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Lightning Protection

About this document ...

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Content approval

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Issue Draft 0c	2-Jan-2007	Pete Whelan	pictures added
Issue Draft 0b	13-Dec-2006	Pete Whelan	formatting
Issue Draft 0a	13-Dec-2006	Pete Whelan	New

Table of Content

1 *Introduction & Scope*

This Document forms part of the Access Network Specification range of ISIS Documents and is applicable to both Openreach Direct Labour and External Contractors.

1.1 Scope

This Document details the performance requirements and items of plant to be used when providing Lightning Protection for use within the Openreach network.

1.2 Overview

To protect Openreach's Access Network effectively from Indirect Lightning strike, two elements are required. A suitable earthing system, and Lightning Protectors which switch any "Over voltage" to this earthing system.

This document details the performance requirements and items of plant to be used when

Providing both the Earthing system (section 2) and the Protectors (section 3).

Note: Most exchange areas are situated in "Normal Earth Resistivity" areas, for "High Earth Resistivity" areas, additional requirements are needed to provide a satisfactory Earthing system.

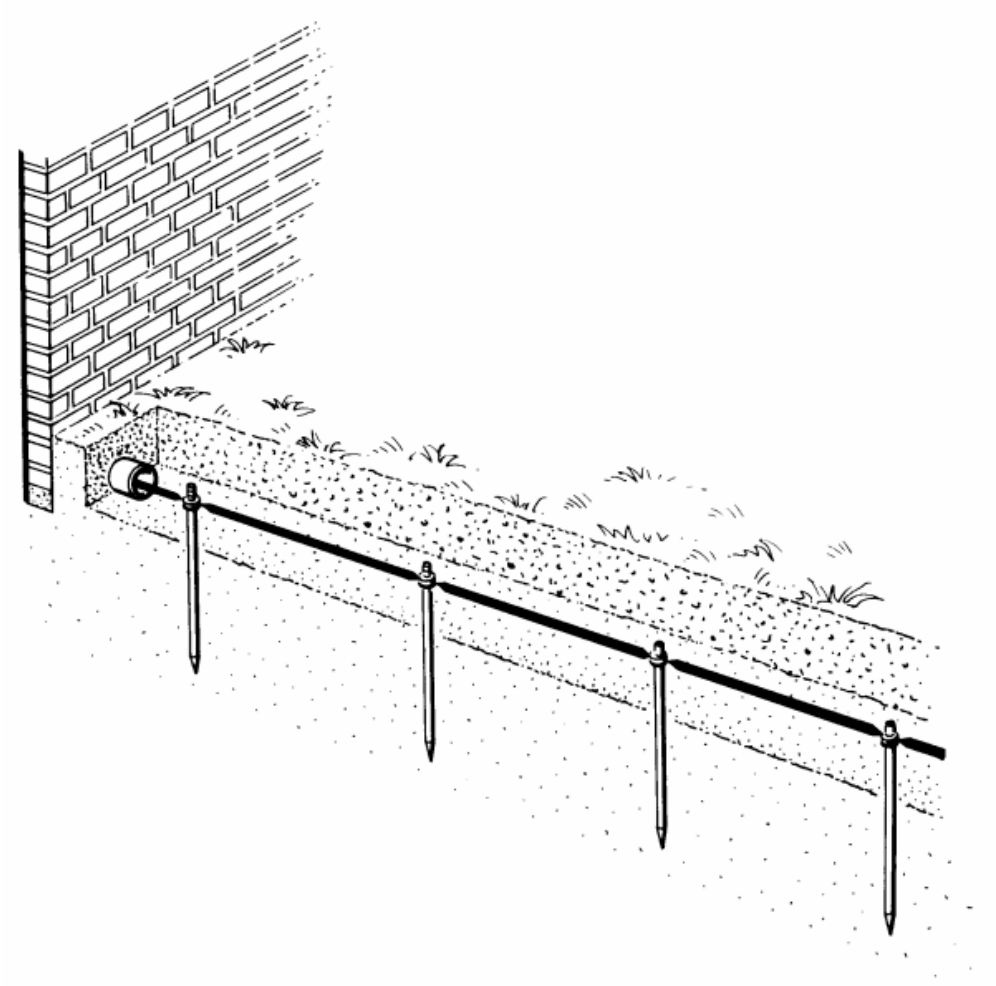
2 *Providing a Lightning Protection Earthing System*

2.1 Areas of Normal Earth Resistivity

A number of methods (see below) are available that will provide a satisfactory Earthing System for Lightning Protection in Normal Earth Resistivity Areas, but suppliers may also seek agreement for any cost effective method that results in an Earthing System Resistance that meets the performance requirements. The Openreach Work Originator will decide on the most appropriate cost effective method to be used at a particular location. (For Asset Assurance Retrospective work the choice of most appropriate cost effective method will be suggested by Supplier's Surveyor and agreed with Openreach Asset Assurance Office.)

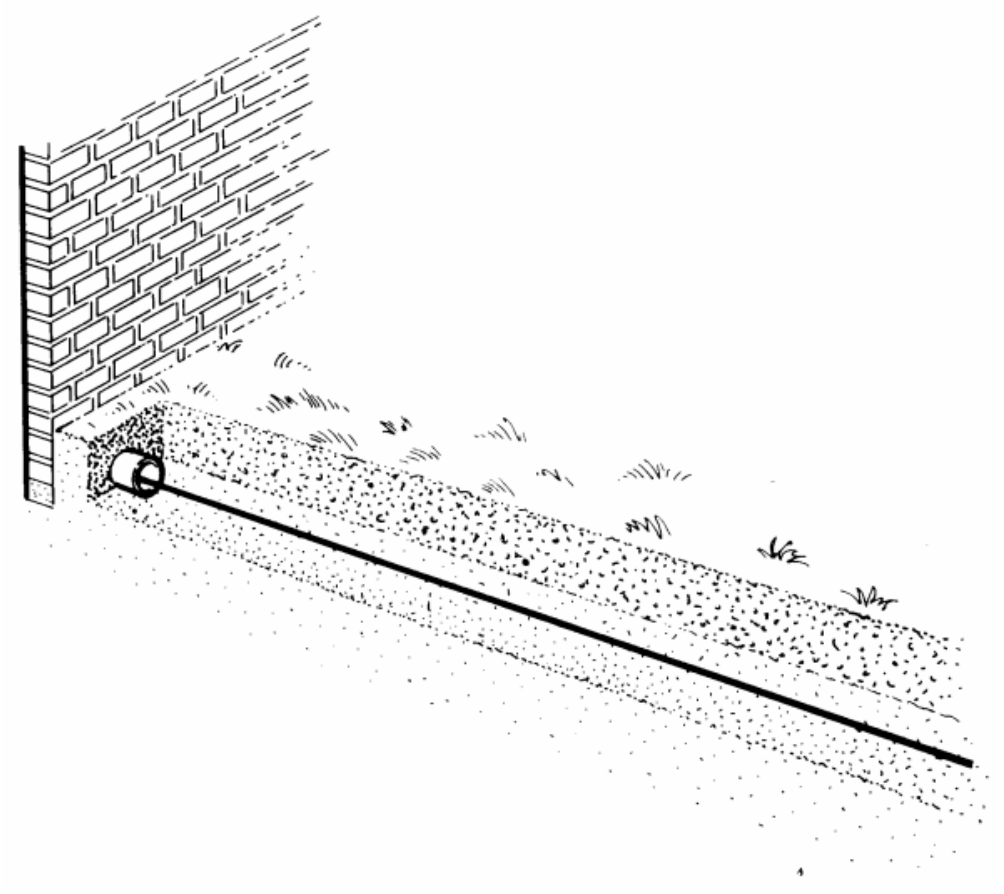
2.1.1 Earth Electrode of Vertical Earth Rods

An Earth Rod system will comprise of 2 x Rod earth No 3, installed vertically at least 3 metres apart - horizontal spacing. (1 rod may be at the base of a pole.) The rods will be connected together by 10mm Earthing Wire. (All items in the ground will be at minimum of 300mm depth of cover.)



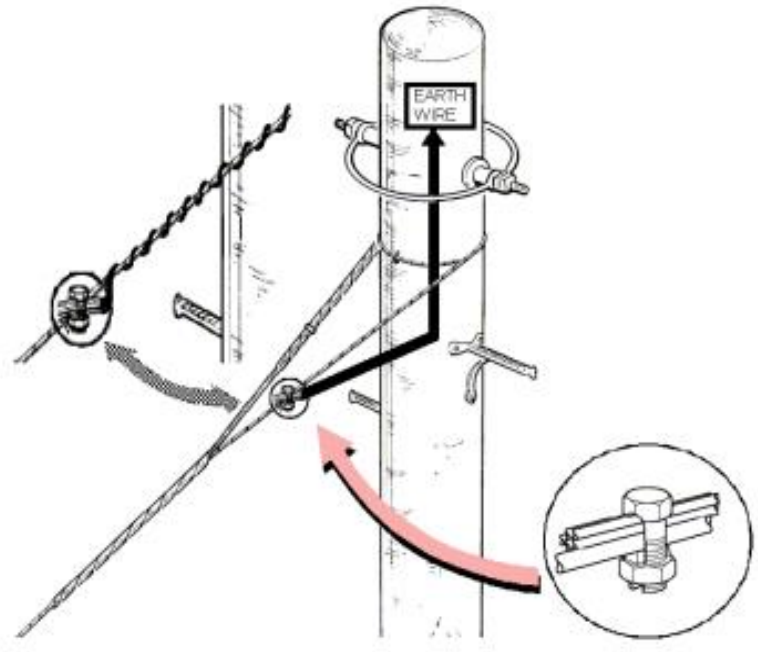
2.1.2 Earth Electrode of Horizontal Copper Tape

A copper tape electrode will comprise of 4.5 metres of Copper Tape, installed horizontally at minimum of 600mm Depth of Cover. (Where new duct is being provided, this tape will be installed under the new duct, but will be at an Absolute Minimum Depth of Cover of 400 mm with the length increased to 6.5metres.)



2.1.3 Earth Connection to Pole Stay

A Pole Stay Electrode connection will comprise of a direct connection between the 10mm Earthing Wire leading to the protectors, and the metallic component of a stay, using a split bolt.



2.1.4 Earth Connection to Dropwire Ring within a Steel Hollow Pole

A Steel Hollow Pole Dropwire Ring Electrode will comprise a direct connection between the 10mm Earthing wire leading to the protectors, and the metal of the Dropwire ring.

2.1.5 Earth Electrode of Copper Tape under a Wooden Pole

An Earth Electrode of Copper tape under a wooden pole will comprise of 4.5 metres of Copper Tape, fixed to the base of the pole, prior to installation of the pole.

This tape will be positioned such that the tape forms a "U" shape under the pole. Only 100mm of tape will be exposed above the ground (for connection to the protectors via 10mm earthing wire), any surplus tape will not be removed, but bent down, away from the vertical, and fixed to the pole.

2.2 Areas of High Earth Resistivity

A number of methods (see below) are available that will provide a satisfactory Earthing System for Lightning Protection in High Earth Resistivity Areas, but suppliers may also seek agreement for any method that results in an Earthing System Resistance that meets the performance requirements. The Openreach Work Originator will decide on the most appropriate cost effective method to be used at a particular location. (For Asset Assurance Retrospective work the choice of most appropriate cost effective method will be suggested by Supplier's Surveyor and agreed with Openreach Asset Assurance Office.)

2.2.1 Earth Electrode of Vertical Earth Rods

An Earth Rod system will comprise of 4 x Rod earth No 3, installed vertically at least 3 metres apart - horizontal spacing. (1 rod may be at the base of a pole.) The Rods will be connected together by 10mm Earthing Wire. (All Items in ground will be at minimum of 300mm depth of cover.) Any Existing / new pole stay will be bonded into the earthing system using split bolt.

2.2.2 Earth Electrode of Horizontal Copper Tape

A copper tape electrode will comprise of 9 metres of Copper Tape, installed horizontally at minimum of 600mm Depth of Cover. (Where new duct is being provided, this tape will be installed under the new duct, but will be at an

Absolute Minimum Depth of Cover of 400 mm with the length increased to 13 metres.) Any Existing / new pole stay will be bonded into the earthing system using split bolt.

2.2.3 Earth Connection to Dropwire Ring within a Steel Hollow Pole

A Steel Hollow Pole Dropwire Ring Electrode will comprise a direct connection between the 10mm Earthing wire leading to the protectors, and the metal of the Dropwire ring.

2.2.4 Earth Electrode of Copper Tape under A Wooden Pole

Method used will be as shown in 2.1.5 (Normal Earth Resistivity Areas), but **MUST** also be supplemented by Vertical Earth Rods, Horizontal Copper Tape or Pole Stay connection. (As shown in 2.1.1, 2.1.2 & 2.1.3 for Normal earth resistivity areas.) Initial spacing of any Vertical Rods shall be minimum of 2 metres from the pole. All Earthing Parts shall be interconnected with 10mm Earthing Wire.

2.3 Extending the Earth System via an Aerial Cable Suspension Wire

The extension of any Earth System from one pole to another will comprise of direct connection of the earthing system to the Aerial cable suspension wire. If the Aerial cable suspension wire has been exposed, connection will be made using a split bolt. (This will only be done if power attachments have been isolated correctly from this section of the aerial cable suspension wire - Joint user poles etc.) If the suspension wire is not exposed, this will be done with a Telenko Earth Bonding clamp that displaces the covering of the suspension wire.

Caution: Under no circumstances should a supplier provide an earth bond that compromises the effect of insulators in suspension wires.

2.4 Earthing Products

Item	Description
Rod Earth No 3	Un-galvanised mild steel rods 1.5m long by 16mm thick. Threaded at both ends to accept Tip and Heads Driving, or to be joined together. Rod Earth no 3 - (Item Code No 014450) Tip for Rod Earth no 3 - (Item Code No 015951) Heads Driving for Rod Earth No 3 - (Item Code No 012201) Nuts 3/8in BSF Hex Ord - (Item Code No 013350)

Copper Tape	Solid Copper Tape 25mm x 3mm in section - supplier to provide. *Note:* It is proposed that ready made Copper Tape and Earthing Wire Kits will be available in the future (4.5m, 6m, 9m and 13m Copper tape lengths joined to 15m earthing wire)
10mm Earthing Wire	Copper Earthing Wire with 10sq mm multi strand conductor and Green / Yellow Sheath. Available as Cable ELP 6491X 10sq mm GN/Y - (Item code No 791551)
Split Bolt	Split Bolt enabling connection of earth bonding to existing pole stays / aerial cable suspension wires, without cutting these wires. Available as Rod Earth 3 Split Bolt (Item Code No 001815)
Telenko Earth Bonding Clamp	Enables connection of earth bonding to Aerial cable suspension wires, without removal of the suspension wire sheathing. Available as Earth & Bonding Clamp (EC13) (Item Code No 016979)

2.5 Performance requirements

The works executioner shall comply with the following performance requirements:

2.5.1 Earthing system resistance requirements

a) In Normal Earth Resistivity areas - any supplier proposed method for providing an Earthing System must achieve a resistance of less than 50 ohms. (100 ohms on day 1 if soil is disturbed on provision)
b) In High Earth Resistivity areas - any supplier proposed method for providing an Earthing System must achieve a resistance of less than 200 ohms. (400 ohms on day 1 if soil is disturbed on provision)

Note: Final earth resistance for disturbed soil may take 2 - 3 months to settle.

2.5.2 Earthing System Connection to Protectors

1. The Connection between Earthing System and Protector Location will be via 10mm Earthing Wire.
2. The Maximum Distance between Earthing system and Protector Location will be 15metres.
3. All work carried out on poles will be in accordance with Openreach Specification EPT/ANS/A010 - Poling

4. All work carried out on Overhead networks will be in accordance with Openreach Specification EPT/ANS/A011 and EPT/ANS/A012 - Overhead cable (Dropwiring and aerial cabling respectively)

3 *Providing Lightning Protectors*

3.1 General

Not all Openreach Access Network plant requires Lightning Protection. The requirement is calculated per location, and will be directed by the Openreach Work Originator.

The Protectors may be fitted in a variety of Standard Openreach Plant items as described below. The Choice of plant item will be directed by the Openreach Work Originator. (For Asset Assurance Retrospective work the choice of plant item will be suggested by Supplier's Surveyor and agreed with Openreach Asset Assurance Office.)

3.2 Lightning Protector Locations

3.2.1 Box Connection 18A /19A (External Wall or Wooden Pole)

The Box Connection 18A or 19A will be used to provide Lightning protection for up to 20 pair cables at Distribution Points (DP's). (See EPT/ANS/A006 for standard termination requirements) When Lightning protection is required the existing rails of the 'Low Cost' box version will be removed and replaced with the appropriate upgrade kit. Item code 051899 - Upgrade kit for Low Cost Box Connection 18A, Item code 051926 - Upgrade kit for Low Cost Box Connection 19A.

The Existing External Protector Modules 1A (Dummy Modules) will be replaced by External Protector Modules 2B (Protectors).

The 10mm Earthing Wire from the earthing system will be terminated on the Box connection 18A / 19A Earth Position by either (a) being connected to Wire Earthing 9141A/W using a split bolt, or (b) utilising a reduced number of strands (3) from the 10mm Earthing Wire, cutting back any surplus strands and making safe any sharp ends.

3.2.2 Block Terminal 66B (Wooden Pole)

The Block terminal 66B will be used to provide Lightning Protection for up to 5 pair cables and Customer's Dropwires in line of route. (See EPT/ANS/A006 for standard termination requirements.)

Protection will be provided using a Protector 25 per pair. The Protector 25 has 2 red wires and 1 green wire. The red wires will be connected 1 to each wire in the pair (Teed across the circuit), and the green wire will be connected to the 10mm earthing Wire from the earthing system using a split bolt.

3.2.3 Block Terminal 71A (Hollow Pole)

To provide Lightning Protection at a Hollow Pole, either Protectors 25B (Mounted on the Block Terminal 71A within the pole) or Protection using a Ready Made or Constructed Joint (as near to pole as possible) will be used.

To provide protection on the BT 71A, the Protector 25 has 2 red wires and 1 green wire. The red wires will be connected 1 to each wire in the pair (Teed across the circuit) and the green wire will be connected to the Earthing Bar on the BT 71A.

The 10mm Earthing Wire from the earthing system will be terminated on the Box connection 71A Earth Position by either (a) being connected to Wire Earthing 9141A/W using a split bolt, or (b) utilising a reduced number of strands (3) from the 10mm Earthing Wire, cutting back any surplus strands and making safe any sharp ends.

3.2.4 Ready Made Protected Joint (Underground Chamber)

The protected joint will be used to provide lightning protection at an underground DP or on cable in line of route. The protected joint is available in 20 pair (sleeve 30P) 50 pair (sleeve 31P) and 100 pair (sleeve 32P) variants. In each case, the Joint has factory fitted Protector 25's, plus a pair cable tail and a 10mm earthing wire tail.

The Pair cable tail will be installed into an inline joint in the network, with the pairs jointed to form a tee across the network pair. (See EPT/ANS/A006 for standard jointing requirements and EPT/ANS/A008 for standard Closure requirements.)

The 10mm earthing wire tail will be connected to the earth system.

3.2.5 Constructed Joint (Underground Chamber or Pole Mounted)

The Constructed joint will be used to provide lightning protection at an underground DP, or on Cable in line of route (either Underground or overhead).

Protection will be provided using a Protector 25 per pair. The Protector 25 has 2 red wires and 1 green wire. The red wires will be connected, one to each wire in the pair (Teed across the circuit) and all the green wires will be connected to the 10mm earthing Wire from the earthing system using a split bolt. (See EPT/ANS/A006 for standard jointing requirements and EPT/ANS/A008 for standard Closure requirements.)

Note: All pairs within the closure will be connected to the earthing system via the protectors. All other continuous metallic components such as armouring, moisture barrier, Metallic screens and suspension strands will be bonded to the same earthing system as the protectors via an additional protector.

Note: To stop water penetrating into the joint, the 10sq mm earthing wire from the earthing system will be blocked. (A potential method is to remove 50mm of it's sheath, at a distance of 100mm from the cable end. Twist the cable to separate the conductors, and install a piece of 28-6mm tubing heat-shrinkable over the bared conductors. This provides a water block).

3.2.6 Internal Distribution Point (DP)

Where the DP cable is terminated on Krone 237A modules, protection will be provided by the provision of Earthing Bar 23 and protectors 23.

Where the DP cable is terminated on Jacks test 44 - 49 then Protector 6C will be used.

In all other cases, Protection will be provided using a Protector 25 per pair. The Protector 25 has 2 red wires and 1 green wire. The red wires will be connected 1 to each wire in the pair (T-ed across the circuit) and all the green wires will be connected to the earthing system.

(See EPT/ANS/A006 for standard terminating requirements and section 10 for standard customer premises requirements)

Note: In customer's premises, the required earth may be obtained by connection to the Customer's Main Earth terminal (By suitable Qualified Person) or by use of the Protective Earth Source Adapter 1A.

3.2.7 Internal Distribution Point with Restricted Headroom

Where the DP cable is terminated on Krone 237A modules and where box headroom is restricted, protection will be provided by the provision of Earthing Bar 23 and protectors 23 within a Box Connection 220A, swivel, (Item Code No 015621) and Krone 237A.

(See EPT/ANS/A006 for standard terminating requirements and EPT/ANS/A016 for standard customer premises requirements).

Note: In customer's premises, the required earth may be obtained by connection to the Customer's Main Earth terminal (By suitable Qualified Person) or by use of the Protective Earth Source Adapter 1A.

3.3 Protection Products

Item	Description
External Protector Modules 1A (Dummy	Used to provide connection in unprotected Box Connection 18A or 19A.

Modules)	Available already fitted into External Connection Module 1B - available as External CON MOD 1B (Item Code No 075994, per10 items) *Note:* EPM 1A has a light grey body colour and is shorter than the EPM 2B
External Protector Module 2B (Protectors)	Lightning Protector Modules to replace Dummy Protector Modules 1A in External Connection Module 1B as part of Protected Box Connection 18A or 19A. Available as External Protection Module 2B (Item Code No 076048) *Note:* EPM 2B has a dark grey body colour and is longer than the EPM 1A Dummy
Box Connection 18A/19A	Pole or Wall mounted Connection Box to terminate up to 20 pairs, using External Connection Module 1B per pair. When used on Wooden Pole, also requires Mounting BT 1A per Box Conn, to allow for dropwires to be dressed safely behind the Box conn. Available as Box Connexion 18A for up to 20 pairs (Item Code No 074855) Available as Box Connexion 19A for up to 10 pairs (Item Code No 075170) Available as Mounting Block Terminal 1A (Item Code No. 073025) Upgrade kit for Low Cost Box Connection 18A (Item Code No. 051899) Upgrade kit for Low Cost Box Connection 19A (Item Code No. 051926
Wire Earthing 9141A/W	Single, solid, copper strand, 1.5 sq mm conductor with Cream sheath marked "Telecom Functional Earth" at intervals. Available as Wire Earthing 9141A/W (Item Code No 033589, per 100m drum)
Protector 25	Protection Device supplied "loose" for connection in Joints or BT's etc. Each protector has 2 red wires (Connect across the pair) and 1 green wire (connect to earth). Available as Protector 25B (Item Code No 315524)
Sleeve 30P	Ready Made Lightning Protected Enclosure incorporating 20 x Protector 25B's, complete with

	15metre tails of 20 pair cable and Earthing Wire 10sq mm. Available as Sleeve 30P (Item Code No 075142)
Sleeve 31P	Ready Made Lightning Protected Enclosure incorporating 50 x Protector 25B's, complete with 15metre tails of 50 pair cable and Earthing Wire 10sq mm. Available as Sleeve 31P (Item Code No 075143)
Sleeve 32P	Ready Made Lightning Protected Enclosure incorporating 100 x Protector 25B's, complete with 15metre tails of 100 pair cable and Earthing Wire 10sq mm. Available as Sleeve 32P (Item Code No 075144)
Strips Connection 237A (Krone)	Modular Connection Strip for 10 pairs. Lightning Protection can be installed using an earthing Bar per Module, and a Protector 23 per pair. Available as Strip Connection 237A (Item Code No 017401, per 10 items)
Earthing Bar 23	Used to extend earth, for Lightning Protection, from the castellated backplate across a Krone 237A connection module. Available as Earthing Bar 23 (Item Code No 003850, per 10 items)
Protector 23	Used with an Earthing Bar 23 to provide plug in Lightning Protection on Krone 237A connection modules. Available as Protector 23 (Item Code No 003849, per 10 items)
Jacks Test 44 - 49	A series of MDF Type Terminating blocks - each capable of terminating 100 pairs. Only the jacks test 45, 47 and 49 are capable of receiving surge protection devices. (Protector 6 series modules)
Protector 6 series modules	Surge Protection Devices that Plug into Jacks Test 45, 47 & 49 (Single Pin) or Modular (5 Pin) MDF type Blocks. Available as Surge Protection Device 6C - Single Pin (Item Code No 003847, per 100 items; or as a refurbished item Item Code 767432 or as the 6D version Item Code 033147) Available as Surge Protection Device 6C - 5 Pin (Item Code No 003848, per 100 items; or when stocks of the

	6C are exhausted or the 6D 5 pin Item Code 033276)
Protective Earth Source Adapter 1A	A plug in adapter that can source a customer's earth from a normal 13A power socket - complete with earth connection wire. Available as Protective Earth Source Adapter 1A (Item Code No 315553)
Block Terminal 71A	For Terminating up to 20 pair PET cable within a Hollow Pole Available as Block Terminal 71A (Item Code No 072125)
Block Terminal 66B	Connection Box to house IDC type connectors Available as Block Terminal 66B (Item Code No 072256)
Tubing, Heat-Shrinkable 28 - 6mm	Tubing that shrinks from 28mm - 6mm Diameter on Heating. Can be used to provide a water block on 10sqmm Earthing cable Available as Tubing HT SHRNKBL 28/6MM (Item Code No 073046)
Box Connection 220A, Swivel	A 20 pair Box Connection with a hinged swivel mounting, to mount two Strips Connection 237A, with the ability to reduce headroom by swivelling the mount on closure when protection modules 23 are fitted. Available as Box Connection 220A swivel (Item Code No 015621)

3.4 Performance Requirements

Protector 25 - no coiled wires, all wires to be as short as possible.

Pre Made protected joints - No sharp bends or coils, earth wire as short as possible.

Protective earth source adapter - use only protector 25B.

Internal DP - check the Earth is connected on Jacks test and Krone backplate.

For jointing performance requirements refer to EPT/ANS/A006.

For Joint Closure performance requirements refer to EPT/ANS/A008.

For Underground Cabling performance requirements refer to EPT/ANS/A003.

For Overhead Cabling performance requirements refer to EPT/ANS/A011 and EPT/ANS/A012.

For Customer premises performance requirements refer to EPT/ANS/A016.

4 *Marking and Labelling*

Marking and labelling of closure systems will be in line with standard Openreach practice.

On completion of any work, the Work Executioner shall hand over to the Work Originator a complete set of amended or new certified records for local line records purposes.

Where applicable, the customer's line should be checked that it is working after any work is finished. This fact should be recorded.

5 *References*

BT Risk Assessment - Task Statement TS 16

BT ISIS - EPT PPS B055 Lightning Protection Handbook

BT ISIS - EPT PPS B025 Earthing Manual

BT Specification EPT ANS A002 (MDFs)

BT Specification EPT ANS A003 (Underground Cabling)

BT Specification EPT ANS A006 (Jointing and Terminating)

BT Specification EPT ANS A008 (Closure Systems)

BT Specification EPT ANS A010 (Poling)

BT Specification EPT ANS A011 (Overhead Cable - Dropwiring)

BT Specification EPT ANS A012 (Overhead Cable - Aerial Cabling)

BT Specification EPT ANS A016 (Customers Premises)

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