in accordance with the installation instruction supplied in the joint kit.
- The joint kit contents and the prepared cable ends must be kept free of foreign matter, and must not be damaged during the jointing process.
- No jagged edges shall be left on terminated screen papers.
- The metal sheath must be belled at the metal sheath cut.
- The cable cores must not be bent tighter than the manufacturers' specified minimum internal bending radius during the jointing process. The completed joint and the first 500 mm of each associated cable must be straight when set in position.
- All components involved in the joint (including cable components) which will come into contact with either mastic tape or adhesive sealants must be thoroughly cleaned and degreased prior to the application of these sealing agents. Cleaning must only be done using lint-free cloth.
- Heatshrink tubings must be properly and evenly shrunk, free of voids, and must not be damaged due to overheating. Heatshrink components with adhesive sealant coatings must provide effective sealing against moisture ingress when installed.
- The outer heatshrink tubings (and the reinforced wrap-around sleeve where used) must overlap the cable oversheaths by a minimum of 100 mm. Where standard heatshrink kits are used, the outer tubular sleeves must also overlap each other by a minimum of 100 mm.
- The completed joint must be allowed to cool down before applying mechanical load to it.
- The completed joint if direct buried, shall be surrounded in soft bedding material up to a depth of 100mm above the joint. The bedding material must comply with the requirements of NS130.

19.0 STRAIGHT THROUGH JOINT MULTICORE, PAPER-INSULATED CABLES 300MM^2 TO 500MM^2 (HV2-4)

19.1 Introduction

This specification provides the requirements for straight through heatshrink joints on 11kV multicore paper insulated, screened, metal sheathed, polymeric oversheathed, armoured and unarmoured cables. The design of the joint covered by this specification is only suitable for 500mm^2 cables. For joints on cables up to 300mm^2 in cross sectional area, refer to the relevant section of this Network Standard.

19.2 Approved joint kits

Table 15 – Straight through joint kits for 500mm^2 multicore cables

Multicore Cable Sizes					
PILC	Insulation Shim Kit	PILC	Insulation Shim Kit	Base Kit Stockcode	Connector Stockcode
500 mm^2 Al	N/A	300 mm^2 Cu	177894	152884	152603
500 mm^2 Al	N/A	500 mm^2 Al	N/A	152884	176372

N/A – Not Applicable, means that insulation shims are not required for that particular cable size.

Notes:

1. The above kits do not include connectors.
2. Insulation shim kits consist of tubings that are used to build up the diameter of the cable cores to suit the base kit.

Table 16 – Joint kit cable range

Three Core Cable Range		Kit Stockcode
PILC	PILC	
500mm^2	500mm^2	152884

19.3 Core connectors

The core connectors used shall be of the compression type and the connector material shall match the conductor material on which it is to be used; i.e. for copper cables the connectors shall be copper, and for aluminium cables the connectors shall be aluminium. For transition joints from copper to aluminium, the connectors shall be of the bi-metal type. For size transition joints the connectors shall match both the transition sizes and the conductor materials. All compression connectors shall be of the blocked type. Compression connectors must be installed in accordance with the manufacturer's recommendations for crimping dies, number of crimps, and position of crimps. Installed connectors shall not diminish either the load current carrying capacity or the fault current carrying capacity of the jointed cables. Jointed cores shall be of the same length (i.e. bird-caging of cores will not be accepted).

19.4 Earth continuity

The metal sheaths of jointed cables shall be made continuous by joining them with tinned copper braids of the appropriate size. The installed braids on each joint shall collectively have a 1 second earth fault current carrying capacity matching that of the cables being jointed. Where the cables being jointed vary in size, the larger cable shall be used to determine the appropriate size of braids to be used.

The minimum total cross sectional area of the copper braids used shall be 117mm^2 for 500mm^2 multicore cables.

Tinned copper braids shall be attached either by wiping or by means of approved mechanical connectors. Installed sheath continuity braids shall not limit the earth fault rating of the jointed cables.

19.5 Requirements

The following requirements must be satisfied when constructing heatshrink straight through joints:

- The straight through joint shall be constructed in accordance with the installation instruction supplied in the joint kit.
- The joint kit contents and the prepared cable ends must be kept free of foreign matter, and must not be damaged during the jointing process.
- No jagged edges shall be left on terminated screen papers.
- The metal sheath must be belled at the metal sheath cut.
- The cable cores must not be bent tighter than the manufacturers' specified minimum internal bending radius during the jointing process. The completed joint and the first 500 mm of each associated cable must be straight when set in position.
- All components involved in the joint (including cable components) which will come into contact with either mastic tape or adhesive sealants must be thoroughly cleaned and degreased prior to the application of these sealing agents. Cleaning must only be done using lint-free cloth.
- Heatshrink tubings must be properly and evenly shrunk, free of voids, and must not be damaged due to overheating. Heatshrink components with adhesive sealant coatings must provide effective sealing against moisture ingress when installed.
- The outer heatshrink tubings must overlap each other and the cable oversheaths by a minimum of 100 mm.
- The completed joint must be allowed to cool down before applying mechanical load to it.
- The completed joint if direct buried, shall be surrounded in soft bedding material up to a depth of 100mm above the joint. The bedding material must comply with the requirements of NS130.

20.0 THREE-TO-ONE JOINT PAPER-INSULATED CABLES (HV2-5)

20.1 Introduction

This specification provides the requirements for a three-to-one joint **from** multicore, paper-insulated, screened, metal sheathed, polymeric oversheathed, armoured and unarmoured cabled **to** three single core, paper insulated, screened, metal sheathed, polymeric oversheathed cables.

This design is suitable for cables up to 500 mm^2 in cross sectional area.

20.2 Approved joint kits

Table 17 – Three-to-one joint kits

Three-to-One Joint				Three-to-One	Connector
from Multicore	Insulation Shim Kit	to Single Core	Insulation Shim Kit	Base Kit Stockcode	Stockcode
185 mm^2 Cu	N/A	95 mm^2 Cu	N/A	178651	176517
185 mm^2 Al	N/A	185 mm^2 Cu	N/A	151290	57018
185 mm^2 Cu	N/A	185 mm^2 Cu	N/A	151290	150250
300 mm^2 Al	N/A	95 mm^2 Cu	177895	151290*	See Note 3
300 mm^2 Al	N/A	185 mm^2 Cu	N/A	151290	56994
300 mm^2 Cu	N/A	185 mm^2 Cu	N/A	151290	176518
300 mm^2 Al	N/A	300 mm^2 Cu	N/A	151290	177727
300 mm^2 Cu	N/A	300 mm^2 Cu	N/A	151290	80929
500 mm^2 Al	N/A	185 mm^2 Cu	175804	152215	See Note 4
500 mm^2 Al	N/A	300 mm^2 Cu	177895	152215	152603
500 mm^2 Al	N/A	500 mm^2 Al	N/A	152215	176372

N/A – Not Applicable, means that insulation shims are not required for that particular cable size.

Table 18 – Joint kit cable range

Three-to-One Joint Cable Range		Kit Stockcode
Multicore	Single Core	
95mm^2 to 185mm^2	95mm^2 to 185mm^2	178651
185mm^2 to 300mm^2	185mm^2 to 300mm^2	151290
500mm^2	500mm^2	152215

*Additional components are required for a 300mm^2 multicore to 95mm^2 single core three-to-one joint and are available direct from TE Connectivity by requesting the following: Three EPPA-034-E roll springs, three OBTF-35/12-300/U transparent barrier tubings and three WCSM-56/16-50/S metal sheath shims. These roll springs and transparent barrier tubings must replace the roll springs and transparent barrier tubings supplied in the kit (stockcode 151290) for the 95mm^2 cable side of the joint only.

Notes:

1. The above kits do not include connectors.
2. Insulation shim kits consist of tubings that are used to build up the diameter of the cable cores to suit the base kit.
3. Buy in from TE Connectivity Part No BK300-95.
4. 500mm^2 AL to 185mm^2 CU bimetal crimp links are included with the insulation shim kit (stockcode 175804).

20.3 Core connectors

The core connectors used shall be of the compression type and the connector material shall match the conductor material on which it is to be used; i.e. for copper cables the connectors shall be copper, and for aluminium cables the connectors shall be aluminium. For transition joints from copper to aluminium, the connectors shall be of the bi-metal type. For size transition joints the connectors shall match both the transition sizes and the conductor materials. All compression connectors shall be of the blocked type. Compression connectors must be installed in accordance with the manufacturer's recommendations for crimping dies, number of crimps, and position of crimps. Installed connectors shall not diminish either the load current carrying capacity or the fault current carrying capacity of the jointed cables. Jointed cores shall be of the same length (i.e. bird-caging of cores will not be accepted).

20.4 Earth continuity

The metal sheaths of the single core cables shall be made continuous with the metal sheath of the multicore cable by joining them with tinned copper braids of the appropriate size. One tinned copper braid shall be used for each single core cable. Each braid shall have a minimum one second earth fault rating equivalent to 1/3 of the one second earth fault rating of the multicore cable.

Tinned copper braids shall be attached to the metal sheath of single core cables using the roll springs supplied in the kit. Attaching the tinned copper braids to the multicore cable shall be either by wiping or by means of approved mechanical connectors.

Installed sheath continuity braids shall not limit the earth fault rating of the jointed cables.

20.5 Requirements

The following requirements must be satisfied when constructing heatshrink straight through joints:

- The three-to-one joint shall be constructed in accordance with the installation instruction supplied in the joint kit.
- The joint kit contents and the prepared cable ends must be kept free of foreign matter and must not be damaged during the jointing process.
- No jagged edges shall be left on terminated screen papers.
- The metal sheath must be belled at the metal sheath cut.
- The cable cores must not be bent tighter than the manufacturers' specified minimum internal bending radius during the jointing process. The completed joint and the first 500 mm of each associated cable must be straight when set in position.
- All components involved in the joint (including cable components) which will come into contact with either mastic tape or adhesive sealants must be thoroughly cleaned and degreased prior to the application of these sealing agents. Cleaning must only be done using lint-free cloth.
- Heatshrink tubings must be properly and evenly shrunk, free of voids, and must not be damaged due to overheating. Heatshrink components with adhesive sealant coatings must provide effective sealing against moisture ingress when installed.
- The outer tubular heatshrink tubings must overlap each other and the cable oversheaths by a minimum of 100 mm.
- The completed joint must be allowed to cool down before applying mechanical load to it.
- The completed joint if direct buried, shall be surrounded in soft bedding material up to a depth of 100mm above the joint. The bedding material must comply with the requirements of NS130.

21.0 STUB TEE JOINT SCREENED AND BELTED PAPER INSULATED MULTICORE CABLES (HV2-72)

21.1 Introduction

This specification provides the requirements for constructing stub tee joint on paper insulated, screened or belted, metal sheathed, polymeric oversheathed, armoured and unarmoured cables.

These stub tee joints are suitable for pit applications.

21.2 Core connectors

The core connectors shall be of the sweated type (i.e. weak back ferrules), made of high conductivity copper. They shall be tinned and suitable for the cable size(s) to be jointed. The type of solder used must be compatible with the conductor material.

Mechanical connectors may be used, however they shall be submitted to Ausgrid first for approval.

Ausgrid's stockcodes of approved connectors are provided in the table below.

Table 19 – Approved connectors

Cable Sizes	Stockcode of Weak Back Ferrule
185-185 mm^2	63842
185-300 mm^2	63891
300-300 mm^2	63917

Installed connectors shall be free of sharp edges and burrs, and shall maintain the load current carrying capacity of the jointed cores.

21.3 Paper insulation and insulating tapes

The paper insulation on all cores must be tapered over a 6 mm length as shown in Figures 8 and 10 The full length of exposed paper insulation, including the tapered section, must be free of dust and moisture, and must not be touched with bare hands.

The crepe paper jointing tapes approved by Ausgrid for 11kV jointing are impregnated with rosin/oil compound, and packed in sealed tins. Tins of insulating paper tapes must be examined prior to opening. If a tin is damaged or any compound leakage is evident, the contents must not be used.

Tins must not be opened until the tapes are ready to be used. Insulating tapes must be tested for moisture content before they are used. Tapes which appear to contain any amount of moisture must not be used.

Insulating tapes must be applied with an overlap of approximately 50% either direct from the roll or from a former. Surplus tapes must be discarded - **they must never be used.**

Ausgrid's stockcodes of approved insulating paper tapes are provided in the table below.

Table 20 – Approved paper tapes

Details	Stockcode
Tin of crepe paper rolls each containing: 18 rolls x 50mm wide, 8 rolls x 20mm wide, and 8 rolls x 10mm wide. All rolls are 35mm OD x 3m long	58024
Tin of crepe paper rolls each containing: 25 rolls x 50mm wide, 8 rolls x 20mm wide, and 4 rolls x 10mm wide. All rolls are 35m OD x 3m long	76018

21.4 Stress cones

Some joints will require the construction of stress cones. Where required, construction of stress cones shall comply with the following requirements:

(a) The screens must be removed to 90mm from the metal sheath cut. Where carbon impregnated paper is used as a screen, the outer layer of paper insulation must also be removed to the screen termination.

(b) Two half lapped layers of crepe paper tape must be applied to the exposed core paper insulation following the same direction of lay as the core paper insulation.

(c) A stress cone foundation must be built using crepe paper tape. The foundation must start at the end of the screen, and must gradually reach a maximum diameter of 13mm larger than the diameter of the core insulation. The maximum diameter must occur 13mm from the end of the screen.

(d) A half lapped layer of tinned copper mesh (25 mm wide, stockcode 67074) must be applied over the stress cone foundation starting onto the metal sheath. The mesh must be stretched to less than half its width while it is being applied.

(e) The tinned copper mesh must be soldered to the metal sheath, and the return spiral must be tack soldered to the stress cone.

(f) Any sharp projections must be smoothed off. Any metal dust resulting from this operation must be carefully removed.

21.5 Earth continuity

The metal sheath of the jointed cables shall be made continuous by wiping the lead sleeve directly onto them. The tinning and wiping of the sleeve and metal sheaths shall provide water tight seals and durable contacts capable of withstanding earth fault currents of the same magnitude as the fault ratings of the cable sheaths involved.

Ausgrid's stockcodes of approved lead sleeves for 11kV joints are provided in the table below.

Table 21 – Approved lead sleeves

Details	Stockcode
1500mm long lead sleeve, copperized, 28mm ID x 3mm wall thickness	80150
1500mm long lead sleeve, copperized, 32mm ID x 3mm wall thickness	68700
1500mm long lead sleeve, copperized, 40mm ID x 3mm wall thickness	68809
1500mm long lead sleeve, copperized, 50mm ID x 3mm wall thickness	68791
1700mm long lead sleeve, copperized, 75mm ID x 3mm wall thickness	68767
1500mm long lead sleeve, copperized, 90mm ID x 3mm wall thickness	68817
1500mm long lead sleeve, copperized, 100mm ID x 3mm wall thickness	68759
1500mm long lead sleeve, copperized 125mm ID x 3mm wall thickness	68742
1800mm long lead sleeve, copperized, 150mm ID x 5mm wall thickness	68734
1700mm long lead sleeve, copperized, 175mm ID x 5mm wall thickness	68833

Ausgrid's stockcodes of approved two way lead end caps for 11kV joints are provided in the table below.

Table 22 – Approved two way lead end caps

Details	Stockcode
Two way lead end cap 180mm ID	80200
Two way lead end cap 203mm ID	78345

21.6 Stripping dimensions

The stripping dimensions and construction details shall be strictly in accordance with the construction requirements provided in Figures 7, 8, 9 and 10.

21.7 Troughing-in of completed joints

Completed joints intended to be directly buried shall be placed in fibre-reinforced cement troughing and completely encapsulated with either approved polyurethane compound (stockcode 75390) or troughing-in bitumen (stockcode 52811).

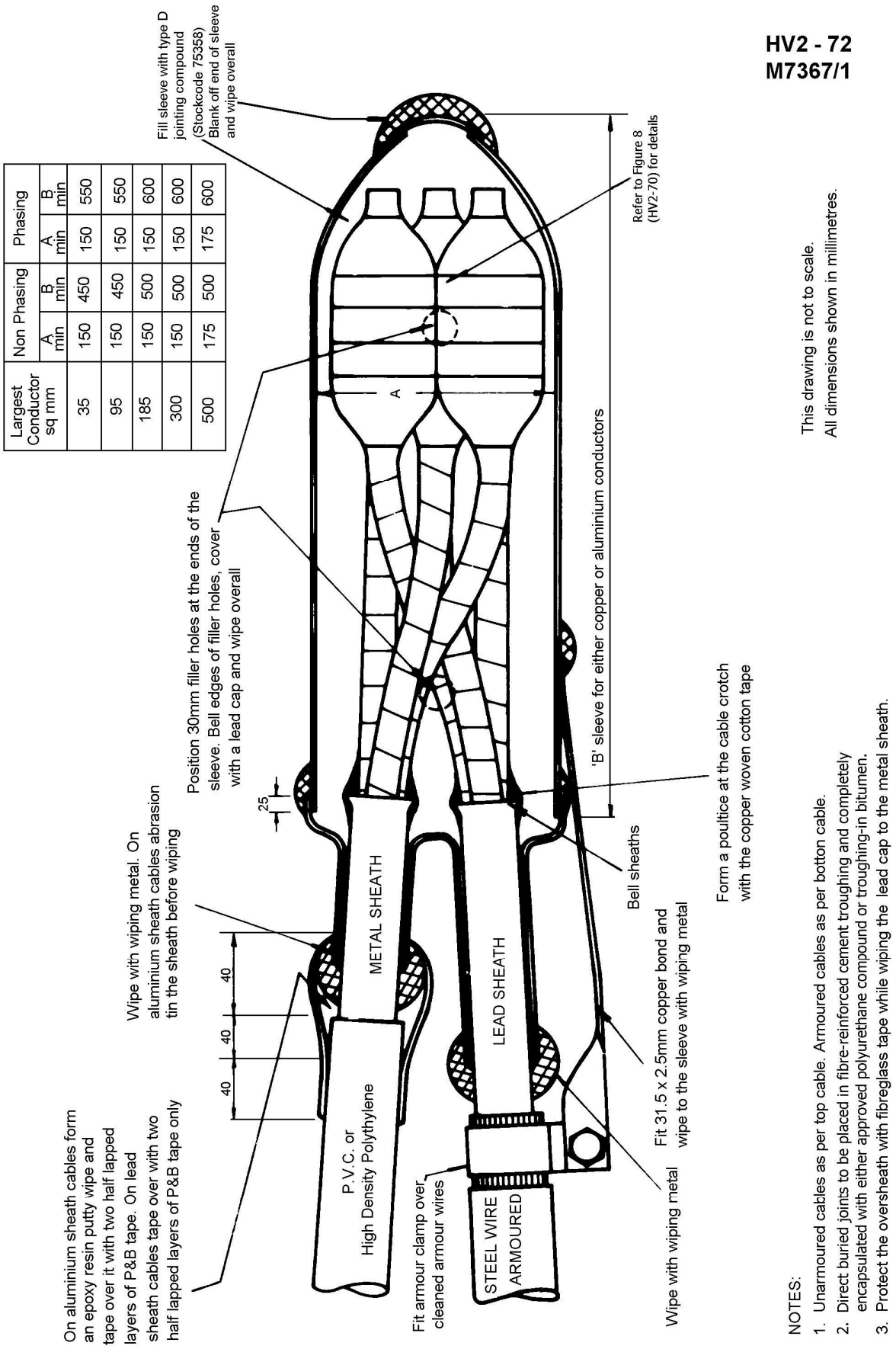


Figure 7 - 11kV Screened Cable STJ (Stubtee) construction details

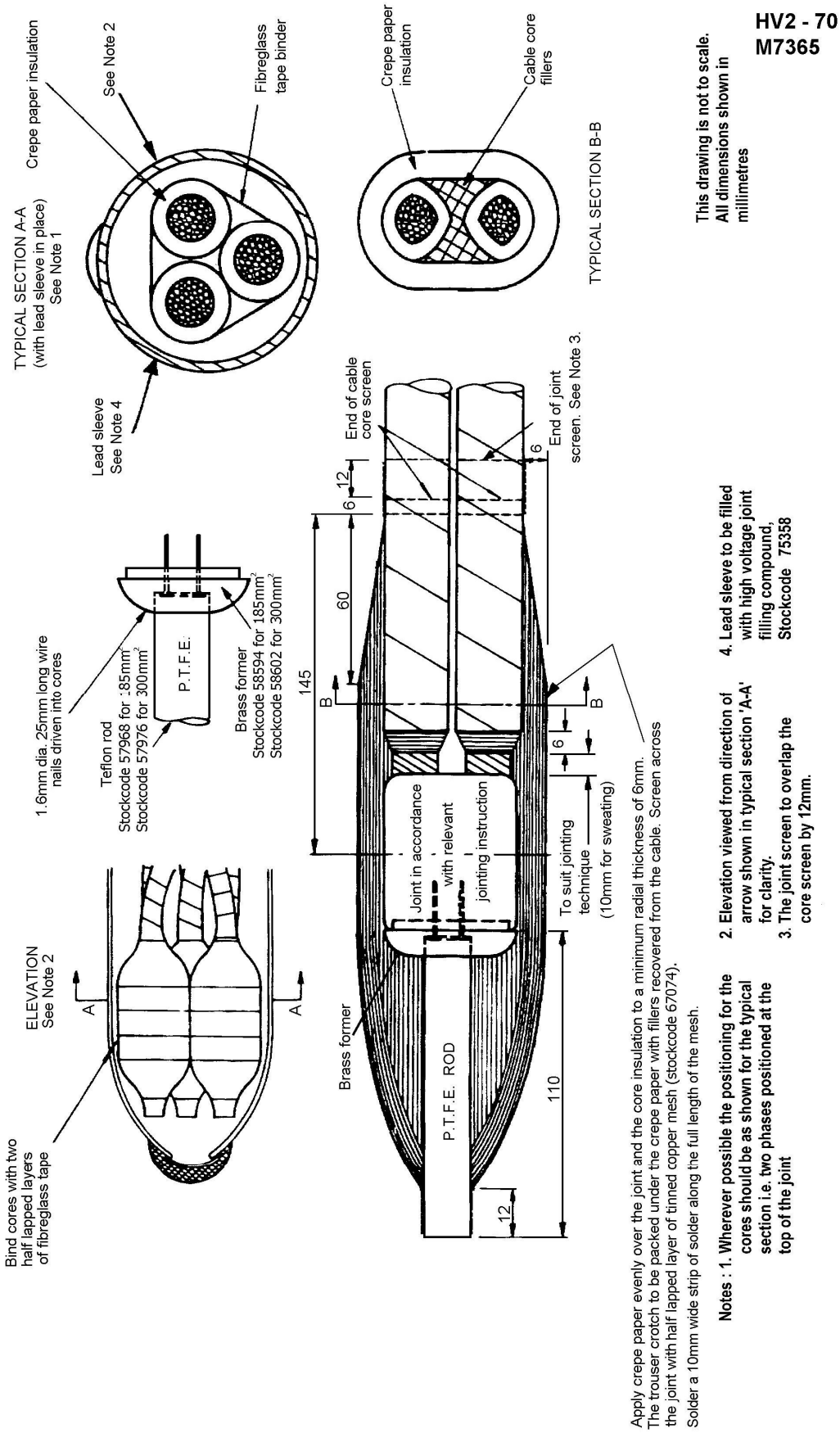


Figure 8 11kV Screened Cables Stub Tee Joints Sectional Details

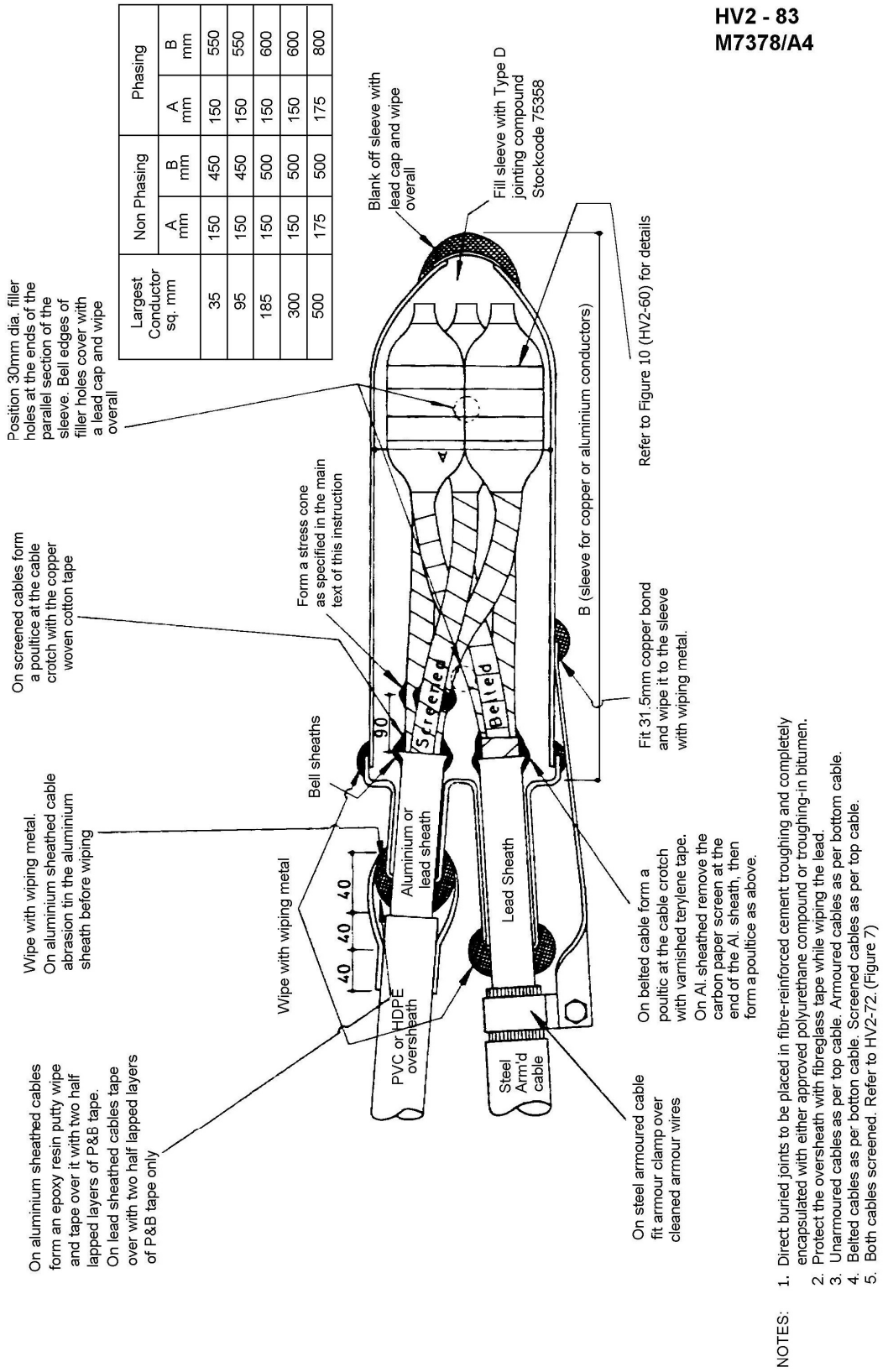


Figure 9 11kV Belted - Screened Stub tee Construction Details

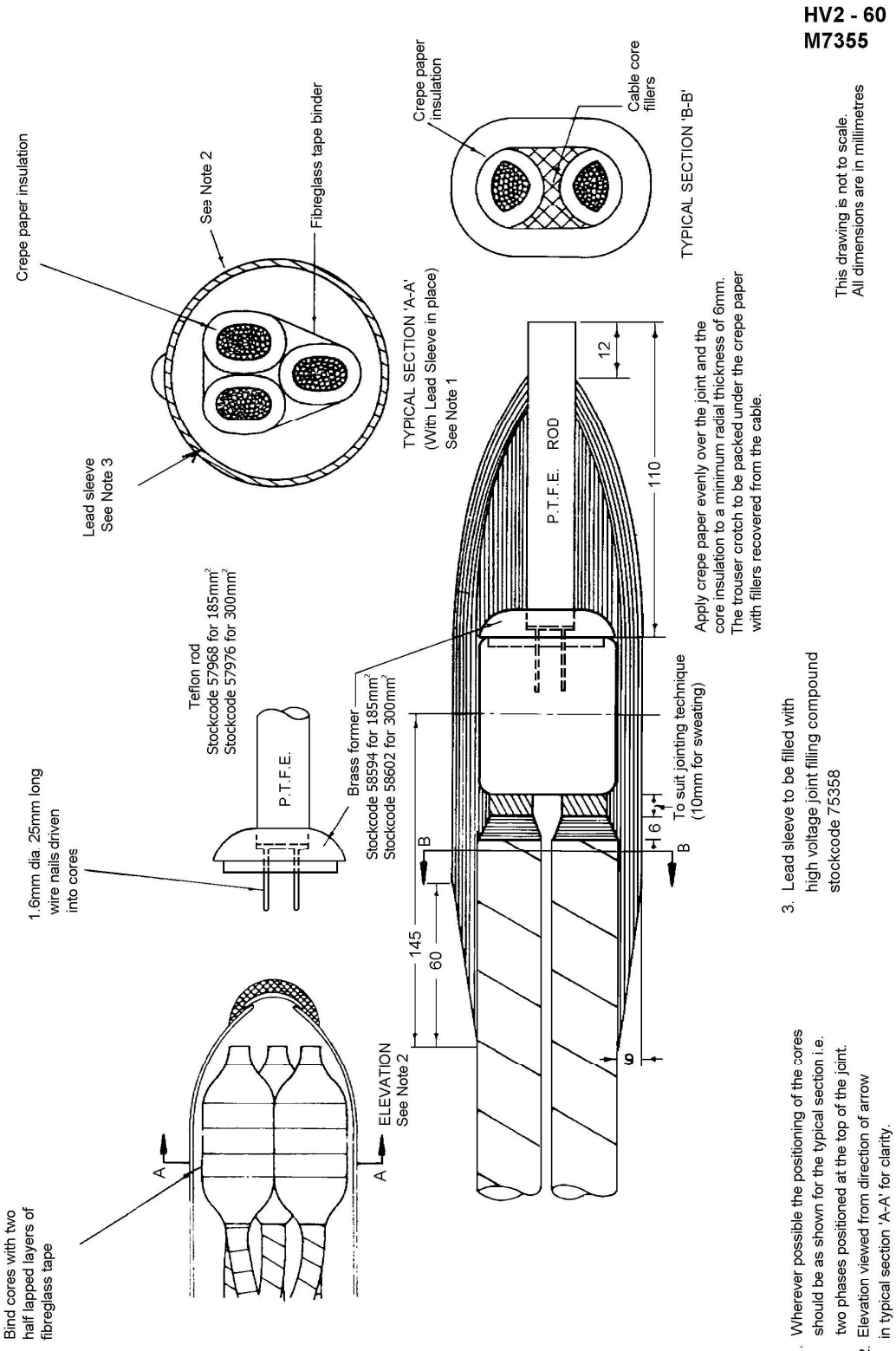


Figure 10 11kV Belted/Belted or Belted/Screened Stubtee Sectional Details

22.0 COLD POUR RESIN STUB TEE JOINTS FOR PILC CABLES (HV2-73)

22.1 Introduction

This specification provides the requirements for constructing a PILC stub tee joint using resin. The cables can be multicore or single core paper insulated, screened or belted, metal sheathed, polymeric oversheathed, armoured or unarmoured cables.

These cold pour resin stub tee joints are not suitable for pit applications.

Table 23 – 11kV PILC Cold Pour Resin Stub Tee Joint Kits

Cable 1	Cable 2	Stub Tee Joint Base Kit Stockcode	Polyurethane Resin Stockcode
97 mm^2 Cu 3-core	97 mm^2 Cu 1-core	MIR-11-PPT-AG	10 x 75390
97 mm^2 Cu 3-core	97 mm^2 Cu 3-core	MIR-11-PPT-AG	10 x 75390
185 mm^2 Cu 1-core	185 mm^2 Cu 1-core	MIR-11-PPT-AG	10 x 75390
185 mm^2 Cu 1-core	194 mm^2 Cu 1-core	MIR-11-PPT-AG	10 x 75390
185 mm^2 Cu 1-core	97 mm^2 Cu 3-core	MIR-11-PPT-AG	10 x 75390
185 mm^2 Cu 3-core	185 mm^2 Cu 1-core	MIR-11-PPT-AG	10 x 75390
185 mm^2 Cu 3-core	185 mm^2 Cu 3-core	MIR-11-PPT-AG	10 x 75390
194 mm^2 Cu 3-core	194 mm^2 Cu 3-core	MIR-11-PPT-AG	10 x 75390
300 mm^2 Cu 1-core	300 mm^2 AL 3-core	MIR-11-PPT-AG	10 x 75390
300 mm^2 AL 3-core	300 mm^2 AL 3-core	MIR-11-PPT-AG	10 x 75390
323 mm^2 AL 3-core	185 mm^2 Cu 1-core	MIR-11-PPT-AG	10 x 75390
323 mm^2 AL 3-core	323 mm^2 AL 3-core	MIR-11-PPT-AG	10 x 75390

Notes:

1. The above kits include mechanical connectors.
2. The joint kit MIR-11-PPT-AG is available direct from Sicame Australia Pty Ltd.
3. Stockcode No 75390 provides 6 litres of resin.

Table 24 – Joint Kit Cable Range

Cable 1 Range PILC	Cable 2 Range PILC	Sicame Base Kit Part No
95mm^2 - 323mm^2 3-core 95mm^2 - 323mm^2 1-core	95mm^2 - 323mm^2 3-core 95mm^2 - 323mm^2 1-core	MIR-11-PPT-AG

22.2 Requirements

The following requirements must be satisfied when constructing a cold pour resin stub tee joint:

- The joint hole must be a minimum depth of 900 mm (for footways) to accommodate the joint mould and still maintain the cover as specified in NS130.
- The cable cores must not be bent tighter than the manufacturer's specified minimum internal bending radius during the jointing process. The completed joint and the first 500mm of each associated cable must be straight when set in position.
- The cable cores must be cut with a hacksaw or a suitable power driven saw to prevent deformation of the conductor strands. Cable cutters shall not be used as they tend to deform the conductor strands.
- The connectors shall be installed in accordance with the manufacturer's installation instructions.
- The joint shall be constructed in accordance with the installation instructions supplied in the joint kit.
- The joint kit contents and the prepared cable ends must be kept free of foreign matter and must not be damaged during the jointing process.
- No jagged edges shall be left on terminated screen papers.
- The metal sheath must be belled at the metal sheath cut.
- Resin shall be used in accordance with the manufacturer's instructions.
- The resin in the completed joint must be allowed to set before applying mechanical load to it or energising the joint. This will typically be a minimum of three hours.
- The completed joint if direct buried, shall be surrounded in soft bedding material to a depth of 100mm above the joint. The bedding material must comply with the requirements of NS130.

23.0 LAY-ON TEE JOINTS FOR SCREENED AND BELTED PAPER INSULATED CABLES (HV3-1)

23.1 Introduction

This specification provides the requirements for constructing the following lay-on tee joints:

- Single core tee cable (paper insulated, screened, metal sheathed, polymeric oversheathed) to single core main cable (paper insulated, screened, metal sheathed, polymeric oversheathed).
- 3 Single core tee cables (paper insulated, screened, metal sheathed, polymeric oversheathed) to multicore main cable which may be either screened, or belted, or a joint between a screened and a belted paper cable. The multicore cable can be armoured or unarmoured.
- Multicore cable tee (which may be either belted or screened) to multicore cable main (which may be either belted or screened). Both cables may be armoured or unarmoured.

These stub tee joints are suitable for pit applications.

23.2 Core connectors

The core connectors shall be of the sweated type (i.e. weak back ferrules), made of high conductivity copper. They shall be tinned and suitable for the cable size(s) to be jointed. The type of solder used must be compatible with the conductor material.

Mechanical connectors may be used, however they shall be submitted to Ausgrid first for approval.

Ausgrid's stockcodes of approved connectors are provided in the table below.

Table 25 – Approved connectors

Cable Sizes	Stockcode of Weak Back Ferrule
185-185 mm^2	63842
185-300 mm^2	63891
300-300 mm^2	63917

Installed connectors shall be free of sharp edges and burrs, and shall maintain the load current carrying capacity of the jointed cores.

23.3 Paper insulation and insulating tapes

The paper insulation on all cores must be tapered over a 6 mm length as shown in Figures 14 and 15. The full length of exposed paper insulation, including the tapered section, must be free of dust and moisture, and must not be touched with bare hands.

The crepe paper jointing tapes approved by Ausgrid for 11kV jointing are impregnated with rosin/oil compound, and packed in sealed tins. Tins of insulating paper tapes must be examined prior to opening. If a tin is damaged or any compound leakage is evident, the contents must not be used.

Tins must not be opened until the tapes are ready to be used. Insulating tapes must be tested for moisture content before they are used. Tapes which appear to contain any amount of moisture must not be used.

Insulating tapes must be applied with an overlap of approximately 50% either direct from the roll or from a former. Surplus tapes must be discarded - **they must never be used.**

Ausgrid's stockcodes of approved insulating paper tapes are provided in the following table.

Table 26 – Approved paper tapes

Details	Stockcode
Tin of crepe paper rolls each containing: 18 rolls x 50mm wide, 8 rolls x 20mm wide, and 8 rolls x 10mm wide. All rolls are 35mm OD x 3m long	58024
Tin of crepe paper rolls each containing: 25 rolls x 50mm wide, 8 rolls x 20mm wide, and 4 rolls x 10mm wide. All rolls are 35mm OD x 3m long	76018

23.4 Stress cones

Some joints will require the construction of stress cones. Where required, construction of stress cones shall comply with the following requirements:

(a) The screens must be removed to 90 mm from the metal sheath cut. Where carbon impregnated paper is used as a screen, the outer layer of paper insulation must also be removed to the screen termination.

(b) Two half lapped layers of crepe paper tape must be applied to the exposed core paper insulation following the same direction of lay as the core paper insulation.

(c) A stress cone foundation must be built using crepe paper tape. The foundation must start at the end of the screen, and must gradually reach a maximum diameter of 13mm larger than the diameter of the core insulation. The maximum diameter must occur 13mm from the end of the screen.

(d) A half lapped layer of tinned copper mesh (25mm wide, stockcode 67074) must be applied over the stress cone foundation starting onto the metal sheath. The mesh must be stretched to less than half its width while it is being applied.

(e) The tinned copper mesh must be soldered to the metal sheath, and the return spiral must be tack soldered to the stress cone.

(f) Any sharp projections must be smoothed off. Any metal dust resulting from this operation must be carefully removed.

23.5 Earth continuity

The metal sheath of the jointed cables shall be made continuous by wiping the lead sleeve directly onto them. The tinning and wiping of the sleeve and metal sheaths shall provide water tight seals and durable contacts capable of withstanding earth fault currents of the same magnitude as the fault ratings of the cable sheaths involved.

Ausgrid's stockcodes of approved lead sleeves for 11kV joints are provided in the table below.

Table 27 – Approved lead sleeves

Details	Stockcode
1500mm long lead sleeve, copperized, 28mm ID x 3mm wall thickness	80150
1500mm long lead sleeve, copperized, 32mm ID x 3mm wall thickness	68700
1500mm long lead sleeve, copperized, 40mm ID x 3mm wall thickness	68809
1500mm long lead sleeve, copperized, 50mm ID x 3mm wall thickness	68791
1700mm long lead sleeve, copperized, 75mm ID x 3mm wall thickness	68767
1500mm long lead sleeve, copperized, 90mm ID x 3mm wall thickness	68817
1500mm long lead sleeve, copperized, 100mm ID x 3mm wall thickness	68759
1500mm long lead sleeve, copperized 125mm ID x 3mm wall thickness	68742
1800mm long lead sleeve, copperized, 150mm ID x 5mm wall thickness	68734
1700mm long lead sleeve, copperized, 175mm ID x 5mm wall thickness	68833

Ausgrid's stockcodes of approved two way lead end caps for 11kV joints are provided in the table below.

Table 28 – Approved two way lead end caps

Details	Stockcode
Two way lead end cap 180mm ID	80200
Two way lead end cap 203mm ID	78345

Ausgrid's stockcode of the approved 3/1 lay on tee joint lead end cap is provided in the table below.

Table 29 – Approved 3/1 lay on tee joint lead end caps

Details	Stockcode
3/1 lay on tee joint lead end cap 185mm ID	89789

23.6 Stripping dimensions

The stripping dimensions and construction details shall be strictly in accordance with the construction requirements provided in Figures 11, 12, 13, 14, and 15.

23.7 Troughing-in of completed joints

Completed joints intended to be directly buried shall be placed in fibre-reinforced cement troughing and completely encapsulated with either approved polyurethane compound (stockcode 75390) or troughing-in bitumen (stockcode 52811).

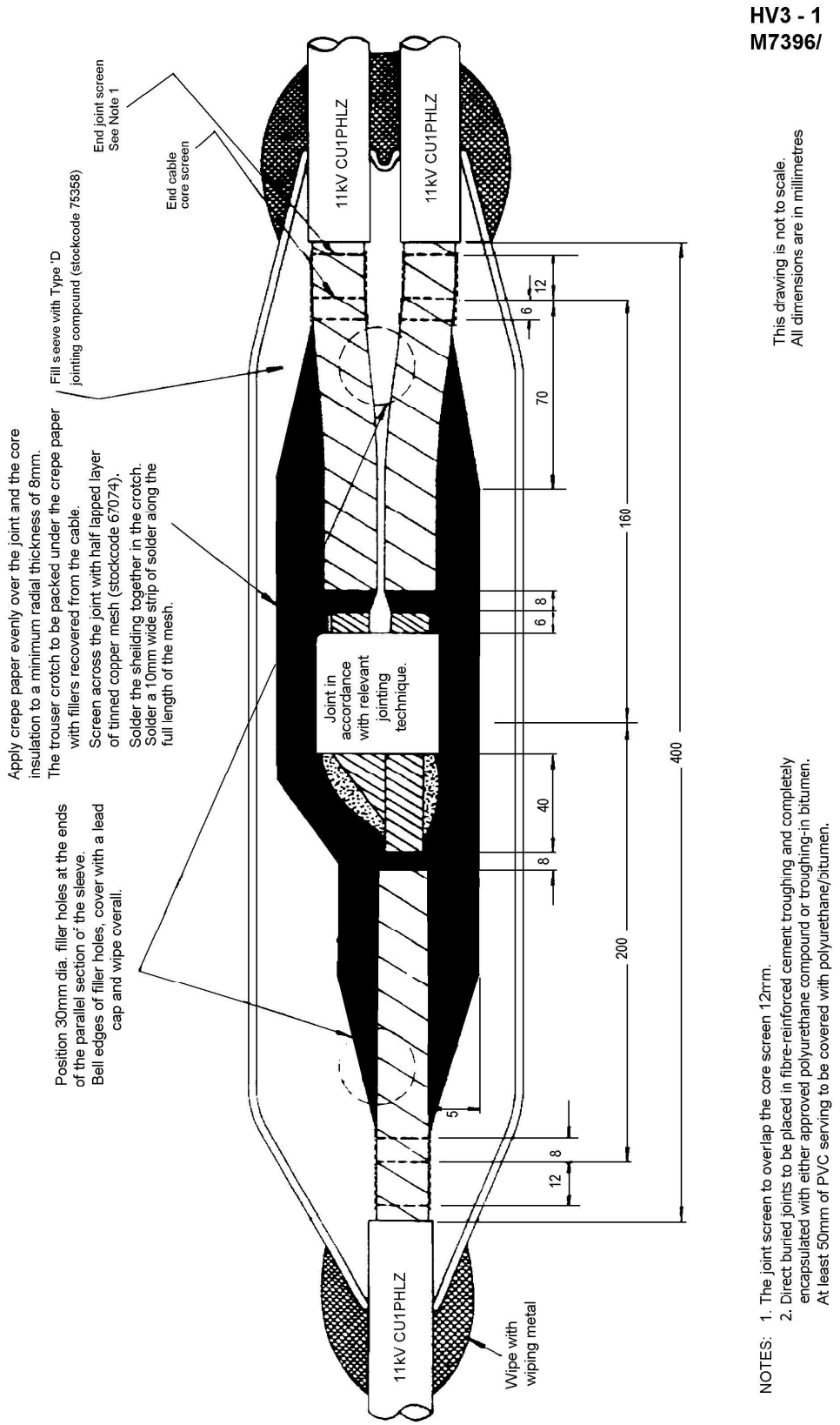


Figure 11 Lay On Tee Joint - Single Core to Single Core Screened Cables

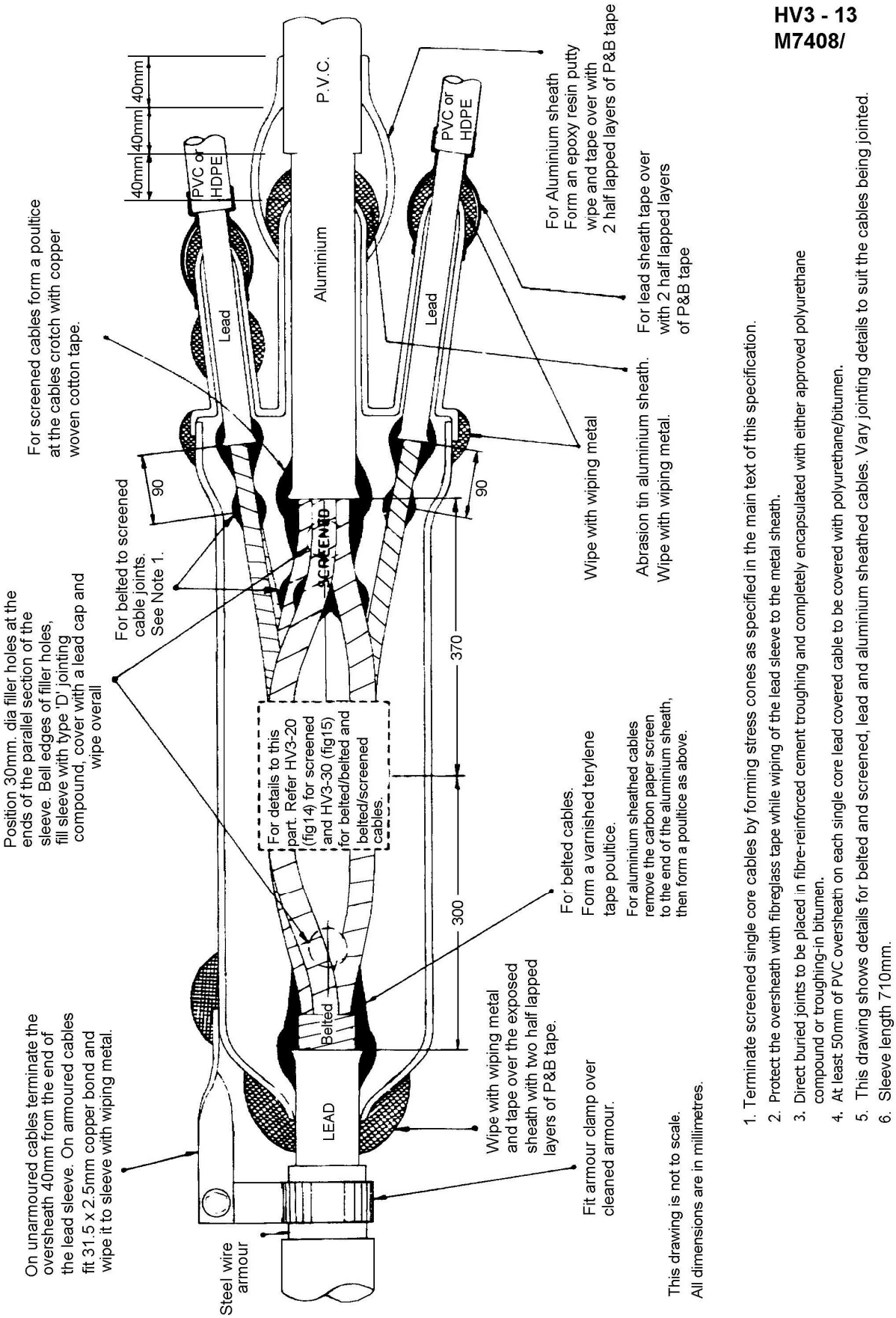


Figure 12 11kV Lay on Tee Joint - Screened Single Core onto Multicore Cables

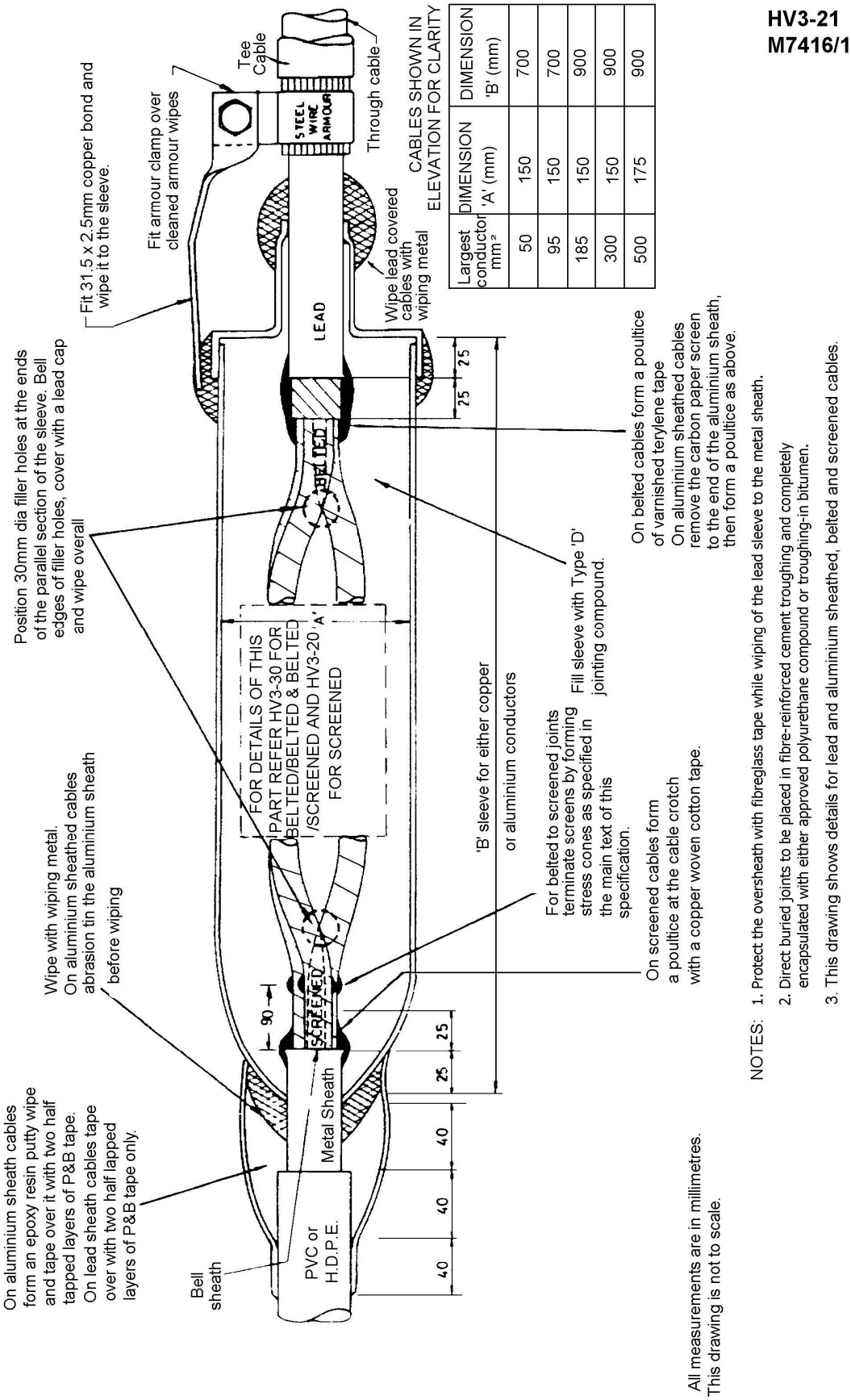


Figure 13 11kV Lay on Tee Joint - Multicore Screened/Belted Cables

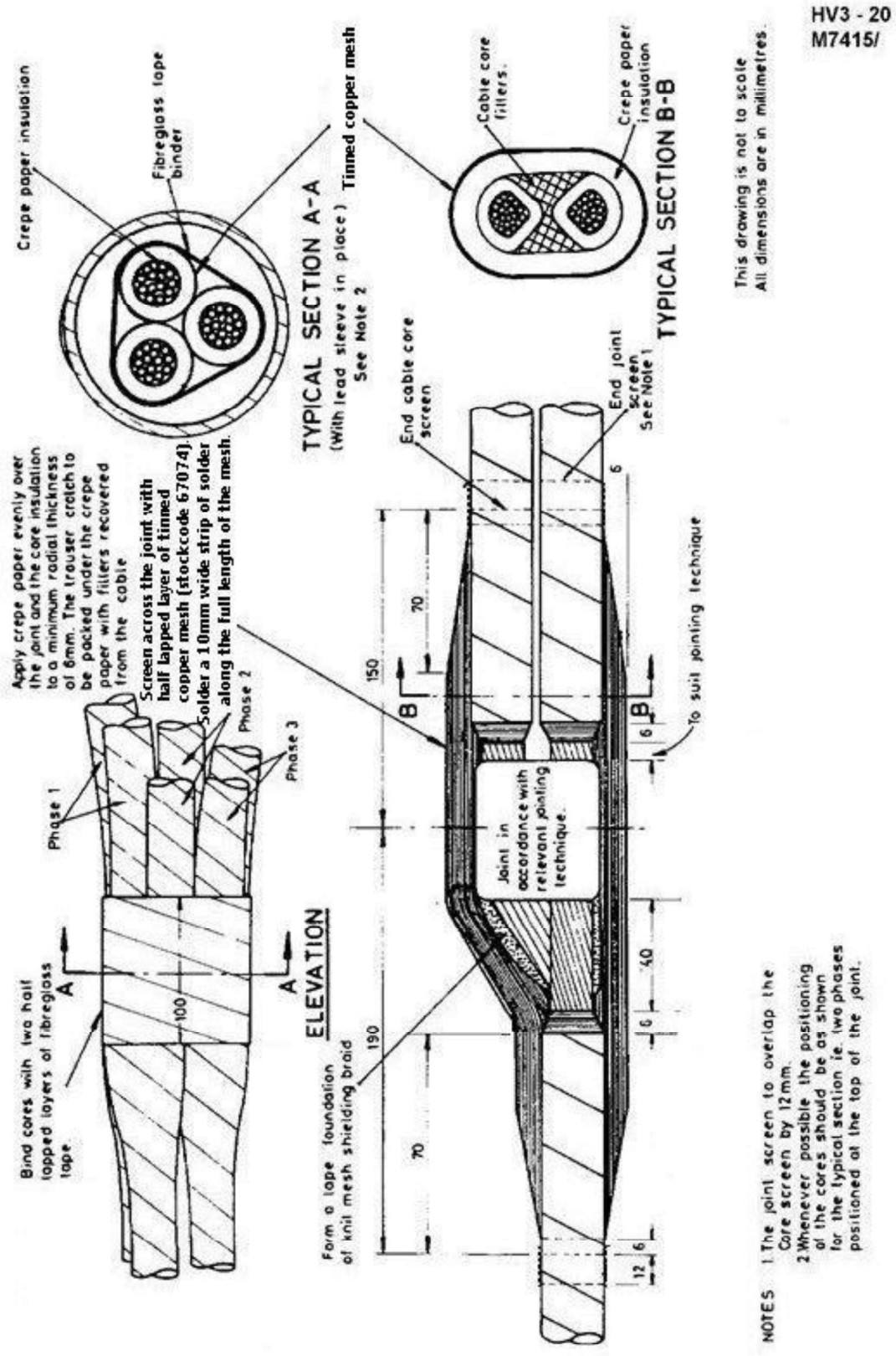


Figure 14 Lay On Tee Joints - 11kV Screened Cable Sectional Details

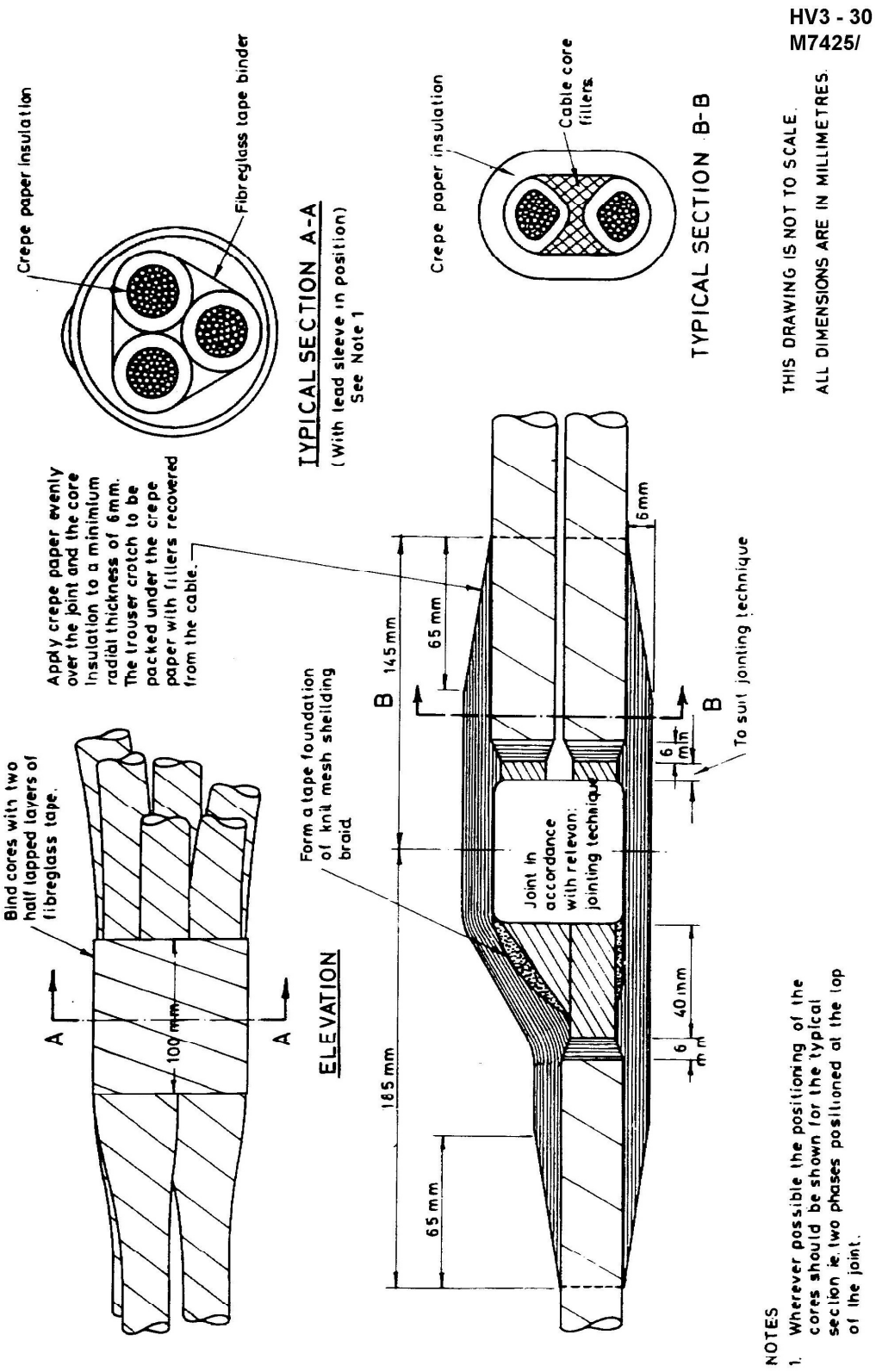


Figure 15 Lay On Tee Joints - 11kV Belted/Belted and Belted/Screened Cables Sectional Details

24.0 COLD POUR RESIN TEE JOINTS FOR PILC CABLES (HV3-31)

24.1 Introduction

This specification provides the requirements for constructing a PILC tee joint using resin. The cables can be multicore or single core paper insulated, screened or belted, metal sheathed, polymeric oversheathed, armoured or unarmoured cables.

These cold pour resin tee joints are not suitable for pit applications.

Table 30 – 11kV PILC Cold Pour Resin Tee Joint Kits

Main Cable Size PILC	Tee Cable Size PILC	Tee Joint Base Kit Stockcode	Polyurethane Resin Stockcode
97 mm^2 Cu 3-core	97 mm^2 Cu 1-core	52464-38	10 x 75390
97 mm^2 Cu 3-core	97 mm^2 Cu 3-core	52464-38	10 x 75390
185 mm^2 Cu 1-core	185 mm^2 Cu 1-core	52464-38	10 x 75390
185 mm^2 Cu 1-core	194 mm^2 Cu 1-core	52464-38	10 x 75390
185 mm^2 Cu 1-core	97 mm^2 Cu 3-core	52464-38	10 x 75390
185 mm^2 Cu 3-core	185 mm^2 Cu 1-core	52464-38	10 x 75390
185 mm^2 Cu 3-core	185 mm^2 Cu 3-core	52464-38	10 x 75390
194 mm^2 Cu 3-core	194 mm^2 Cu 3-core	52464-38	10 x 75390
194 mm^2 AL 3-core	323 mm^2 AL 3-core	52464-38	9 x 75390
300 mm^2 Cu 1-core	300 mm^2 AL 3-core	52464-38	9 x 75390
300 mm^2 AL 3-core	300 mm^2 AL 3-core	52464-38	9 x 75390
323 mm^2 AL 3-core	185 mm^2 Cu 1-core	52464-38	9 x 75390
323 mm^2 Cu 3-core	97 mm^2 Cu 3-core	52464-38	10 x 75390
323 mm^2 AL 3-core	323 mm^2 AL 3-core	52464-38	9 x 75390

Notes:

1. The above kits include mechanical connectors.
2. The joint kit 52464-38 is available direct from Sicame Australia Pty Ltd.
3. Stockcode No 75390 provides 6 litres of resin.

Table 31 – Joint Kit Cable Range

Main Cable Range PILC	Tee Cable Range PILC	Sicame Base Kit Part No
95mm^2 - 323mm^2 3-core 95mm^2 - 323mm^2 1-core	95mm^2 - 323mm^2 3-core 95mm^2 - 323mm^2 1-core	52464-38

24.2 Requirements

The following requirements must be satisfied when constructing a cold pour resin tee joint:

- The joint hole must be a minimum depth of 900 mm (for footways) to accommodate the joint mould and still maintain the cover as specified in NS130.
- The cable cores must not be bent tighter than the manufacturer's specified minimum internal bending radius during the jointing process. The completed joint and the first 500mm of each associated cable must be straight when set in position.
- The cable cores must be cut with a hacksaw or a suitable power driven saw to prevent deformation of the conductor strands. Cable cutters shall not be used as they tend to deform the conductor strands.
- The connectors shall be installed in accordance with the manufacturer's installation instructions.
- The joint shall be constructed in accordance with the installation instructions supplied in the joint kit.
- The joint kit contents and the prepared cable ends must be kept free of foreign matter and must not be damaged during the jointing process.
- No jagged edges shall be left on terminated screen papers.
- The metal sheath must be belled at the metal sheath cut.
- Resin shall be used in accordance with the manufacturer's instructions.
- The resin in the completed joint must be allowed to set before applying mechanical load to it or energising the joint. This will typically be a minimum of three hours.
- The completed joint if direct buried, shall be surrounded in soft bedding material to a depth of 100mm above the joint. The bedding material must comply with the requirements of NS130.

25.0 STORES AND MATERIALS

Only approved materials and equipment may be used in the construction of infrastructure which ultimately forms part of Ausgrid's electrical network. The approved materials and equipment contained in this Network Standard are detailed in Ausgrid's Approved Material List (AML) with manufacturer and supplier information and Ausgrid stockcodes where appropriate. Ausgrid will consider adding alternative materials and equipment to the AML in accordance with NS181.

ASPs may obtain approved materials and equipment items as listed in the AML from any source. Where an ASP wishes to use alternative materials and equipment, application to have the materials or equipment considered for approval is to be made in accordance with NS181. Alternatively, where approved materials and equipment are held as stock in Ausgrid's stores system, ASPs may purchase them from Ausgrid. All enquiries and requests for quotations shall be directed by email to aspsales@ausgrid.com.au and include the appropriate stockcode numbers.

All materials used on Ausgrid's network must be new.

26.0 CABLE DESCRIPTION CODES

Cable description codes are provided in NS100 External Annexure C.

27.0 RECORDKEEPING

The table below identifies the types of records relating to the process, their storage location and retention period.

Table 32: Recordkeeping

Type of Record	Storage Location	Retention Period*
Approved copy of the Network Standard	Document repository Network sub process Standard – Company	Unlimited
Draft Copies of the Network Standard during amendment/creation	Work Folder for Network Standards (HPRM ref. 2014/21250/326)	Unlimited
Working documents (emails, memos, impact assessment reports, etc.)	Records management system Work Folder for Network Standards (HPRM ref. 2014/21250/326)	Unlimited

* The following retention periods are subject to change e.g. if the records are required for legal matters or legislative changes. Before disposal, retention periods should be checked and authorised by the Records Manager.

28.0 AUTHORITIES AND RESPONSIBILITIES

For this Network Standard the authorities and responsibilities of Ausgrid employees and managers in relation to content, management and document control of this Network Standard can be obtained from the Company Procedure (Network) – Production / Review of Engineering Technical Documents within the document repository. The responsibilities of persons for the design or construction work detailed in this Network Standard are identified throughout this Standard in the context of the requirements to which they apply.

29.0 DOCUMENT CONTROL

Content Coordinator : Head of Asset Engineering Policy & Standards

Distribution Coordinator : Manager Asset Standards