The application and removal of local earths and temporary continuity jumpers on AC Electrified Lines

1 Introduction

1.1 Scope

(a) This working instruction supplements the procedure for isolating and earthing the overhead line equipment as specified in the Working on or about 25kV AC Electrified Lines (NR/SP/ELP/29987).

1.2 Definitions

(a) **Designated Earthing Point (DEP**). This is a location at which the overhead line conductor system may be earthed for the purpose of issuing Permits to Work, using DEP local earths applied and removed by means of an earth pole.

(b) **Earth Attachment Point (EAP).** This is a physical point or assembly at a DEP to which either the line end or earth end of the DEP local earth is to be connected. One EAP is connected to the conductor system and another to traction earth.

(c) **DEP Local Earth** This is an appliance for use at a DEP to connect between a return conductor or isolated overhead line equipment and traction earth. (It is applied between the return conductor or the EAP on the isolated overhead line equipment and the EAP connected to the traction earth, normally via an overhead line structure and its connection to the traction return rail. It shall always have orange sheathed cable. The application and removal of local earths and temporary continuity jumpers on A.C. Electrified Lines DEPs have been introduced to enable both ends of local earths to be applied and removed by means of earth poles. The length of these DEP local earths has been co-ordinated with the positioning of EAPs so that, in the event of an earth end clamp becoming detached with the line end still attached, the risk of inadvertent contact is avoided.

(d) **Earth Pole** This is a device consisting of a handle, primary insulator and other attachments, used for the application and removal of DEP local earths, longlocal earths and temporary continuity jumpers.

(e) **Long Local Earth** This is an appliance to connect between a return conductor or isolated overhead line equipment and an overhead line structure or traction return rail or other metalwork bonded to the traction return rail. It shall always have blue sheathed cable.

(f) **Temporary Continuity Jumper** This is an appliance for use as a temporary connection when the electrical continuity of the overhead line, return conductor, etc. is broken. It shall always have blue sheathed cable. The application and removal of local earths and temporary continuity jumpers on A.C. Electrified Lines

The application and removal of local earths and temporary continuity jumpers on AC Electrified Lines

2 General

(a) All earths and continuity jumpers shall be maintained in accordance with document NR/OLE B15, Instruction for the Preparation, Care and Maintenance of Local Earths. All other equipment shall be examined in accordance with the appropriate instructions prior to use and any items found defective shall not be used. Primary Insulators are subject to regular testing; none shall be used unless they have a current test certificate permitting their use and they are not defective.

(b) Care shall be taken during the application and removal of local earths and temporary jumpers to avoid contact with adjacent live equipment.

(c) Only the approved components, as listed in Appendix A, shall be used for applying local earths.

(d) Only DEP local earths shall be employed for earthing except in unavoidable circumstances such as:

i. Earthing of a broken return conductor.

ii. Where a DEP is defective.

iii. In accordance with the requirements of NR/SP/ELP/29987 Working on or about25kV AC Electrified Lines.

In these circumstances long local earths shall be used strictly in accordance with section 4.0.

(e) Local earths or continuity jumpers fitted with screw type clamps shall be used when these are required to pass continuous current.

The application and removal of local earths and temporary continuity jumpers on A.C. Electrified Lines

(f) In use the minimum length of earth pole shall consist of bottom section and primary insulator together with the appropriate top fitting/adaptor. As necessary,intermediate sections (including half sections if appropriate may be used to provide the reach required.

(g) In the event that earths are subjected to traction fault current on site, all work should be stopped until those earths subjected to fault current have been replaced.

3 Application and Removal of DEP Local Earths

3.1 Application

(a) Visually check that the structure to rail bond at the DEP is intact. Where the bond is buried it may be assumed to be intact unless there are signs of disturbance to the ground. Where earth wire is installed, visually check the earth wire and its connection(s) to the traction return rail are intact.

(b) The earth end connection of the DEP local earth shall always be made BEFORE the line end is connected to the overhead line equipment.

(c) Apply both the earth and line end clamps using an earth pole. If the clamp is to be applied to an alumaweld or copper ply conductor the clamp shall only be applied to the line guard provided. Clamps must not be applied directly to these conductors.

3.2 Removal

(a) The line end connection of the DEP local earth shall always be removed BEFORE the earth end is broken. The application and removal of local earths and temporary continuity jumpers on A.C. Electrified Lines

(b) Remove both the line and earth end clamps using an earth pole.

4 Application and Removal of Long Local Earths

4.1 Application

(a) If application is to be made to an overhead line structure, visually check that the structure to rail bond is intact. Where the bond is buried it may be assumed to be intact unless there are signs of disturbance to the ground. If application is to be made to a painted surface, sufficient paint shall first be removed to ensure good metal to metal contact between the clamp and the steelwork.

Note: It is the anvil of the earth end clamp which is the electrical contact not the point of the screw.

(b) Before use, examine the condition of each earth (including the condition of the label). If damage is evident the earth is not to be used and must e returned for repair.

The application and removal of local earths and temporary continuity jumpers on AC Electrified Lines

(c) Long earths should be labelled at the clamp (earth) end with a visible label bearing the following legend: 'THIS CLAMP (EARTH) END TO BE APPLIED FIRST AND REMOVED LAST'

(d) The person who applies the earth end must also apply the line end.

(e) Where two or more earths are to be applied at the same time within 3 metres of each other, the same person must apply all the earths concerned.

(f) If there is a mixture of short and long earths protecting an isolation, the long earths should be applied last. The application and removal of local earths and temporary continuity jumpers on A.C. Electrified Lines

(g) The clamp (earth) end must be applied before the line end.

(h) Apply the earth end clamp by hand and tighten, using only the tommy bar on the clamp, and check that it is secure.

(i) Apply the line end clamp using an earth pole. If the clamp is to be applied to an alumaweld or copper ply conductor the clamp shall only be applied to the line guard provided. Clamps must not be applied directly to these conductors.

(j) When a screw clamp is used at the line end check that the clamp is tight. Where necessary ensure that the cable is secured clear of trains using, if appropriate, the hook shown on Drawing A4 - 5 in Appendix 1. The application and removal of local earths and temporary continuity jumpers on A.C. Electrified Lines

(k) If the earth end clamp becomes detached whilst the line end clamp is attached, the earth end clamp SHALL BE REGARDED AS LIVE AND DANGEROUS AND SHALL NOT BE APPROACHED OR TOUCHED until the line end clamp has been removed and lowered to the ground using an earth pole. The long local earth may be then applied again using the above method.

(l) Part 2 of the Form B should be endorsed to indicate “long earths in use at structure no…” and read back to the Electric Control Operator.

4.2 Removal

(a) The person who removes the line end must also remove the earth end.

(b) Where two or more earths are to be removed at the same time within 3 metres of each other, the same person must remove all the earths concerned and all line ends must be removed before any earth end is touched.

(c) If there is a mixture of short and long earths protecting an isolation, the long earths should be removed first.

(d) The line end connection of the long local earth shall always be removed BEFORE the clamp (earth) end is broken.

(e) Remove the line end clamp using an earth applicator pole. The application and removal of local earths and temporary continuity jumpers on A.C. Electrified Lines

(f) Remove the clamp (earth) end by hand.

REMEMBER

The clamp (earth) end must be applied before the line end

and

The clamp (earth) end must be removed after the line end

5 Application and Removal of Temporary ContinuityJumpers

(a) When a Permit to Work has been issued for work which involves breaking the continuity of the overhead line equipment (e.g. removing a jumper or opening on overhead line switch), then a temporary continuity jumper shall first be applied

across the proposed break. The temporary continuity jumper shall remain in place until the continuity of the equipment has been restored (e.g. the jumper has been replaced or the switch reclosed).

(b) Where the continuity of the overhead line is not to be restored (e.g. when cutting in a section insulator), local earths shall be applied on each side of the discontinuity in duplicate and as close as possible to, and at no greater distance than 75m from the break.

(c) When it is necessary to apply temporary continuity jumpers after the equipment has been earthed but before a Permit to Work has been issued these jumpers shall be applied and subsequently removed using an earth pole. These continuity jumpers shall be detailed on Part 2 of Form "B".

6 Earthing at Power Line Crossings

In order to comply with the NR/SP/ELP/29987 Working on or about 25kVA.C. Electrified Lines, the "adjacent electricity board power lines" are shown on Isolation Diagrams or Instructions.

These power lines are specifically defined as those which run adjacent to the railway at a distance of up to 100m from it or cross it at an included angle of 0° to 70° and are at a voltage exceeding 33kV.

The length of parallelism for adjacent power lines shall be that length where they are within 100m of the overhead line equipment, and for crossing power lines the area where they are within 100m of the overhead line equipment.

Where work is to be carried within the area of parallelism intermediate local earths shall be provided at 400m (max.) spacing.

7 Typical Locations for Local earths and Continuity Jumpers

7.1 Typical Applications

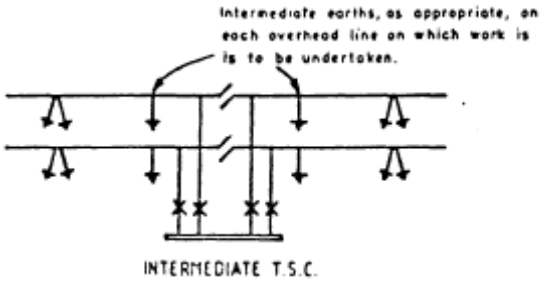
There are some situations when the earthing of overhead line equipment requires special consideration. Examples are given as follows.

7.1.1 Work on a Neutral Section

Duplicate earths shall be applied to the overhead line equipment as close as possible to and within 75m of each side of the neutral section, except that, when all lines are isolated and no parallel Electricity Board power lines exist, provided

duplicate earths are connected between the supply point and the neutral section the 75m limit may be extended to 3200m.

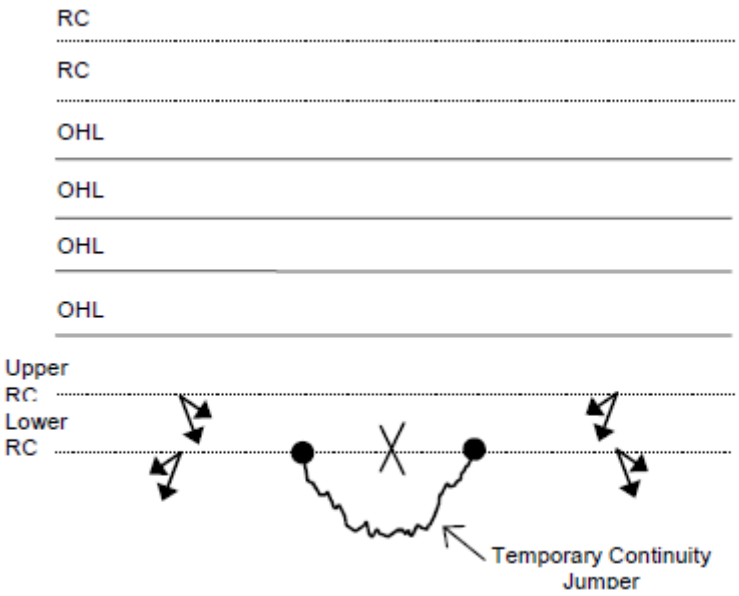
7.1.2 Providing Continuity through a Busbar



All Circuit Breakers shall be closed.

The application and removal of local earths and temporary continuity jumpers on A.C. Electrified Lines

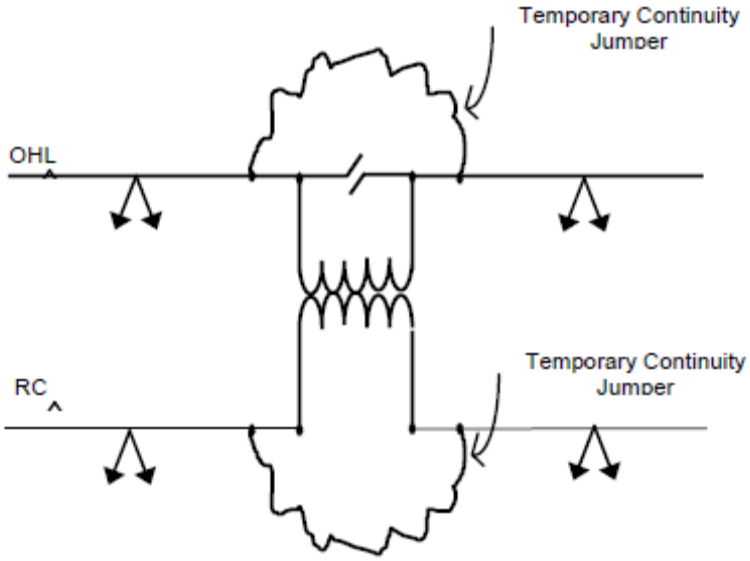
7.1.3 Work on Return Conductors (Four Track)



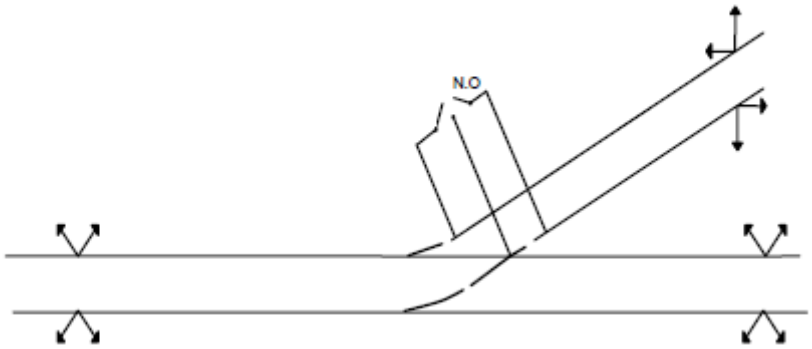
The work involves breaking the lower return conductor.

The overhead line shall be isolated and earthed as necessary in accordance with NR/SP/ELP/29987 Working on or about 25kV A.C. Electrified Lines.

7.1.4 Removal of Booster Transformer HV/LV Connections



7.1.5 Earthing at a Junction with Continuity



Normally Open (NO) switches to be closed. Intermediate earths are to be applied as appropriate.

7.1.6 Earthing at a Junction with Continuity Through Overhead Line Isolators

Where terminal end sidings cannot be energised by flashover of an insulator (e.g. a common headspan with only one insulator between the main line and sidings equipments), then provided that they are in accordance with the table below, duplicate earths may be installed at the throat end only. However, should the continuity of the overhead line in those sidings be broken, then earths **SHALL** be installed in accordancewith section 5 (b), above, before work is carried out on the overhead line at or beyond the discontinuity.

For this purpose the duplicate earths installed at the throat end may be considered as one of the sets of duplicate earths adjacent to that side of the discontinuity.

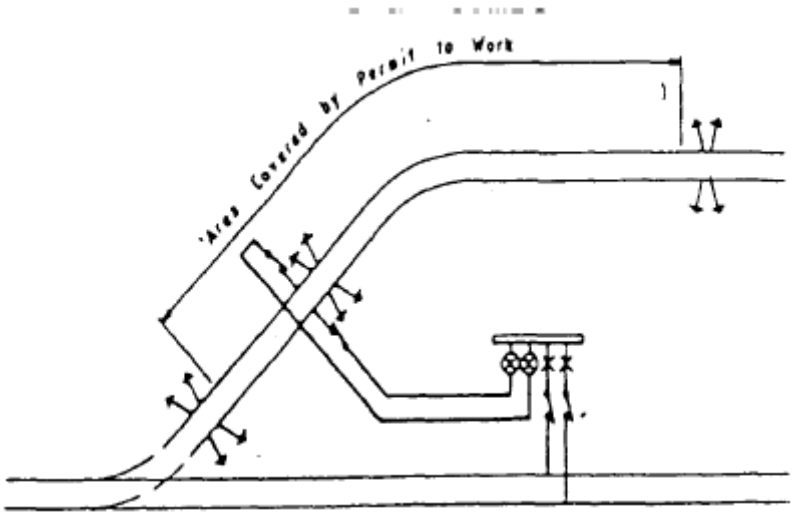
Maximum Permitted length of a Terminal End Siding Adjacent to Energised Running Lines when Earthed at the Throat End with the Terminal End Unearthed

	Type of Supression		
Type of Railway	**None**	**RC only**	**RC & BT**
Single Track	230m	407m	700m
Double Track	289m	550m	700m
Four Track	330m	800m	550m

Where work is carried out within 75m of the buffer stops, a set of duplicate earths may be applied within this distance instead of at the feeding end but these shall always be associated with the line on which work is to be carried out.

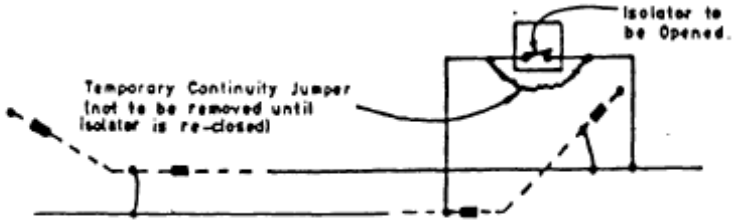
When sidings are longer than the above table and a permanent common jumper is installed at the buffer ends, provided that a set of duplicate earths are installed at the feeding end, any additional earths need only be applied to one line.

7.1.7 Earthing at a Point within the Area of a Permit to Work where All Lines are Isolated



The overhead line isolator(s) at the feeding point(s) within the area of the Permit to work shall be opened or duplicate earths applied within 75m of the in-feed point(s).

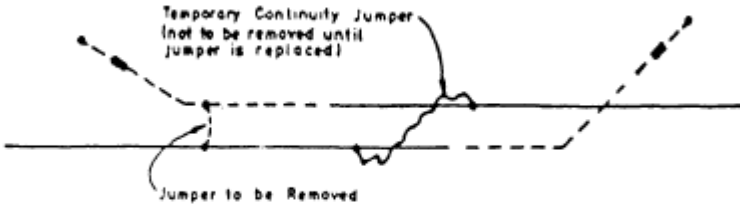
Intermediate earths shall be applied as required.



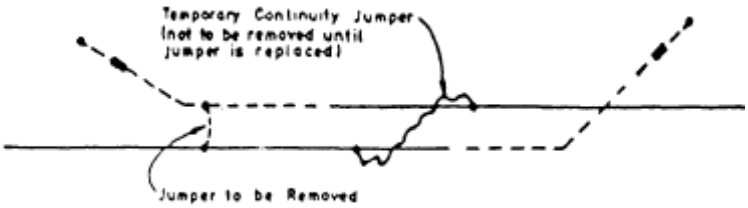
7.2 Where the Continuity of the Overhead Line Equipment is to be Broken

Before work is carried out on overhead line isolators, continuity or feeder jumpers, etc., which involves breaking the continuity of the earthed overhead line equipment (e.g. by opening a closed isolator), a temporary continuity jumper shall be applied as shown below.

7.2.1 Work on an Isolator at an Insulated Overlap

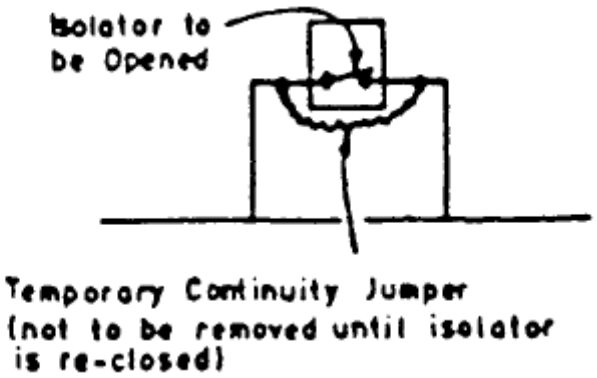


7.2.2 Work on an Uninsulated Overlap

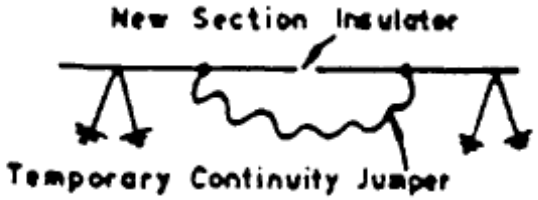


The application and removal of local earths and temporary continuity jumpers on AC Electrified Lines

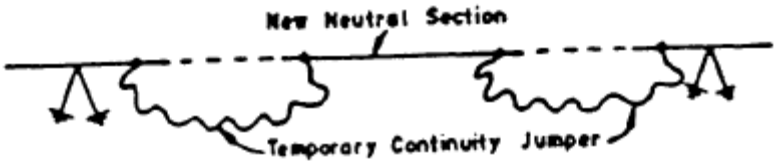
7.2.3 Work on an Isolator



7.2.4 Cutting in a New Section Insulator or Neutral Section



or



Duplicate earths shall be applied to the overhead line equipment as close as possible to and within 75m of each side of the neutral section, except that, when all lines are isolated and no parallel Electricity Board power lines exist, provided duplicate earths are connected between the supply point and the neutral section the 75m limit may be extended to 3200m.

Appendix A – Components of Portable Earthing Equipment

1. Glass Fibre Operating Poles

Top Section - for use with adaptor (91/805) combined with operating socket (91/852) and dispenser (91/2484) - Cat. No. 91/2356 to Drg.No. HP/91/2356/1.

Intermediate Section - Cat. No. 91/2061 to Drg. No. HP/91/2061.

Primary Insulator - Cat No. 91/2470.

Bottom Section - This includes the chain and spare bolt to attach to the Primary Insulator andthe rain shield (Cat. No. 91/20533) and this sub assembly is Cat. No. 91/2480 to Drg. No. HP/91/2480.

2. Pole Head Dispensers

91/2484 CCL Part No. C272811, for use with pole applied clamp (91/11874) to Drg. No. TD 272/27, Part No. 272811 91/20526 Part No. P331, (where still used) for use with pole applied clamps (91/10015 and 91/10016).

3. Pole Head Adaptor (a) and Socket (b) (to be used as a pair) for use with Clamp 91/20527

(a) Adaptor - Bowthorpe Part No. P3689 - Cat. No. 91/805

(b) Operating Socket - P & B Part No. S9D - Cat. No. 91/852.

4. Canvas Carrying Bag

Various canvas carrying bags are available, both vertical and horizontal types, for glass fibre poles. Vertical Type. Pattern No. 2/951B-Z from: Westminster Detectors Ltd. P.O. Box 719, Gerrards Cross, Bucks. SL9 8AY. (0753- 889644).

Horizontal Type.

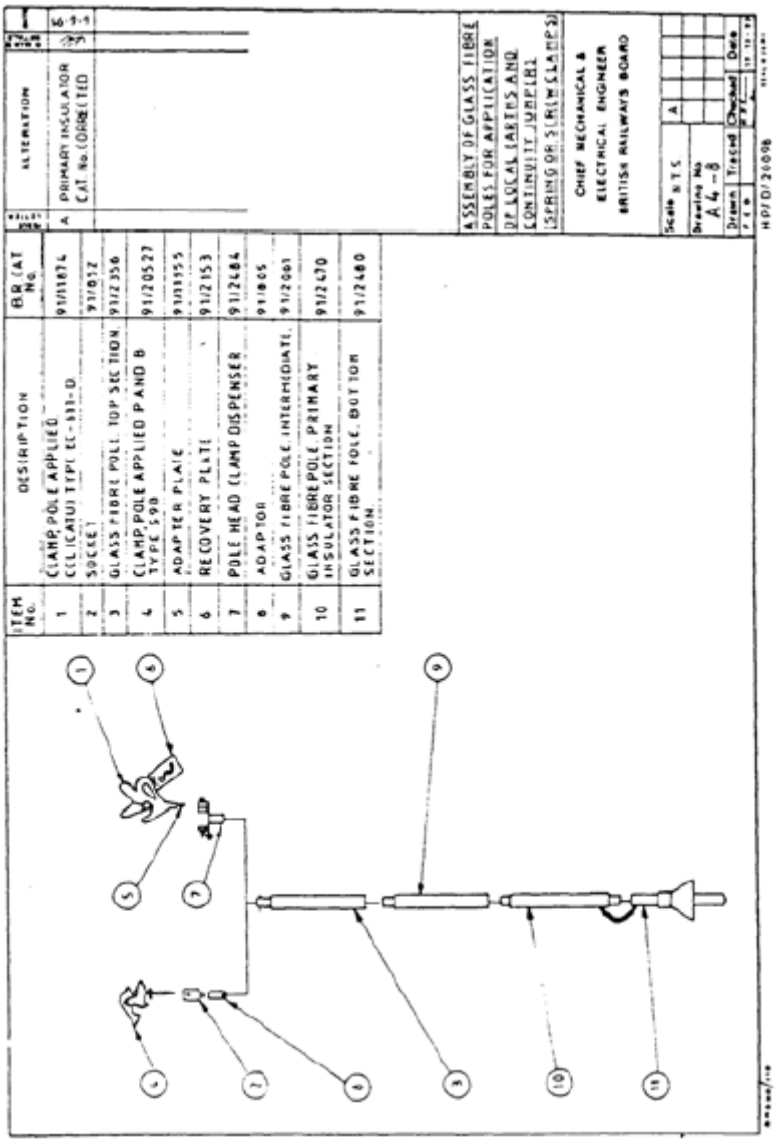
To Pattern No. 2377 from: H. Fine & Son Ltd. Victoria House, 93, Manor Farm Road, WEMBLEY, MIDDLESEX, HAO 1XB. (01-997-5055)

5. Hook

Hook for tying local earths clear of traffic, purpose made from 8mm. galvanised steel wire (91/10323) in accordance with Drg. No. A4-5. See section 7. Appendix A.

The application and removal of local earths and temporary continuity jumpers on AC Electrified Lines

6. Drawing - Glass Fibre Pole Operating Files



The application and removal of local earths and temporary continuity jumpers on AC Electrified Lines

7. Drawing – Details of Hook for use with Local Earths