National Grid UK Electricity Transmission plc

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NATIONAL SAFETY INSTRUCTION

Guidance Notes

NSI 4
WORK ON OR NEAR HIGH VOLTAGE OVERHEAD LINES

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### DOCUMENT HISTORY

<table>
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<th>Issue</th>
<th>Date</th>
<th>Summary of Changes / Reason</th>
<th>Author(s)</th>
<th>Approved By (Title)</th>
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</table>
| 1     | Apr. 08  | Reformatted and re-drafted to follow 3rd edition Electricity Safety Rules layout. NSI 4 working group updates, safety notes and safety bulletins have been incorporated. | OHL Manager  
Doug Lockwood  
NSI 4 Working Group | MDE Manager  
Les Adams |
| 2     | March 09 | NSI 4 working group updates, safety notes and safety bulletins have been incorporated.     | SRAT Manager  
Mick Brown,  
OHL Manager  
Doug Lockwood  
NSI 4 Working Group | MDE Manager  
Les Adams |
| 3     | March 10 | NSI 4 working group updates details below                                                   | SRAT Manager  
Mick Brown,  
OHL Manager  
Doug Lockwood  
NSI 4 Working Group | MDE Manager  
Les Adams |
| 4     | March 2011 | Reformatted and re-drafted. NSI 4 working group updates details below                     | SRAT Manager  
Mick Brown,  
OHL Manager  
Doug Lockwood  
NSI 4 Working Group | MDE Manager  
Les Adams |
| 5     | June 2013 | NSI 4 working group updates, safety notes, safety bulletins and OHL memos have been incorporated. | SRAT Manager  
Mick Brown,  
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SSR Manager  
Mark Poucher  
NSI 4 Working Group | Approved via  
SEDDs  
Mike Dean  
(ETAM)  
Derek Bickers  
(SSR) |
## KEY CHANGES

<table>
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| All | Various typing errors corrected  
All references to “Must” changed to “Shall”  
Title pages of each section updated for clarity. |
| Definitions | Earthing Team – Definition reworded to include the recipient of the Safety Document working as part of the earthing team. |
| Section 1 Standard Requirements | Rule 4.9 & 4.10 amended to remove the mandatory requirement for DAR outage when lowering conductors. Further guidance added to give examples where a DAR outage is required.  
**New Guidance added**  
- To cover emergency situations when working with both circuits out of service.  
- For work that can be included when working on Downleads or down-droppers under a dedicated Permit for Work.  
- Management of missing or incorrect flag brackets to incorporate recommendations from Safety Bulletin 299.  
- Work under a Limited Access Certificate to ensure the setting to work process is the same for outage & non-outage work.  
Flow-chart amended, notes page added into guidance section.  
Flow-chart Notes amended and updated to reflect current working practices.  
References to Double DrESS removed. |
| Section 2 Application & Removal of Drain Earths | **New Guidance added**  
- To ensure that the Master Safety Document is always MP(A).  
- Use of Multiple Limited Access Certificates.  
- Management of tower painting works (OHL Memo)  
- The mandatory requirement for the use of the “T” connector when connecting two or more Sparrow plate connecting bonds.  
- Application of Drain Earths when working with Conductors where de-stranding is required.  
- Work on semi-tension towers when fitting or removal of the jumpers.  
Further guidance added on the management of reduced earthing schemes.  
DEC forms section reformatted for clarity, paragraph changed to reinforce the requirement for a Competent Person to be responsible for final DEC 3 inspections. |
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<td></td>
<td>Drawings changed to show a single connecting bond between Sparrow Plates inline with other earthing schemes where only one <strong>Drain Earth</strong> is shown for clarity.</td>
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<tr>
<td></td>
<td>Drawing changed and text added to highlight the requirement to use a T connector when connecting Sparrow Plate connecting bonds together.</td>
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<th>OHL Maintenance Schemes</th>
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<tr>
<td>Scheme 2</td>
<td>New guidance added to highlight the Drain Earthing requirements on crossarms that do no require the temporary disconnection of Jumpers.</td>
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<td>Paragraph ameded to reflect the correct sequence for the application of <strong>Drain Earths</strong>.</td>
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<tr>
<td>Scheme 3</td>
<td>1. Reference to the use of single Sparrow plate removed.</td>
</tr>
<tr>
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<td>2. Reference to Bridging Earths removed</td>
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<tr>
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<td>3. Paragraph changed to reflect correct sequence of work</td>
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<tr>
<td></td>
<td>4. Drawings changed to show a single connecting bond between Sparrow Plates this is inline with other earthing schemes where only one <strong>Drain Earth</strong> is shown for clarity.</td>
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<td>5. Drawing changed and text added to highlight the requirement to use a T connector when connecting Sparrow Plate connecting bonds together.</td>
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<tr>
<td>Scheme 4</td>
<td>Drawing amended to reflect correct methods of work.</td>
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<td>Safety warning added to ensure that <strong>Drain Earth(s)</strong> are applied to the Earthwire Conductor on the line side of the insulated link prior to accessing the conductor</td>
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<tr>
<td>Scheme 5</td>
<td>Drawing changed to correct typing error “Bridging Earths” changed to “Bridging Earth”</td>
</tr>
<tr>
<td>Scheme 7</td>
<td>1. Drawings amended to show a single connecting bond between Sparrow Plates this is inline with other earthing schemes where only one <strong>Drain Earth</strong> is shown for clarity.</td>
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<tr>
<td></td>
<td>2. Drawing amended and text added to highlight the requirement to use a T connector when connecting Sparrow Plate connecting bonds together.</td>
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<tr>
<td>Scheme 10</td>
<td>– Removed</td>
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### Section 5  
**OHL Tension Stringing**

| Main title changed to Overhead Line Tension Stringing of Phase Conductors  
All guidance in relation to Equipotential Environments removed from this section.  
General Requirements for OHL tension stringing reformatted to ACOP style in line with other sections of this NSI.  
**Activity 2**  
1. Drawings changed to show a single connecting bond between Sparrow Plates this is inline with other earthing schemes where only one Drain Earth is shown for clarity.  
2. Drawing amended and text added to highlight the requirement for the use of “T” connector when connecting Sparrow Plate connecting bonds together. |

### Section 6  
**Earthwire Replacement**

| Overhead Line Tension Stringing of Earthwires  
General Requirements  
Paragraph reworded to reinforce the requirement to apply Short Drain Earth(s) to the Earthwire.  
Further guidance and safety warning added to ensure that Drain Earth(s) are applied to the Earthwire conductor on the lines side of the any insulated link prior to accessing the earthwire conductor. (IMS)  
Statement added to allow conductive pulling of earthwire conductor on a specific site by site basis.  
**Section 6 (1)**  
Overall layout drawing amended to reflect the correct Drain Earthing scheme.  
**Section 6. 2.4.2**  
Drawing amended to include further guidance for the requirement to apply Drain Earth(s) prior to accessing the Earthwire conductor. |

### Section 7  
**Fibre Optic Wrap**

| Reference to stringing operations changed to wrapping operation  
Paragraph 2.2.3 cross reference error corrected. |

### Section 8  
**Additional Guidance**

| Title page amended to include all OHL Equipotential Zone Environments Equipotential Zone Environments  
Section updated to include all OHL Equipotential Zone Environments Cross Jumpering  
Guidance added to cover situations when phasing is not the same on both circuits being connected together.  
Reference to the use of Ampacts removed.  
**Overhead Line Primary Earths**  
*Table 1 – Note amended to remove reference to the maximum number of Drain Earth(s) that can be fitted to the sparrow plate.* |
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<td>Authorisation Matrices for <strong>personnel</strong></td>
<td>Contractor authorisation Matrices updated to include section 9 &amp; 10.</td>
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WORK ON OR NEAR TO HIGH VOLTAGE OVERHEAD LINES

WHOLE DOCUMENT CONTENTS

- Section 1 - Standard Requirements
- Section 2 - Application and Removal of Drain Earths
- Section 3 - Drain Earth Shorting Schemes (DrESS)
- Section 4 - Overhead Line Maintenance Schemes
- Section 5 - Overhead Line Tension Stringing of Phase Conductors
- Section 6 - Overhead Line Tension Stringing of Earthwires
- Section 7 - Fibre Optic Wrap
- Section 8 - Additional Guidance
- Section 9 - Appendices
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WORK ON OR NEAR TO HIGH VOLTAGE OVERHEAD LINES

SECTION 1

STANDARD REQUIREMENTS

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1 PURPOSE AND SCOPE

To provide guidance on National Safety Instruction 4, when applying principles established by the Safety Rules to achieve Safety from the System for Personnel working on 275 / 400 kV overhead lines (OHLs). It sets minimum Drain Earth requirements for all work on or near OHLs. This includes terminal Equipment in substations and the precautions for working on Earthwires.

For work on 132kV Overhead Lines advice on current management shall be sought from an OHL Delivery Engineer. See Section 10 for Report Form.

Work activities not within the scope of this NSI:

- Work on phase conductors, insulators and fittings of Live circuits.
- Cellular Telecommunication Aerials where the work can be achieved without establishing safety precautions on the HV System utilising the G3 procedure ‘Work on Cellular Telecommunication Installations’.

The layout of this guidance note reflects that of legislative codes of practice, where the rule (or mandatory obligation) is identified by a green panel on the left-hand side. The guidance follows after the rule and is identified by a blue panel.

Within National Grid the guidance notes hold equivalent status of an Approved Code of Practice (ACOP) in law. If not followed, you will be required to demonstrate that your safe system of work is of an equal or higher standard.

2 DEFINITIONS

Terms printed in bold type are as defined in the Safety Rules.

<table>
<thead>
<tr>
<th>Title</th>
<th>Definition</th>
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<tbody>
<tr>
<td>Complex Circuit</td>
<td>A Dead circuit that has two or more Live circuits inducing current into it.</td>
</tr>
<tr>
<td>Simple Circuit</td>
<td>A Dead circuit that has only one Live circuit inducing current into it.</td>
</tr>
<tr>
<td>Partial DrESS</td>
<td>A Drain Earth Shorting Scheme (DrESS) which provides at a point on the circuit (e.g. a tower), a low resistance connection between any two phases or between the top phase and the earthwire having a rated current carrying capacity of 450 A.</td>
</tr>
<tr>
<td>Single DrESS</td>
<td>A Drain Earth Shorting Scheme (DrESS) which provides, at a point on the circuit (e.g. a tower), a low resistance connection between the earthwire, top-phase, middle-phase and bottom-phase having a rated, current-carrying capability of 450 A.</td>
</tr>
<tr>
<td>Double DrESS</td>
<td>As a Single DrESS but having a rated current-carrying capability of 900 A.</td>
</tr>
<tr>
<td><strong>Substation</strong></td>
<td><strong>Applied DrESS</strong></td>
</tr>
<tr>
<td>----------------</td>
<td>------------------</td>
</tr>
<tr>
<td><strong>A Drain Earth</strong> Shorting Scheme (DrESS) applied in a substation on the downleads or downdroppers from the terminal tower suitable for use as an OHL Primary Earth.</td>
<td></td>
</tr>
</tbody>
</table>

| **Earthing Team** | **A team led by the recipient of the Safety Document or by a Competent Person under the instruction of the recipient of the Safety Document to apply / remove Drain Earth(s) in accordance with an Earthing Schedule and to apply / remove red pennants on towers.** |

| **Earthing for Induced Voltages** | **Drain Earth(s) applied to reduce and control induced voltages at the point of work/work zone.** |

| **Earthing for Induced Currents** | **Drain Earth(s) applied to control and manage the flow of induced currents on the circuit to be worked on.** |

| **Equipotential Zone** | **An arrangement of conducting metallic footplates, designed to ensure that during fault conditions, dangerous potential differences do not appear across the body of Personnel working near ground based machinery.** |

| **Short Drain Earth** | **Type Registered Drain Earth with a maximum length of 1.5 m** |

| **Short Bridging Earths** | **Type Registered Bridging Earth with a maximum length of 1.5 m** |

| **Field Equipment** | **Items such as winches, pullers, tensioners, conductor access platforms, access equipment and cranes which could be subject to dangerous induced voltages/currents.** |

| **Field Equipment Earths** | **Type Registered connections used for bonding items of Field Equipment to earth. The earths are distinctively coloured orange to identify them from Drain Earth(s) and are not included on an Earthing Schedule.** |

| **Duplex Drain Earth** | **Type Registered Drain Earth used in substations to facilitate work on Downleads and Downdroppers.** |

| **Fully Conductive Conductor System** | **A system used in tension stringing where induced currents are allowed to flow in a controlled manner using Type Registered equipment.** |

| **Multiple Safety Documents** | **A series of identical Safety Documents that have the same number but a unique suffix to identify the individual document. The suffix is alphabetical, commencing at suffix A and progressing through the alphabet. The use of some letters is omitted to prevent any possibility of error in reading a suffix (i.e. I, Q and O).** |

| **Structure** | **A tower, gantry or other means of support giving access to exposed HV conductors.** |

<p>| <strong>Type Registered</strong> | <strong>Items of equipment that have been designed, tested and added to a Type Registered List (TRL).</strong> |</p>
<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
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</thead>
<tbody>
<tr>
<td>Downlead</td>
<td>The connection from the terminal tower on a circuit to the substation gantry or anchor blocks, or when an OHL connects to an underground cable, the connection from the crossarms to the cable sealing end structure (see Fig 1 below).</td>
</tr>
<tr>
<td>OHL Delivery Engineer</td>
<td>A <strong>Senior Authorised Person</strong> (NSI4) with sufficient technical qualifications and or experience to assess the <strong>Drain Earth</strong> requirements for induced voltage and current management when appropriate.</td>
</tr>
<tr>
<td>Permanently Disconnected OHL Circuit</td>
<td>A section of overhead line circuit that has been permanently disconnected from the National Grid <strong>HV system</strong> but remains under National Grid Safety Rules (see Section 8 (6) Fig E).</td>
</tr>
<tr>
<td>Disconnected Circuit Primary Earth(s)</td>
<td>A permanent <strong>Primary Earth</strong> rated to protect against inadvertent re-energisation and of a specific design as detailed in Section 8 (6) Fig A.</td>
</tr>
<tr>
<td>Sectionalised OHL Circuit</td>
<td>An OHL circuit whereby a temporary disconnection(s) has been made in order to restore part of the same OHL circuit back into <strong>Operational Service</strong> (see Section 8 (6) Fig F).</td>
</tr>
<tr>
<td>OHL Primary Earth</td>
<td>A pre determined arrangement of portable OHL <strong>Drain Earth(s)</strong> providing adequate protection against inadvertent re-energisation in accordance with the Management Procedure - <strong>NSI2 Earthing High Voltage Equipment</strong>. (The OHL <strong>Primary Earth</strong> shall have a National Grid Portable <strong>Primary Earth</strong> “No unauthorised interference” notice affixed to it to ensure it is readily identifiable as a <strong>Primary Earth</strong>).</td>
</tr>
<tr>
<td>Down Dropper</td>
<td>The final connection from the bottom of the Downlead to the substation or other termination equipment (e.g. busbars, line traps, cable sealing ends etc).</td>
</tr>
</tbody>
</table>

**Fig 1**
3 DANGERS

The main Dangers to Personnel working on overhead lines and towers are electric shock and burns arising from:

- Inadvertently infringing Safety Distance
- The application of Earthing Devices to Charged or Live High Voltage Equipment
- Inadequate precautions to safely manage any induced currents in the conductors and associated fittings
- Inadequate precautions to suppress or safely discharge any induced or other impressed voltages in the conductors and associated fittings
- Inadequate precautions to provide and maintain an equipotential environment for Personnel working with Field Equipment or other associated equipment.
- Badly connected, insecure or inadequate Earthing Devices
- The Rise of Earth Potential around the base of a tower (R.O.E.P.)
- Inadequate, damaged or missing earth bonding from terminal towers to the substation main earth system
- Effects of lightning strikes on towers and conductors

Where the word Safety Warning appears in the text, it is to signify that there will be additional risks of locally unearthed conductors being touched and other additional Dangers which could result in injury to Personnel.
4 General Requirements

4.1 Primary Earth(s) shall be initially applied to the line side of any Point(s) of Isolation within a substation. The Primary Earth(s) shall not be separated from the OHL by any temporary or permanent disconnection prior to the issue of OHL Safety Documents.

4.2 Prior to work being carried out on a Complex Circuit the section of the circuit to be worked on shall be made into a Simple circuit.

4.3 Where Drain Earth(s) are required on a terminal or sealing end tower a minimum of a Single DrESS shall be applied to that terminal or sealing end tower.

4.4 If work is to be carried out on phase conductors within 5 towers of the terminal tower or on the terminal tower itself, the integrity of the terminal tower earth tape connections to the substation main earthing system shall be verified. No work shall continue if the integrity of these earths is found to be faulty or defective.

4.5 Tower access and work above ground level shall only be carried out with a minimum of a Competent Person and a Person.

4.6 For any work on downleads and down droppers, a separate, dedicated Permit for Work shall be issued.

4.7 The Competent Person in charge of a Working Party shall ensure that the Equipment identification is effective before any access is allowed to a Structure.

4.8 The line end of all Drain Earth(s) shall be applied and removed by the use of a Type Registered earthing pole.

4.9 When working adjacent to a Live circuit, the Senior Authorised Person shall assess the requirement to switch out the Delayed Auto Reclose (DAR) on the adjacent circuit.

4.10 In the event of the adjacent Live circuit tripping when the DAR is switched out, the circuit shall not be re-closed until the Competent Person in receipt of the Safety Document has been contacted.

Guidance

NSI 4

4.1 Primary Earth(s) shall be either the normal substation applied Earthing Device, a Substation Applied DrESS or by the application of an OHL Primary Earth in accordance with Section 8 (6).

Work on OHL circuits and the management of induced circulating currents and voltages requires Primary Earth(s) to be initially connected to all ends of an OHL circuit within the substation prior to the Consent and issue of OHL Safety Documents.

The Primary Earth(s) shall not be separated from the OHL by...
any temporary or permanent disconnection(s) that exists between;

A1. The line side applied earthing device up to the down dropper / substation Busbar terminations.

A2. Where a cable sealing end and associated cable are located between the substation Busbar terminations and OHL down dropper / down lead; the Primary Earth(s) shall not be separated from the OHL by any temporary or permanent disconnection(s) that exists between the line side applied earthing device, up to the down dropper / down lead cable sealing end terminations.

As an initial condition, Rule 4.1 permits disconnection(s) to exist if down leads, down droppers or a span of the OHL have been previously removed / disconnected, provided that:

B1. Primary Earths(s) are applied within the substation side(s) of the disconnection(s) or by satisfying guidance A1/A2 above.

B2. Appropriate NSI 4 earthing schemes are in place on the OHL side of the disconnection.

Under these circumstances, prior to the issue of a Safety Document, the Control Person (Safety) shall confirm with the OHL Senior Authorised Person, that the induced current and voltage issues will be addressed via the application of NSI4.

If temporary disconnections are to be established as part of the OHL and / or substation line-end work, the Control Person (Safety) shall confirm with the OHL Senior Authorised Person, that the induced current and voltage issues will be addressed via the application of Management Procedure - NSI 4 Work on or near High Voltage Overhead Lines, such that no other existing OHL Safety Documents will be invalidated.

Where this is not possible, the Senior Authorised Person shall discuss and agree alternative earthing arrangements with an OHL Delivery Engineer. Further guidance on OHL disconnections can be found in the following diagrams on page 9.

In the event of emergency OHL recovery, disconnections as A1 & A2 (above) may exist prior to the issue of an OHL Safety Document provided :-

- Approval is given by an OHL Delivery Engineer.
- Double circuit outage conditions will be secured under a single Safety Document.
- A risk assessment shall be undertaken which considers Dangers from induced currents and voltages from parallel or feed circuits.
• The OHL Delivery Engineer shall confirm with the Control Person (Safety) that induced current and voltage issues will be addressed via the application of Management Procedure - NSI 4 Work on or near High Voltage Overhead Lines.
## NSI4 Guidance on Disconnections

**As an 'initial condition', no disconnections may exist between the Substation applied PE and the OHL connection point (in this case the down dropper).**

Note: Once the initial conditions have been met, then disconnections are permitted to be established within this area provided that the NSI4 requirements for induced voltages / currents are maintained.

## NSI4 Guidance on Disconnections (Where a cable section exists)

**As an 'initial condition', NSI4 allows the existence of disconnections within the OHL spans (this includes Down Leads & Down Droppers). The SAP however must confirm the ability to maintain the requirements of NSI4 for induced voltages / currents.**

Note: Once the initial conditions have been met, then disconnections are permitted to be established within this area provided that the NSI4 requirements for induced voltages / currents are maintained.
In the case of Permanently Disconnected OHL Circuits, advice shall have been sought from the appropriate OHL Delivery Engineer. (Additional guidance is given in Section 8 (6).

An OHL Delivery Engineer shall agree any changes to the Drain Earthing requirements and be consulted for work on terminal Equipment in substations. (Typical substation configurations are shown in the following diagram).

**Induced Currents in Substations**
4.2 For both outage and non-outage work on phase conductors, insulators, fittings and on Earthwires, the Senior Authorised Person shall make reference to the following flowchart for the Management of Induced Currents to determine the Drain Earth requirements.

- Work Identified
  - Work on Phase conductors, Insulators and Fittings
    - Outage Required
      - No
      - Yes
        - Work on Towers & Earthwires
          - Refer to OHL Colours (Comic Database)
            - Double DRESS Required
              - Apply Double DRESS Earthing to Section 3 (See Note 1)
            - Single DRESS Required
              - Apply Single DRESS Earthing to Section 3 (See Note 1)
            - Induced Voltage Drain Earthing Required
              - Apply Double DRESS Earthing to Section 3
              - (See Note 1)
        - For work on Terminal or Cable Sealing End Towers
          - Apply Single Dress to Section 3
        - If the Dead Circuit is not Parallel on the High and Low side of the Tower to be Worked on (See Note 3)
          - Breaking Conductors
            - Yes
            - No
        - Outage Required
          - No
          - Yes
            - Lower / Run Earthwire Conductor
              - Yes
              - No
        - Earthwire Connections Broken
          - Yes
          - No
- For work on Terminal or Cable Sealing End Towers
  - Apply Single Dress to Section 3
- Schemes
  - Section 4 (4,8,7,8)
  - Section 5
  - Section 8
- Schemes
  - Section 4 (2,3,5,6,7,8,9)
  - Section 5 – (All)
  - Section 8 (5)
- Schemes
  - Section 4 (4)
  - Section 6 (All)
  - Section 8 (2)
- Schemes
  - Section 4 (9)
  - Section 4 (9)
- Work Proceeds
### Guidance

**NSI 4**

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**Note 1** – A DrESS earthing scheme needs to be applied between, or at the point of work and the junction tower. If there is more that one junction tower then more than one DrESS earthing scheme may be required.

**Note 2** – Before the application of any Drain Earthing scheme the Comic database shall be consulted and any circulating currents shall be managed by the application of a DrESS earthing scheme.

**Note 3** – For situations where the Dead Circuit is not parallel with the Live circuit on the high and low side of the tower i.e. Diamond Crossings, L9 towers or where the phases are separated horizontally, advice shall be sought from the OHL Delivery Engineer to establish the most appropriate Drain Earthing scheme.

High induced currents can flow in the Drain Earth(s) applied to a Complex Circuit. The conversion of a Complex Circuit to a Simple Circuit can be achieved by the application of a DrESS earthing scheme to sectionalise the OHL circuit or by the local application of a DrESS earthing scheme at the point of work. See Section 2 for guidance on appropriate earthing schemes to use.

High induced currents (450 A) can flow in the conductors of a Simple Circuit. The management of this current involves the provision of parallel paths to enable the current to flow. This will limit the flow of current in lifting tackle, winch bonds and conductor stockings.

**4.3** Details for the application of a Single DrESS can be obtained from Section 2.

**4.4** Guidance for the management of defective earth tapes is given in TGN (E) 215. In circumstances where it is not reasonably practicable to apply the requirements of TGN (E) 215, a Single DrESS shall be applied to the terminal tower, or between the Point of Work and the terminal tower.

**4.5** The Competent Person is responsible for ensuring Safety Distance is not infringed. They shall be able to communicate with all members of the Working Party.

Contractors shall arrange for the training, assessment and appointment of their staff as Persons and Competent Persons. All members of the Working Party shall, as a minimum, have been appointed as a Person. All staff required to hold Safety Documents shall be appointed as a Competent Person.

Each Person climbing the tower shall understand and comply with the requirements of the safe system of work.
4.6 The dedicated Permit for Work may include other work on the towers being worked on e.g. replacement of insulators on the adjacent side of the tower or work on other towers where Drain Earth(s) are applied which are associated with the dedicated Permit for Work.

4.9 Examples of activities that require the DAR to be switched out include:

- Tension stringing of conductors.
- Raising or lowering of earthwire.
- Raising or lowering of conductors on middle or top phases.
- Use of Cranes or Mobile Elevated Work Platforms.

The Senior Authorised Person shall ensure that the nominated Competent Person responsible for requesting the DAR is aware of their responsibilities to inform all other Working Parties affected by the DAR outage or its restoration and any associated lightening risk notifications, (see NSI 4, section 1, 10.1 Lightening) See Section 10 for the appropriate form.

When contacting the Control Person (Operations) to request a DAR outage, the Competent Person will convey the following information to ensure the correct DAR is switched out:

- Circuit Name
- Route Designation
- TOGA Outage Booking Reference

4.10 The Competent Person nominated as DAR contact shall ensure that all Senior Authorised Person’s and Competent Person’s in receipt of Safety Document(s) have been notified of the fault on the adjacent circuit. The nominated DAR contact shall liaise with the relevant Senior Authorised Person and ENCC to ensure that the restoration of circuit can be managed efficiently which may include implementation of any actions required to ensure safety of personnel.

5 Assessment of Risk / Method Statements

5.1 A suitable and sufficient Risk Assessment(s) shall be carried out before any work is undertaken on or near to OHLs.

5.1 When work is being carried out on towers where reduced clearance to Live conductors can occur, the Senior Authorised Person preparing the Safety Document(s) shall decide what special arrangements are to be undertaken.

The arrangements may be one or more of the following:

- Specifying the exact limits of demarcation
- Requirement for Personal Supervision by a Senior
**Guidance**

NSI 4

5.1 Cont

**Authorised Person or Competent Person**

- Application of a Method Statement
- Application of an Approved procedure

The requirements for Drain Earth(s) shall form part of the Risk Assessment.

For work on the earthwire which is likely to cause a significant increase in sag, a suitable and sufficient Risk Assessment shall be carried out.

Consideration shall be given for the need for, and availability of, circuit and/or DAR outages to determine if the work can be done under double circuit, single circuit or non-outage conditions.

A review of all Risk Assessments shall be carried out by everyone on site.

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**NSI 4**

6.1 to 6.2

**6 Access / Egress and Work which Requires Circuit Outages**

6.1 Access / Egress and work where Safety Distance may be infringed shall be carried out under a Permit for Work.

6.2 During the issue/transfer of a Permit for Work the recipient of the Safety Document shall confirm that the Circuit Identification complies with the details in the OHL Technical Data Sheet(s).

---

**Guidance**

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6.2

6.2 The Senior Authorised Person issuing the Permit for Work shall also issue to the Competent Person receiving the Permit for Work the following items:

- Sufficient Circuit Identification wristlets for each member of the Working Party
- Sufficient Circuit Identification flags which fit the sockets or brackets on the towers to be climbed
- Sufficient Drain Earth(s) and an associated Earthing Schedule, where applicable

Prior to the issue of the Safety Document the Senior Authorised Person will confirm to the Competent Person all the relevant information from the Technical data sheet, highlighting the flag bracket identification nomenclature. The Technical data sheet shall be issued with the Safety Document.

On notification that a flag bracket is reported as either missing or incorrect the Senior Authorised Person will take the following action.
NSI 4
6.2 Cont.

• Stop all work immediately at the tower.

If Flag bracket is reported as missing,

• Using operational diagrams and technical data sheets the Senior Authorised Person shall positively identify the circuit and instruct Competent Person to fit new flag bracket. Work can then proceed.

If Flag bracket is reported as incorrect,

• Using operational diagrams and technical data sheets the Senior Authorised Person shall positively identify the circuit on site to confirm that the flag bracket is incorrect, and then instruct Competent Person to replace with the correct flag bracket. Work can then proceed.

During the work preparation stages the Senior Authorised Person shall make reference to the available condition monitoring data and where reasonably practicable rectify any missing or incorrect flag brackets prior to the issue of the Safety Document.

The Senior Authorised Person may decide it is not necessary to apply Drain Earth(s) to all phases. This reduced earthing shall not affect the safety of persons.

The Competent Person who has received the Permit for Work shall ensure that:

• All members of the Working Party are fully briefed on all aspects of the work, hazards and their roles.

• The Working Party Register is completed.

• A Circuit Identification flag is correctly fitted to the appropriate socket or bracket at the tower to be worked on.

• Each member of his Working Party is in possession of a Circuit Identification wristlet.

• Red pennants, if appropriate, are fitted to clearly identify limits of the safe working area

• Drain Earth(s) are fitted by the Earthing Team in accordance with the Earthing Schedule. A copy of the Drain Earthing requirements shall be issued to the Competent Person in charge of each Earthing Team.

Each Person climbing the tower shall:

• Check that the Circuit Identification flag is correctly fitted.

• Check the tower nomenclature corresponds with the tower nomenclature on the Safety Document.
7 Access / Egress and Work which does not require Circuit Outages

7.1 Access / egress and work on towers where there is no significant risk of infringing Safety Distance during the course of the work may be carried out with circuit(s) Live.

7.2 For earthwire work Short Drain Earth(s) or Short Bridging Earths shall be used to maintain all earth bonding connections or to maintain earthwire continuity.

7.3 Whenever Personnel are required to access the tower peak and carry out work which may bring them closer than 1 metre to the Earthwire i.e. Condition Assessment or Tower Painting, then a Short Drain Earth(s) shall be applied between the tower steelwork and earthwire using a Type Registered 600 mm earthing pole.

7.4 For earthwire work at terminal towers a minimum of 3 Short Drain Earth(s) or 3 Short Bridging Earths attached to a Sparrow Plate shall be used to cater for any possible induced current.

7.5 The Senior Authorised Person preparing the Limited Access Certificate shall define the use of the Short Drain Earth(s) / Short Bridging Earths in the ‘Further Precautions’ section of the Limited Access Certificate. An Earthing Schedule shall be issued with the Limited Access Certificate to record the details.

7.1 When the Senior Authorised Person decides it is necessary to confirm these instructions in writing, he shall record the assessment and controls to be applied in AMBP 311 RAMS. Where the RAMS control all Safety from the System hazards there is no requirement to issue a Limited Access Certificate.

Where contractors are carrying out work near HV Equipment and the means of achieving Safety from the System is by limiting the work area, a Senior Authorised Person shall confirm these instructions in writing by the issue of a Limited Access Certificate. The only exception to this requirement is where the identified work, and / or work area, as detailed and controlled in the risk assessment and method statement are limiting in their own right, thus ensuring there is no risk from the System.

The Senior Authorised Person shall, in the assessment of the work, consider that the conductors and insulators may be moved by the wind from the still air position and the Competent Person shall ensure this will not be a source of Danger during the course of the work. Guidance for assessing Safety Distance in still air conditions can be found in Section 9 Appendix A.

The Senior Authorised Person issuing the Limited Access...
Guidance
NSI 4
7.1 cont to 7.4

Certificate shall also issue to the Competent Person receiving the Limited Access Certificate the following items:

- Sufficient Drain Earth(s) and an associated Earthing Schedule, where applicable

The Competent Person who has received the Limited Access Certificate shall ensure that:

- All members of the Working Party are fully briefed on all aspects of the work, hazards and their roles.

- The Working Party Register is completed.

- Red pennants, if appropriate, are fitted to clearly identify limits of the safe working area.

- Drain Earth(s) are fitted by the Earthing Team in accordance with the Earthing Schedule. A copy of the earthing requirements shall be issued to the Competent Person in charge of each Earthing Team.

Each Person climbing the tower shall:

- Check the tower nomenclature corresponds with the tower nomenclature on the Safety Document.

7.3 Access within 1 metre is permitted for the duration of applying the Short Drain Earth(s).

Where Short Drain Earth(s) are applied to earthwires carrying fibre optic wrap, extra care shall be taken when applying the Short Drain Earth(s) to ensure that the Fibre Optic Cable is not crushed or damaged. Where possible the Short Drain Earth(s) shall be applied to the conductor between the earth wire fitting / anchor clamp and fibre optic clamps or support frames.

On certain towers OPGW extends from the peak of the tower to base level. If the integrity of the permanent earth bonds fitted to the OPGW extending down the tower leg(s) is verified, then there is no requirement to apply a Short Drain Earth to this OPGW to approach within 1 m.

7.4 Where the work involves approach within 1 m to the earthwire on terminal towers, but does not involve work on the earthwire or earth bonds then only one Short Drain Earth is required.

8 Control of DrESS Earthing Scheme(s)

8.1 DrESS earthing schemes shall be controlled via an Earthing Schedule or Safety Document Card Safe.

Guidance
NSI 4
8.1

8.1 DrESS ear scheme(s) controlled via an Earthing Schedule.

This will normally be carried out when a single Working Party
is carrying out a task(s) during an OHL outage. The **Earthing Schedule** shall make reference to the application / removal of the DrESS earth scheme(s) and the fact that it shall be applied prior to the task(s) being carried out and removed only when the task(s) has been completed.

DrESS earth scheme(s) controlled via a **Safety Document Card Safe**.

This will normally be carried out when there is more than one **Working Party** of any one company e.g. National Grid, OHL Contractor or tower painting Contractor etc. The relevant **Permit for Work** and associated **Earthing Schedule** for the application / removal of the DrESS earthing scheme will be locked in a Card Safe.

All subsequent **Permit For Work** shall be endorsed in Section 2, under “Further Precautions”, with the words “DrESS earthing scheme is applied to tower …… under **Permit for Work** ……”

The **Card Safe** number shall be entered in the appropriate box in Section 4 of the **Permit for Work**.

The **Senior Authorised Person** issuing the **Permit for Work** shall, in addition to all other items, issue a **Key for the Card Safe** holding the DrESS **Permit for Work**. This issue will be recorded on the **Permit for Work** in Section 4.

### 9 Tower Demarcation

#### 9.1 For both Outage and Non Outage work the **Senior Authorised Person** shall assess the need for demarcation. Where demarcation is necessary it shall be carried out as follows:

Before any other work, a minimum of 2 red pennants shall be fixed to each of the crossarms supporting the conductors not to be worked on, positioned at the junction of these crossarms with the tower body or at a position close to, or as near as reasonably practicable, to this position. Pennants shall be no more than 1 m from the tower body. The pennants shall remain in position until all work on the tower has been completed.

#### 9.2 When Red Pennants are to be fixed in a manner which differs from 9.1 above, then the **Senior Authorised Person** shall provide specific instructions and / or a detailed sketch / drawing with the **Safety Document(s)**

#### 9.3 Demarcation shall be affixed by a **Competent Person(s)** or **Person(s)** under the **Personal Supervision** of a **Competent Person**. Each Person climbing the tower shall ensure the tower is clearly demarcated before starting work.

#### 9.2 Refer to Section 9 Appendix B for tower demarcation template. The **Senior Authorised Person** can indicate demarcation requirements on the template and issue with **Safety Document(s)**

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**Guidance NSI 4 8.1 Cont**

**Guidance NSI 4 9.2**
9.3 The Person(s), whilst fixing or removing red pennants, shall be under the Personal Supervision of a Competent Person, who shall be able to communicate with him to warn of any possible infringement of Safety Distance. This Competent Person may be positioned on the ground or on the tower.

10 Adverse Weather Conditions

10.1 In the event of or the near approach of a lightning storm, all work on OHLs shall cease immediately.

10.1 Personnel are to withdraw to a minimum of 10 m from any tower and connected equipment.

Personnel shall be vigilant with regard to lightning and other adverse weather. They shall inform colleagues and the NOC Response Team immediately of any adverse weather conditions which may affect the work. The NOC Response Team shall pass this information as appropriate.

The Senior Authorised Person shall ensure that the nominated Competent Person responsible for requesting the Lightning Risk status is aware of their responsibilities to inform all other working parties that are affected along the route.

11 Actions Following Faults on Adjacent Circuits

11.1 Where a circuit has been subject to a fault all Earthing Devices shall be inspected before further work is carried out.

11.1 Where a circuit has been subject to a fault, the integrity of Earthing Devices cannot be guaranteed. Therefore, following a fault on an adjacent circuit, all Earthing Devices shall be inspected before further work is carried out.

This shall be in the form of a visual inspection to identify any Drain Earth(s) that have become detached or severely burnt or if there are signs of excessive arcing onto tower steelwork as a result of high fault currents.
# SECTION 2
APPLICATION AND REMOVAL OF DRAIN EARTH(S)

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1 Scope

The Schemes detailed in this Attachment indicate the requirements for the application of portable Drain Earth(s) and Field Equipment Earths in preparation for various work procedures.

The methods detailed are normal requirements and may be changed or supplemented by a Senior Authorised Person in particular job circumstances provided that Safety from the System is maintained.

All Schemes in this Attachment have been written on the basis that all three phases of a circuit are to be worked on. Where the Senior Authorised Person has decided that it is not necessary to earth all phases then the term "circuit" in the Schemes Shall be replaced by "phase(s)".

2 General Principles

2.1 An Earthing Scheme shall be produced for all work on OHLs where Danger can arise from induced voltages and currents.

2.2 Drain Earth(s) shall be applied and removed in accordance with the requirements of this NSI and associated earthing schemes.

2.3 Where reasonably practicable only Short Drain Earth(s) / Short Bridging Earths shall be used on an earthwire to prevent Safety Distance being inadvertently infringed.

2.4 All Drain Earth(s) shall be accounted for on issue and clearance of Safety Document.

2.5 When the work requires use of Multiple Safety Documents, then the Senior Authorised Person may issue all the Drain Earth(s) for the work with one Safety Document (the Master Safety Document).

2.1 Where there is not a scheme to cover a particular work situation e.g. diversions or emergency repairs, the Senior Authorised Person, in conjunction with an OHL Delivery Engineer, shall prepare an earthing scheme which may be a combination or modification of existing scheme(s). In these situations, it is the responsibility of the Senior Authorised Person issuing the Earthing Schedule to ensure that the recipient of the Safety Document is aware of the requirements of the modified scheme.

2.2 The Senior Authorised Person shall determine the requirements for the application of Double DrESS, Single DrESS or Induced Voltage only earthing arrangements by reference to Management of Induced Currents Flowchart and to NOC OHL Colours Technical Database (COMIC – Control of Modifications Information Catalogue) incorporating Drain Earth(s) requirements.

Note: Drain Earth(s) requirements identified by the NOC OHL Colours Technical Database (COMIC) can change as they are subject to system operating parameters and revisions will be made by the NOC without notification.
The Senior Authorised Person has the responsibility to decide whether Drain Earth(s) are required and, if so, to ensure that the correct number(s) of Drain Earth(s) are issued together with an Earthing Schedule.

2.3 Some designs of tower and/or methods of work require Drain Earth(s) longer than 1.5 m. Where this situation arises, then a Risk Assessment shall be undertaken to determine the most suitable method of application to ensure Safety Distance will not be infringed during application and removal of the Drain Earth(s) or whilst they are in situ.

2.4 Where reasonably practicable, the Drain Earth(s) will be counted out and counted in from secure containers. However, when large quantities of Drain Earth(s) are issued (e.g. on major projects or refurbishments) it may not be practical to follow this method. For these situations the procedure in paragraphs 5.1 to 5.6 of this section (Control of Drain Earth(s)) shall be used.

2.5 The Master Safety Document shall always be Safety Document number/ MPA.

The Master Safety Document shall record the total number of Drain Earth(s) issued.

All secondary multiple Safety Documents shall record zero Drain Earth(s). A copy of the Master Earthing Schedule shall be issued with each secondary multiple Safety Document.

Section 2 of each secondary multiple Safety Document shall be endorsed with the following:

“Drain Earth(s) shall be applied as directed by the recipient of this Master Permit for Work and in accordance with attached Earthing Schedule”.

The principles of the use of multiple Safety Documents can be applied for work under a Limited Access Certificates.

Guidance for the Management of tower painting works.

One Multiple Permit for Work will be issued that covers all work to be undertaken including Drain Earth(s) application or removal, fall arrest rope rigging, painting and QA activities.

The Permit for Work Section 1, Work to be done: - Carry out tower painting and associated activities.

The Master Permit for Work shall be issued to Site Supervisor/Senior Foreman who is responsible for setting people to work and directing the site operations. He is responsible for the co ordination of multiple working parties within a specified work area and will co ordinate the Drain Earth(s) requirements. The Master Permit for Work has the total number of Drain Earth(s) issued with it.

All Secondary Safety Documents associated with the Master Permit for Work will have zero Drain Earth(s) issued along with
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2.5 Cont

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<td></td>
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<td>a copy of the Master <strong>Earthing Schedule</strong>, in accordance with Section 2 (2.5)</td>
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<td>The Master <strong>Permit for Work</strong> Section 2 Further Precautions shall be endorsed with:</td>
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<td></td>
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<td>“<strong>Drain Earth(s)</strong> shall be applied as directed by the recipient of this Master <strong>Permit for Work</strong> and in accordance with attached <strong>Earthing Schedule</strong>”</td>
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<td></td>
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<td>All Secondary multiple <strong>Permit for Work(s)</strong> Section 2 Further Precautions shall be endorsed with:</td>
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<td></td>
<td></td>
<td><strong>Drain earth(s)</strong> shall be applied as directed by the Master <strong>Safety Document</strong> recipient and in accordance with <strong>Safety Document No.--------</strong> (master <strong>Safety Document</strong> number)</td>
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<td></td>
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<td>Contractors RAMS shall include how different levels of <strong>Competent Persons</strong> will be managed to ensure the appropriate authorisation for the task i.e. NSI 4 CPB or CPC and shall define the responsibility of the Master <strong>Permit for Work</strong> recipient and method for <strong>Drain earth(s)</strong> control and coordination.</td>
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<td></td>
<td></td>
<td>National Grid QA teams issued with a Secondary <strong>Safety Document</strong> and a copy of the <strong>Earthing Schedule</strong>. National Grid <strong>Competent Person</strong> shall co ordinate with Master <strong>Permit for Work</strong> recipient to ensure only towers within <strong>Earthed</strong> sections are QA checked.</td>
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<td></td>
<td></td>
<td><strong>Earthing Schedule(s)</strong></td>
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<td>The following statement shall be included on the <strong>Earthing Schedule</strong> “A daily check shall be made before work starts that appropriate <strong>Drain Earth(s)</strong> are still in place. In accordance with NSI 4, section 4, Scheme 1 (3.1)”</td>
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<td></td>
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<td>In addition this requirement shall be defined in both MDE and Contractors RAMS.</td>
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<td><strong>3.1</strong></td>
<td><strong>Drain Earth(s)</strong> and associated equipment shall be Type Registered.</td>
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<td></td>
<td>OHL equipment used during the application and removal of <strong>Drain Earth(s)</strong> is listed in Type Registered List 2.2 Part 5</td>
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<td></td>
<td><strong>Drain Earth(s)</strong> is listed in Type Registered List 2.2 Part 5</td>
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<tr>
<td></td>
<td>All portable <strong>Drain Earth(s)</strong> and portable earthing equipment shall be inspected and maintained in accordance with the Asset Management Business Procedure (AMBP 131).</td>
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<td><strong>Raising Earths</strong></td>
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<td>When raising the equipment, care shall be taken by <strong>Personnel</strong> at ground level to ensure that the rope and equipment do not infringe <strong>Safety Distance to Live</strong> conductors on an adjacent circuit or</td>
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4.1.1 cont to 4.3.3

come within 1 m of the isolated and locally unearthed conductors of the circuit on which work is to be carried out. Particular care shall be taken at tee-off, terminal and large angle towers to avoid infringing Safety Distance.

4.2 Application of Drain Earth(s)

4.2.1 The earth end connections of all Drain Earth(s) shall be attached before any conductor ends are connected.

4.2.2 When all earth end connections and Sparrow Plate Connecting Bonds are secured, the conductor end clamps can be firmly applied to the conductors using a Type Registered earthing pole.

4.2.3 At tension towers, provided the jumper is connected at both ends and Earthed; the fitting of Drain Earth(s) to the line side of tension insulators may be carried out using a Type Registered 600 mm earthing pole, from a suitable working position at the line end of the insulator set.

4.2.4 Where Drain Earth(s) are to be applied to all three phases, they shall be applied to the top conductor(s) first, then to the middle conductor(s) and finally to the bottom conductor(s) at the tower.

4.2.5 Where the application of Drain Earth(s) is required to the earthwire, in addition to the phase conductors, Drain Earth(s) shall be applied to the earthwire first, followed by the top phase, then the middle phase and finally the bottom phase.

4.2.6 If at any time an earth connection is found to be defective, no attempt shall be made to touch it until a further earth has been connected in parallel with it.

4.2.7 If at any time a Sparrow Plate Connecting Bond is found to be defective, no attempt shall be made to touch it. The entire DrESS system Drain Earth(s) shall be removed from the conductors and then the Sparrow Plate Connecting Bond fault can be rectified. Consultation of an OHL Delivery Engineer can also be sought.

4.3 Removal of Drain Earth(s)

4.3.1 The removal of Drain Earth(s) shall be carried out in reverse order of application given in 4.2.4 above as applicable i.e. first bottom, then middle, then top conductor(s) and finally, if applied, the earthwire.

4.3.2 At tension towers, provided the jumper is connected at both ends and Earthed, the removal of the clamps from the line side of tension insulators may be carried out using a Type Registered 600 mm earthing pole, from a suitable working position at the line end of the insulator set.

4.3.3 Conductor end clamps of all Portable Drain Earth(s) shall be removed first, using the Type Registered earthing pole. At no time shall the earth end clamp of a Portable Drain Earth(s), a Sparrow Plate or a Sparrow Plate Connecting Bond be disconnected whilst a conductor end clamp is attached.
4.2.1 Where Sparrow Plates are not used, each earth end clamp shall first be attached to the tower steelwork and screwed up tightly so that the tip of the clamping screw penetrates any paint film and provides a good electrical and mechanical connection.

Where Sparrow Plates are used:

- Fit one or two Sparrow Plates to the tower cross arm main member as necessary. Tower member clamps to be connected and secured.
- Thumbscrews shall be screwed down tightly so that the hardened steel points bite firmly into the tower steel.
- All Sparrow Plate Connecting Bonds shall be connected securely before attaching the earth ends of any Drain Earth(s).
- When connecting two or more Sparrow Plate Connecting Bonds together the Type Registered T connector shall be used.
- Attach Compressed Ferules to the sparrow plate via the termination clamps securely.

4.2.2 The fitting of the conductor end clamps shall normally be carried out by Personnel positioned on the tower crossarms, as far from the conductors as reasonably practicable.

4.2.3 The linesman may move out to a suitable working position to give access to apply a Drain Earth(s) to the line side of the jumper connection. Using the sash line, he shall pull out from the cross arm a Type Registered 600 mm earthing pole fitted with the conductor end clamp of a Drain Earth(s), the earth end clamp having already been secured to the Sparrow Plate.

The conductor end clamp shall then be secured to the conductor using the Type Registered 600 mm earthing pole, ensuring that the linesman does not come in to contact with the clamp or pole socket. The Type Registered 600 mm earthing pole shall be returned to the cross arm and the procedure repeated as necessary.

For conductors where aluminium de-stranding is required during the installation process or during maintenance procedures, The Senior Authorised Person shall ensure that sufficient Drain Earth(s) are applied to the line side of the de-stranded conductor. The Senior Authorised Person shall ensure that any movement of Drain Earth(s) is controlled via the Earthing Schedule and identified in the Risk Assessment for the work.

4.2.4 For work on Semi-tension towers the Senior Authorised Person shall ensure that Drain Earth(s) are applied to the high and low side of the tower prior to the fitting or removal of Jumpers.

The Senior Authorised Person may assess that it is not necessary to earth all phases.
### Guidance

| NSI 4 | 4.2.4 Cont to 4.3.3 |

- For induced voltage earthing schemes the **Senior Authorised Person** may reduce the Drain Earthing requirements without the submission of an F1 form providing safety for persons is maintained.

- For any reduction in DrESS earthing schemes the **Senior Authorised Person** shall submit an F1 form to the OHL Delivery Engineer in accordance with section 10.

#### 4.2.6 For a defective **Drain Earth** the conductor end clamp of the defective earth shall be removed and the earth lead coiled back to the earth end clamp and secured to the tower. This earth end clamp shall remain in position until all conductor end clamps have been removed.

For a defective Sparrow Plate Earth the conductor end clamp of the defective earth shall be removed and the earth lead coiled back to the Sparrow Plate and secured to the tower. The earth end of the Sparrow Plate Earth shall remain in position in the Sparrow Plate until all conductor end clamps have been removed. If there is insufficient spare capacity to connect a replacement earth into the Sparrow Plate, then a second Sparrow Plate shall be fitted and connected to the original using a Sparrow Plate Connecting Bond to allow the fitting of the replacement Sparrow Plate Earth.

#### 4.2.7 Safety Warning: All **Drain Earth(s)** shall be removed from all conductors at a tower prior to disconnecting any Sparrow Plate Connecting Bonds. The exception to this is when the Green Sparrow Plate is being used during conductor renewal.

The removal of the conductor end clamps shall normally be carried out by Personnel positioned on the tower crossarms as far from the conductors as reasonably practicable.

#### 4.3.1 A linesman may move out to a suitable working position to remove the **Drain Earth** from the line side of the jumper connection. The conductor end clamp shall then be removed from the conductors using the Type Registered 600 mm earthing pole. The pole and clamp shall then be returned to the crossarm, ensuring that the linesman does not come in to contact with the clamp or pole socket. The Type Registered 600mm earthing pole shall be returned and the procedure repeated as necessary.

#### 4.3.3 All conductor end clamps shall then be temporarily secured to the crossarm, before any of the earth end clamps are removed. The coiled and tied Portable **Drain Earth(s)**, Sparrow Plate Connecting Bonds and the Type Registered earthing pole shall then be lowered to the in accordance with the requirements of Section 2 (4.1).

The only exceptions to this rule are:

- When using the Reynolds Bond is being transferred between crossarms

- Work involving the use of a platform when the platform applied earths can be removed completely to move the platform between crossarms
## 5 Control of Drain Earth(s)

### 5.1 A nominated person shall be identified to carry out the Drain Earth Control process.

### 5.2 A register of Drain Earth(s) shall be maintained at all times.

### 5.3 Whenever Drain Earth(s) are applied / removed from a tower this event shall be recorded.

### 5.4 Immediately prior to the clearing of Safety Document(s), a detailed line inspection shall be carried out.

### 5.5 If any Drain Earth(s) / earthing equipment are to be left on the tower as part of the Safety Document clearance process, then the relevant sections of the Safety Document shall be completed by the Competent Person clearing the Safety Document.

### 5.6 Prior to cancelling the Safety Document(s), it is the duty of the Senior Authorised Person to ensure that he has all necessary forms required to satisfy himself that all Drain Earth(s) have been removed from the circuit. The Senior Authorised Person will decide the extent (if any) of further inspection that is required in order to verify that all towers are de-earthed prior to the Safety Documents being cancelled.

### Guidance

#### NSI 4
5.1 to 5.3

### 5.1 Maintenance Work - being carried out by National Grid maintenance teams the control of Drain Earths shall be the responsibility of the Competent Person holding the Safety Document.

### 5.2 A register of Drain Earth(s) shall be recorded on Form DEC 1, which shall be held in the work pack by the PIC and maintained daily.

The use of a DEC 1 form may not be required if the maintenance work is being carried out at a single tower. In this situation it will suffice to use the Earthing Schedule to identify where Drain Earths are fitted and removed. However, if the work area is spread over several towers then consideration shall be given to the use of this form to control the Drain Earths.

For Contractors, the procedure for control requires that a number of key steps are recorded and information is transferred regularly and promptly. All contractors that are employed by National Grid will be responsible for identifying nominated people to carry out the Drain Earth Control process.

### 5.3 Whenever Drain Earth(s) are applied / removed from a tower this event shall be recorded on form DEC1 (Application and Removal of Drain Earth(s)). The form provides a record of Drain Earth(s) as they are applied or removed.

A register of Drain Earth(s) shall be recorded on Form DEC 2 (Site earthing Register) and maintained daily.

Form DEC 2 shall be kept in a location known to the Senior Authorised Person. This will enable the Senior Authorised
Guidance
NSI 4
5.3 Cont to 5.6

Person to ascertain the location of Drain Earth(s) at all times.

There is no requirement to detail the type or quantity of Drain Earth(s) that have been applied / removed.

The removal section shall only be completed if all Drain Earth(s) are removed from the tower.

5.5 Where unusual circumstances exist (e.g. a DrESS tower where Sparrow Plates and Connecting Bonds are left in position but all Drain Earth(s) are removed from the conductors) note shall be made in the comments section of form DEC1.

5.6 The inspection shall be carried out by a Competent Person (or a Person under the instruction of a Competent Person) and recorded on form DEC3 (Tower Earth Final Inspection).

The line inspection shall consist of a personal visit to each tower. It shall not rely on verbal instruction from other persons. The DEC3 shall be signed by the Competent Person responsible for the visual inspection.

Form DEC1 does not replace this requirement.

In circumstances where visual inspection of the line is either not possible or is obstructed (e.g. poor visibility) and it is not possible to obtain completed DEC3 forms in the required timescales, the Senior Authorised Person is responsible for deciding whether line re-energisation can proceed.
# SECTION 3

**DRAIN EARTH SHORTING SCHEMES (DrESS)**

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Scheme 1

Application of Single or Double DrESS Earthing Schemes

1.1 Prior to the application of Drain Earth(s) fit one or two Sparrow Plates, as necessary, to each crossarm (if two are fitted, fit one each side of the crossarm and connect them together by Sparrow Plate Connecting Bonds). Also fit one Sparrow Plate to the peak of the tower near to the Earthwire. Sparrow Plate connecting bonds and Type Registered “T” connectors (if required) shall then be connected between phase Sparrow Plates and the Earthwire Sparrow Plate.

For the number of Sparrow Plate Connecting Bonds and Drain Earth(s) required (see Table 1 below).

The Drain Earth(s) shall be attached to multiple Sparrow Plates such that each Sparrow Plate carries the same, or as near as practicable the same, Drain Earth(s).

1.2 Connect the earth end of all Drain Earth(s) to the Sparrow Plates.

Use Short Drain Earth(s) to connect the Sparrow Plate on the peak of the tower to the Earthwire.

1.3 Apply Drain Earth(s) to the earth wire and each sub conductor per the diagram for this Scheme.

Drain Earth(s) shall be applied to the Earthwire first, followed by the top phase, then the middle phase and finally the bottom phase. Drain Earth(s) shall be removed in the reverse order.

Heavy currents may flow when applying a Double DrESS earthing scheme. After the line end of the first Drain Earth has been applied, the line ends of the subsequent Drain Earth(s) shall be applied as quickly as possible to the other sub conductors.

Table 1

<table>
<thead>
<tr>
<th>Number of Sub Conductors</th>
<th>Single Dress</th>
<th>Double Dress</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number of Drain Earth(s) required per Sub Conductor to carry 450 Amps</td>
<td>Number of Sparrow Plate Connecting Bonds required to carry 450 Amps</td>
</tr>
<tr>
<td>Quad</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Triple</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Twin</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Single</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Earth Wire</td>
<td>3</td>
<td>1</td>
</tr>
</tbody>
</table>
Section 3, Scheme 1 - Application of a Single or Double DrESS
Scheme 2

Application of a Partial DrESS Earthing Scheme

2.1 Prior to the application of Drain Earth(s), fit one or two Sparrow Plates, as necessary, to the two adjacent crossarms (if two are fitted, fit one each side of the crossarm and connect them together using Sparrow Plate Connecting Bonds) or to the top cross arm and to the earthwire peak. Sparrow Plate Connecting Bonds and Type Registered “T” connectors (if required) shall then be connected between phase Sparrow Plates and, if fitted, the earthwire Sparrow Plate.

A Partial DrESS is applied between either two adjacent phases or the top phase and the earth wire to provide a parallel path for the induced current. The same phases or phase and earthwire conductors shall be used at adjacent towers or each end of a section of line.

For the number of Sparrow Plate Connecting Bonds and Drain Earth(s) required see Table 2 below.

2.2 Connect the earth end of all Drain Earth(s) to the Sparrow Plates.

Use Short Drain Earth(s) to connect the Sparrow Plate on the peak of the tower to the Earthwire.

2.3 Apply Drain Earth(s) to conductors per the diagram for this Scheme.

Table 2

<table>
<thead>
<tr>
<th>Number of Sub Conductors</th>
<th>Partial DrESS, Through Current and Partial Bridging &amp; Platform Applied Earths</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number of Drain Earth(s) Required Per Sub Conductor to carry 450 Amps</td>
</tr>
<tr>
<td>Quad</td>
<td>1</td>
</tr>
<tr>
<td>Triple</td>
<td>1</td>
</tr>
<tr>
<td>Twin</td>
<td>2</td>
</tr>
<tr>
<td>Single</td>
<td>3</td>
</tr>
<tr>
<td>Earth Wire</td>
<td>3</td>
</tr>
</tbody>
</table>
Section 3, Scheme 2 - Application of a Partial DrESS
Scheme 3

Application of a Substation Applied DrESS

3.1 Confirm integrity of Terminal Tower Earthing connection and earth tape at earthing position.

Examine earth tape and clean paint / surface contamination as necessary to allow efficient electrical connection.

Safety Warning:

Shall any earth tapes / connections be missing or damaged, then no further work is to be undertaken until repair or replacement has been carried out or a Temporary Earthbond System has been installed to TGN(E) 215.

Ensure that the earth tape to be connected to is not the “high frequency earth”.

Confirm earth tape is connected to substation mesh.

3.2 Connect the earth end clamps of all Substation Applied DrESS Drain Earth(s) to the earth tape.

3.3 Uncoil Substation Applied DrESS Drain Earth(s) and run out to a position below the point where the Drain Earths will be applied.

The Substation Applied DrESS can be applied to the Downleads or the Down Droppers.

3.4 Using a Type Registered Earthing Pole, apply the correct number of earths per phase.

Table 3 sets out the requirements for different conductor bundles using 150 mm² Drain Earth(s).

Table 4 sets out the requirements for different conductor bundles using 50 mm² Duplex Drain Earth(s).

In some circumstances, the use of a Mobile Elevated Work Platform (MEWP) may be required. Guidance for the use of MEWPs can be found in Section 8 (1).

Once all Substation Applied DrESS Drain Earth(s) have been applied, take the weight of the Substation Applied DrESS Drain Earth(s) and secure at the conductor end using a Karabiner and 1.2m webbing strop. Note: When using a MEWP to apply the Substation Applied DrESS Drain Earth(s), supporting Karabiners can be fitted at the same time on each phase to avoid unnecessary repositioning of the MEWP.

To reduce movement, secure Substation Applied DrESS Drain Earth(s) at the earth end using a Karabiner and 1.2m webbing strop.

Safety Warning:

Tables 3 and 4 are only to be used for the management of circulating currents. If a short circuit rating or Primary Earth function is required then Table 2 in Section 8 (6) shall be used.
Table 3  Number of 150 mm² Drain Earths to be applied to cater for circulating currents up to 450A.

<table>
<thead>
<tr>
<th>Number of Sub Conductors</th>
<th>Number of 150 mm² Substation Applied DrESS Drain Earths required per sub conductor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quad</td>
<td>1</td>
</tr>
<tr>
<td>Triple</td>
<td>1</td>
</tr>
<tr>
<td>Twin</td>
<td>1</td>
</tr>
<tr>
<td>Single</td>
<td>2</td>
</tr>
</tbody>
</table>

Table 4  Number of 50 mm² Duplex Drain Earths to be applied to cater for circulating currents

<table>
<thead>
<tr>
<th>Number of Sub Conductors</th>
<th>Number of 50 mm² Duplex Substation Applied DrESS Drain Earths required per sub conductor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quad</td>
<td>1</td>
</tr>
<tr>
<td>Triple</td>
<td>1</td>
</tr>
<tr>
<td>Twin</td>
<td>2</td>
</tr>
<tr>
<td>Single</td>
<td>4</td>
</tr>
</tbody>
</table>

Note1: Table 4 quotes the requirements for line end clamps to be applied to each sub-conductor.

E.g. On quad bundles, two complete Duplex Assemblies will be required per phase with one line end clamp per sub-conductor.
Section 3, Scheme 3 - Application of Substation applied Double DRESS

- Karabiner and webbing strop
- Dropper
- Busbar
- Ensure Tower Bonded to Substation Earthing System
- Substation Applied Drain Earths (ref. Table 3)
- Substation Earth Tape
SECTION 4
OVERHEAD LINE MAINTENANCE SCHEMES

CONTENTS

1 Application of Drain Earth(s) to manage Induced Voltage (Point of Work) Scheme 1

2 Temporary Disconnection of Jumpers Scheme 2

3 Application and removal of Drain Earth(s) at a temporary disconnection/section of a circuit (Maximum of 12 weeks) Scheme 3

4 Lowering and Raising Phase or Earthwire Conductors at tension towers (Non Tension Stringing Techniques) Scheme 4

5 Repair of Bolted Joint Connections on Tension Towers using the Reynolds Bond Scheme 5

6 Application of Earthing Bridles when Cutting, Jointing Conductor or Repairing Damaged Conductors Scheme 6

7 Removing and Replacing Downleads Scheme 7

8 Lowering / Raising Phase Conductors from Suspension Towers Scheme 8

9 Work on Earthwires not Involving Lowering, Raising or Affecting the Sag of the Earthwire Scheme 9
Scheme 1

Application of Drain Earth(s) to manage induced voltage (not involving the connection or disconnection of conductors)

1 Work on Phase conductors, insulators and line end fittings

1.1 Apply 1 Drain Earth to each sub conductor on each phase per diagram for this Scheme.

2 Installation and use of an Access Platform

2.1 Apply 1 Drain Earth to each jumper sub conductor on each phase.

Prior to hauling out the steel winch wire rope, a Field Equipment Earth shall be attached to the chassis of the winch and bonded to the tower steel work or to an earthing spike and to an Equipotential Plate, in accordance with Section 8 (2).

As soon as the platform is raised to the working position and before the winch rope is disconnected, a Field Equipment Earth shall be applied between the tower crossarm and the platform.

Safety Warning: Care to be taken in the vicinity of Live HV Equipment due to possible initial charge on Field Equipment. Always use a Type Registered earthing pole to apply and remove the Platform Field Equipment Earth.

When the platform is to be lowered, the steel wire winch rope shall be connected to the steel wire rope lifting sling on the platform before the Field Equipment Earth is disconnected.

3 Work inside Safety Distance but not closer than 1 metre to conductors which may be subject to induced voltages

3.1 For all tower designs apply Drain Earth(s) to each sub conductor on each phase, at towers not more than 10 spans apart, such that earths are positioned on each side of the point of work.

This scheme can be used for work on the tower crossarms and tower bodies where clearance to Earthed steelwork is not a problem e.g. for Tower Painting. (Note: Certain tower designs and types may require an additional Risk Assessment).

Safety Warning: A daily check shall be made before work starts that all Drain Earth(s) are still in place.

4 Work on conductors or spacers from a conductor trolley

4.1 For all tower designs apply Drain Earth(s) to each sub conductor on each phase, at towers not more than 10 spans apart, such that earths are positioned on each side of the point of work. In addition, apply Drain Earth(s) to each sub conductor on each phase to all tension towers within this zone.

To enable a conductor trolley to by-pass insulator sets on Earthed towers, the Drain Earth(s) shall be applied to each phase from its supporting crossarm in the following sequence:

- Earth top phase conductors from top crossarm
- Earth middle phase conductors from middle crossarm
- Earth bottom phase conductors from bottom crossarm
On completion of the earthing, the conductor trolley(s) may be landed on the phase(s) to be worked on.

Work shall only be carried out within the zone covered by the Drain Earth(s).

Whilst in use, the wheels of the conductor trolley shall provide electrical contact with the conductors on which they are running.

*Personnel* in the conductor trolley shall maintain a minimum clearance of 1 metre from any earthed metal on the towers. Particular care shall be taken when passing the conductor trolley through a suspension insulator set.

If access or egress is required at a tower other than one already Earthed, Drain Earth(s) shall be applied to all conductors on all phases at that tower by a separate Earthing Team. They shall not be applied by the *Personnel* in the conductor trolley.

This scheme shall not be used when there is an enhanced risk of a lightning storm or when inclement weather could affect the ropes used with the conductor trolley.

**Safety Warning:** A daily check shall be made before work starts that all Drain Earth(s) are in place.

5 Use of trolleys on single spans

5.1 For all tower designs apply Drain Earth(s) to each sub conductor on each phase.

The conductor trolley may traverse the spans in either direction from the tower where the Drain Earth(s) are applied without the application of any additional Drain Earth(s).

**Safety Warning:** When using a rope to pull the conductor trolley, it shall be coiled up and raised such that it avoids any contact with obstacles in the span.

The trolley shall not pass beyond the vibration dampers at the remote end of the span from the earths.

Drain Earth(s) and resources shall be available to apply Drain Earth(s) at the adjacent tower, if necessary, at all times whilst the work is being carried out.

The Senior Authorised Person shall carry out a risk assessment to determine whether the adjacent tower is readily accessible for earthing and the time factor involved shall the need for trolley rescue arise.
Section 4, Scheme 1 - Application of Drain Earths to manage Induced Voltage
Scheme 2

Temporary disconnection of jumpers

Application of a Through Current Drain Earthing Scheme for the temporary disconnection of Jumpers on Phase Conductors

1 Drain Earth(s) shall be fitted to all conductors on the nearest tower either side of the tower to be worked on in accordance with Section 4, Scheme 1.

2 Prior to the application of Drain Earth(s) on the tower to be worked on, fit one or two Sparrow Plates, as necessary, to the crossarm(s). Where two Sparrow Plates are fitted to one crossarm; fit one Sparrow Plate on each side of the crossarm and connect them together using Sparrow Plate Connecting Bonds.

For the number of Sparrow Plate Connecting Bonds and Drain Earth(s) required see Section 3, Scheme 2 - Table 2.

On crossarm(s) where the application of through current Drain Earth(s) is not required, Drain Earth(s) shall be applied in accordance with Section 4, Scheme 1

3 On the crossarm(s) where Sparrow Plates are installed, the earth end of all Drain Earth(s) on that crossarm shall be connected to the Sparrow Plates.

4 Apply Drain Earth(s) to the tower to be worked on in accordance with the diagram for this scheme

If disconnection of one jumper end only is required, apply Drain Earth(s) as shown in option 1. The jumper terminal may then be disconnected but the Drain Earth connection on the jumper shall not be removed.

If complete removal of the jumper is required, apply Drain Earth(s) as shown in option 2. The jumper may be disconnected at both ends.

If it is necessary to lower the jumper to the ground, the Drain Earth conductor end clamp(s) shall be removed from the jumper and the Drain Earth(s) coiled back and secured to the crossarm.

Prior to reconnection of jumpers, a check shall be made that Drain Earth(s) are still fitted at the tower to be worked on and at the nearest tower on each side.

If reconnection of one end of the jumper only is required, a check shall be made that Drain Earth(s) are fitted to the jumper and the conductor on the line side of the anchor clamp to which the jumper is to be attached. The jumper terminal may then be reconnected.

If a complete jumper is to be refitted, a check shall be made to ensure that all Drain Earth(s) are connected to the conductor's line side of the jumper terminals. A Drain Earth(s) shall be fitted to the jumper prior to the reconnection of the jumper terminals.
Scheme 3

Application and removal of Drain Earth(s) at a temporary disconnection / section of a circuit (maximum of 12 weeks)

Disconnection

1. Drain Earth(s) shall be fitted to all conductors on the nearest tower either side of the tower to be worked on. Apply Drain Earth(s) in accordance with Section 4, Scheme 1

2. Prior to the application of Drain Earth(s) on the tower to be worked on, fit Sparrow Plates, as necessary, to each crossarm and the peak of the tower.

   Sparrow Plates shall be connected together using Sparrow Plate Connecting Bonds and Type Registered “T” connectors (if required) see Section 8 (6) for further guidance.

3. The earth end of all Drain Earth(s) shall be connected to the Sparrow Plates.

   Use Short Drain Earth(s) to connect the Sparrow Plate on the peak of the tower to the Earthwire.

4. Apply a Single DrESS Earthing Scheme to the side of the tower that will be made Live.

   Use Section 3 Scheme 1 and apply the number of Drain Earth(s) in accordance with Table 1.

   On completion of this stage of the work, attach a pilot suspension insulator set from each crossarm and connect to the jumpers.

5. Apply Drain Earth(s) on the side of the tower which will remain Isolated and Earthed; these earths will become Overhead Line Primary Earth(s).

   Using the principles in Section 3 Scheme 1, apply the number of Drain Earth(s), Sparrow Plate Connecting Bonds and Sparrow Plates in accordance with the guidance given in Section 8 (6)

   Connect these Drain Earth(s) to the line side of the jumper connections.

   The jumpers can now be cut at their centre such that the side that will be made Live will be supported by the pilot sets.

   Remove the half jumpers from side that is to remain Isolated and Earthed or, if this is not possible, secure them to the tension insulator sets on that side of the tower.

6. Remove Drain Earths from all conductors applied in 1 above.

7. Remove the Single DrESS Earthing Scheme from the half jumpers to allow future re-energisation of this section of the circuit.

   Ensure these Drain Earth(s) are coiled and secured to the tower crossarms.

   Consideration shall be given to securing excess length of all Drain Earth(s) or Sparrow Plate Connecting Bonds to avoid damage by excess movement.
8. A nominated Competent Person shall carry out monitoring of the earthing system at regular intervals during the 12 week period.

Reconnection

9. Ensure all Sparrow Plates, Connecting Bonds and earth end connections on the tower to be reconnected are secure and undamaged.

10. Re-apply the Single DrESS Earthing Scheme to the side of the tower that was energised.

   Use Section 3 Scheme 1 and apply the number of Drain Earth(s) in accordance with Table 1.

11. Drain Earth(s) shall be fitted to all conductors of the nearest tower either side of the tower to be worked on.

   Apply Drain Earth(s) in accordance with Section 4, Scheme 1.

12. The jumpers can now be reinstalled and the pilot insulator sets removed.

13. Remove all Drain Earth(s), Sparrow Plates and Connecting Bonds in the reverse order to the application.
Section 4 - Scheme 1

Temporary String of Insulations

Section 4, Scheme 3 - Application and Removal of Drain Earths at a temporary disconnection (Maximum of 12 weeks)
Scheme 4

Lowering/Raising Phase Conductors/Earthwire at Tension Towers (Non Tension Stringing Techniques)

Lowering

1. **Drain Earth(s)** shall be fitted to all conductors of the circuit to be worked on at the first tower out in the section not to be lowered.

   Apply **Drain Earth(s)** in accordance with Section 4, Scheme 1.

2. Apply a Partial DrESS scheme between the phase to be worked on and the phase above or below it, or between the top phase and the earthwire if the earthwire is to be lowered (at the tension tower where the conductors are to be lowered and at the first tower out in the section to be lowered).

   At the same time apply **Drain Earth(s)** to the other phases on both these towers.

   Apply Partial DrESS Earthing in accordance with Section 3, Scheme 2

   For the number of Sparrow Plate Connecting Bonds and **Drain Earth(s)** required see Table 2.

   The earth end of all **Drain Earth(s)** shall be connected to the Sparrow Plates.

3. (i) For lowering a phase / conductor – apply Partial Bridging Earth(s).

   (ii) For lowering an earthwire – apply 3 Short Bridging Earths to the conductors on the side to be lowered and 3 Short **Drain Earth(s)** to the other side of the tower.

   **Phase Conductor – See Diagram for this scheme;**

   To facilitate the application of the Partial Bridging Earth, it will be necessary to remove the earth end arcing horn of the insulator set(s) to be lowered and fit Deas Bar(s) to the ball ended eye links.

   Apply **Drain Earth(s)** to the Deas Bar **before** applying Bridging Earths from the Deas Bar to the conductor.

  Detach the jumper end(s) from the conductor(s) to be lowered and secure to the crossarm. On bundle conductor lines, when not all conductors of the bundle are to be lowered, attach to the adjacent conductors. The **Drain Earth** connections to the jumper(s) shall not normally be removed.

   When lowering the phase / conductor, release the landing pin, then remove the **Drain Earth(s)** from the Deas Bar using a Type Registered 600mm earthing pole.

   **Safety Warning:** When lowering conductors, apply **Drain Earth(s)** to the conductors at ground level using a Type Registered 2500 mm earthing pole **before** touching conductors.

   Care shall be taken with the positioning of the Deas Bar and insulator fittings when they reach the ground. The insulating properties of the Deas Bar can be easily by-passed if it is allowed to sit on metallic trackway or very wet ground.
Earthwire Conductor – See Diagram for this scheme

Note: For lowering of an earthwire the phase conductors of the Isolated and Earthed circuit shall be fitted with Drain Earth(s) in the section to be worked on.

Ensure the earth ends of all Short Bridging Earths and Short Drain Earth(s) are connected to the Sparrow Plate at the peak of the tower.

Safety Warning: When lowering the earthwire conductor, release the landing pin and then remove the Short Bridging Earths using a Type Registered 600 mm earthing pole. Ensure nothing makes contact with the earthwire conductor at this stage as it is now locally unearthed.

When lowering the earthwire conductor, apply Drain Earth(s) to the conductor at ground level using a Type Registered 2500 mm earthing pole before touching the conductor.

If an earthwire, or phase conductor(s) without their insulators, is to be lowered, an Insulated Link shall be installed between the winch bond and the conductor clamp to prevent current passing through the winch bond as shown in the diagram for this scheme.

Before hauling out any winch rope, the chassis of the winching vehicle shall be bonded to the tower steelwork or to an earthing spike by a Field Equipment Earth and the Equipotential Plate shall be bonded to the winch chassis Section 8 (2).

The winch rope may then be raised up the tower and rigged for taking up conductor tension.

Raising

4. Ensure Drain Earth(s) are fitted to all conductors of the circuit to be worked on at the first tower out on the opposite side of the tension tower where the conductor is to be raised.

Apply Drain Earth(s) in accordance with Section 4, Scheme 1.

5. Ensure Partial DrESS Earthing schemes have been fitted between the phase to be worked on and the phase above or below it, or between the top phase and the earthwire if the earthwire is to be raised (at the tension tower where the conductors are to be raised and at the first tower out in the section to be raised).

At the same time apply Drain Earth(s) to the other phases on both these towers.

6. Apply Partial DrESS Earthing in accordance with Section 3, Scheme 2.

For the number of Sparrow Plate Connecting Bonds and Drain Earth(s) required see Table 2.

The earth end of all Drain Earth(s) shall be connected to the Sparrow Plates.

7. To raise a phase / conductor – apply Partial Bridging Earth(s) across insulator strings between Deas Bars and conductors.

To raise an Earthwire – apply 3 Short Bridging Earths to the conductors on the side to be raised and 3 Short Drain Earth(s) to the other side of the tower.

8. Raising the conductors is a reversal of lowering as described in 3 above.

Safety Warning: Before attaching the winch bond to the insulator string when raising
phase / conductor, the Deas Bar shall be fitted and the Bridging Earths fitted between the Deas Bar and line end of insulator string.

When raising conductors apply **Drain Earth(s)** to the Deas Bar prior to landing the conductors, using a Type Registered 600 mm earthing pole.

Care shall be taken with the positioning of the Deas Bar and insulator fittings when on the ground. The insulating properties of the Deas Bar can be easily by-passed if it is allowed to sit on metallic trackway or very wet ground.

Before hauling out any winch rope, the chassis of the winching vehicle shall be bonded to the tower steelwork or to an earthing spike by a Field Equipment Earth and the Equipotential Plate shall be bonded to the winch chassis Section 8 (2).

The winch rope may then be raised up the tower and rigged for taking up conductor tension.

If an earthwire, or phase conductor(s) without their insulators, is to be raised, an Insulated Link shall be installed between the winch bond and the conductor clamp to prevent current passing through the winch bond as shown in the diagram for this scheme.

After taking up tension in the winch rope to lift the conductor clear of the ground, the conductor end clamp of the **Drain Earth(s)** connected to the tower steelwork or earth spike shall be removed using a Type Registered 2500 mm earthing pole.

When raising the earthwire conductor, apply the Short **Drain Earth(s)** prior to landing the conductor using a Type Registered 600mm earthing pole.

**Safety Warning:** Before any contact is made to the earthwire conductor on the line side of an insulated link **Drain Earth(s) shall be are applied.**
SAFETY WARNING
After removing the Drain Earth ensure that nothing makes contact with the conductor as it is now live.

Section 4 Scheme 4 - Lowering and Raising Conductors at a Tension Tower
Scheme 5

Repair of Bolted Joint connections on tension towers using the Reynolds Bond

1. At the crossarm where the Hot Joint is to be repaired, prior to the application of any Drain Earth(s), fit a Sparrow Plate to the crossarm on the side nearest to the Hot Joint.

   **Safety Note:** The Drain Earth(s) to be applied to the jumper shall not have their earth ends connected to the Sparrow Plate. This will allow the Sparrow Plate associated with the Reynolds Bond to be safely removed, along with the Reynolds Bond, to facilitate moving of this equipment between crossarms for situations where work is to be carried out on more than one phase.

   Apply Drain Earth(s) to each sub conductor of the jumpers on all three phases of the tension tower to be worked on.

2. Connect the Earth end of the Bridging earth and Reynolds Bond into the Sparrow Plate.

3. Apply the Bridging Earth to the line side of the joint to be repaired.

4. Apply Reynolds Bond to the conductor and jumper to bridge the joint to be repaired.

   The conductor at the points where the conductor end clamps will be applied are to be thoroughly cleaned prior to the fitting of the Reynolds Connecting Bond.

   The clamps of the Reynolds Bond shall be applied using a Type Registered 600 mm earthing pole and securely tightened.

   The Hot Joint can then be disconnected, cleaned and reconnected per the procedure in the Linesman’s M1 Manual.

   **Safety Warning:** This scheme shall only be used for the repair of one end of a bolted jumper at a time.

5. After repair of the Hot Joint the Reynolds Connecting Bond shall be removed before removing any other Drain Earth(s).

6. At this stage the Reynolds Bond, complete with its associated Sparrow Plate can be moved to another phase if required.

7. Upon completion of the Hot Joint repair remove all conductor ends on the crossarm being worked on.

8. Remove Drain Earth(s) from jumpers from all three phases of the tension tower being worked on.
NOTE:
Application of the Reynolds Connecting Bond at the Line End Conductor Jumper will be carried out using a Type Registered 600mm Earthing Pole.

Section 4, Scheme 5 - Repair of bolted joints on tension towers using Reynolds Connecting Bond
Scheme 6

Application of Earthing Bridles when cutting, jointing conductor or repairing damaged conductor

Cutting and Jointing Conductor

1 After lowering conductors to the ground for jointing, Earthing Bridles connected to tower steelwork or to an Earthing Spike shall be applied across the point on the conductor where the cut is to be made using a Type Registered earthing pole.

Apply 1 Earthing Bridle per sub-conductor on Quad and Triple strung conductors.

Apply 2 Earthing Bridles per sub-conductor on Twin strung conductors.

Apply 3 Earthing Bridles per sub-conductor on Single strung conductors and Earthwires.

Replacing a length of conductor

2 After lowering the conductors to the ground, run out a new length of conductor alongside it; the centre of this new length of conductor shall be Earthed to an Earthing Spike or the tower steelwork. Earthing Bridles connected to the tower steelwork or to an Earthing Spike shall be applied between the old and the new conductor beyond the position where the joints are to be made using a Type Registered earthing pole. The Earthing Bridle shall not be removed until the conductor is re-jointed at both ends.

• Apply 1 Earthing Bridle per sub-conductor on Quad and Triple strung conductors.

• Apply 2 Earthing Bridles per sub-conductor on Twin strung conductors.

• Apply 3 Earthing Bridles per sub-conductor on Single strung conductors and Earthwires.
Section 4, Scheme 6 - Application of Earthing Bridles when cutting, jointing conductor or replacing damaged conductor
Scheme 7
Removal and Replacement of Downleads

Removal

1. Apply Drains Earth(s) to the first tower beyond the terminal tower to Section 4, Scheme 1.

2. Confirm integrity of Terminal Tower Earthing connection.

   Apply a minimum of a Single DrESS Earthing Scheme to the terminal tower

   Ensure that Sparrow Plates, Connectng Bonds and Type Registered “T”
   Connectors (if required) are fitted to the line side of the crossarm and the Drains
   Earth(s) are attached to the jumpers as close to the line side of the tower as
   possible.

   Safety Warning: Shall any earth tapes / connections be missing or damaged,
   then no further work is to be undertaken until repair or replacement has been
   carried out or a Temporary Earthing System has been installed to TGN (E) 215.

3. Apply Drains Earth(s) in the substation to the overhead line Downdroppers.

   Ensure that the earth tape to be connected to is not the “high frequency earth”.

   Visually confirm the earth tape is connected to the substation earth mesh.

   For Downleads that are connected to gantries in substations, ensure that these
   Drains Earth(s) are fitted in such a way that lowering off the Downleads / Droppers from the gantries will not cause them to be damaged or pulled off at the
   earth or conductor ends.

   Duplex Drains Earth(s) may be used as an alternative to normal Drains Earth(s)

4. Apply Bridging Earth(s) to the tower end of each Downlead.

   This will consist of Partial Bridging Earth(s) and Short Bridging Earth(s)
   connected via a Deas Bar from the crossarm to the conductor(s).

   To facilitate the application of the Bridging Earths, it will be necessary to remove
   the earth end arcing horn of the insulator set to be lowered and fit Deas Bar to
   the ball ended eye link.

   Apply Drains Earth(s) to the Deas Bar before applying Bridging Earths from the
   Deas Bar to the conductor.

   Ensure that the conductor ends of these earths are fitted sufficiently far enough
   beyond the jumper to anchor clamp joint to allow disconnection of the jumper at
   this point.

   Before hauling out any winch rope, the chassis of the winching vehicle shall be
   bonded to the tower steelwork or to an earthing spike by a Field Equipment Earth
   and the Equipotential Plate shall be bonded to the winch chassis Section 8 (2)

5. Lower off the Downlead at the Substation Gantry end.

   Ensure that the Drains Earth(s) fitted in 3 will not be damaged or pulled off during
   this process.
Before hauling out any winch rope, the chassis of the winch vehicle shall be bonded to the Substation earthing system and the Equipotential Plate shall be bonded to the winch chassis Section 8 (2).

Alternatively, it may be necessary to remove the Down Droppers prior to lowering off the Downlead at the Substation end. If this is the case, then the additional step in 7 shall be undertaken prior to lowering off the Downleads.

The Downlead can then be lowered.

**Safety Warning:** Before any work on the Substation Gantry is carried out, the Senior Authorised Person shall establish that it has adequate means of identification per the National Grid Safety Rules (R8).

6 Disconnect terminal tower jumpers on the Downlead side of the jumpers.

The Downleads can be lowered off from the terminal tower at this stage.

As the tension is taken up in the winch bond, the Short Bridging Earths shall be disconnected immediately after the Downlead landing pin is removed and coiled back to the crossarm using a Type Registered 600 mm earthing pole.

7 Apply Bridging Earths to the bottom of the Downleads.

This may require the removal of the earth end arcing horn on the Downlead insulator strings attached to the gantry.

A Mobile Elevated Working Platform may be required to fit the conductor ends of these earths. This vehicle shall also be bonded to the Substation earthing system.

**Replacement**

8 Ensure that a minimum of a Single DrESS Earthing Scheme, as installed in 2, is fitted to the terminal tower and the first tower beyond the terminal tower is Earthed to Section 4, Scheme 1.

Confirm integrity of Terminal Tower Earthing connection.

Apply a minimum of a Single DrESS Earthing Scheme to Section 3, Scheme 1 ensuring that Sparrow Plates, Connecting Bonds and Type Registered “T” connectors (if required) are fitted to the line side of the crossarm and the Drain Earth(s) are attached to the jumpers as close to the line side of the tower as possible.

**Safety Warning:** Shall any earth tapes / connections be missing or damaged, then no further work is to be undertaken until repair or replacement has been carried out or a Temporary Earthbond System has been installed to TGN(E)215.

9 Fit Partial Bridging Earths to the Downleads and Short Bridging Earths on the terminal tower where the Downleads are to be landed.

Ensure that the conductor ends of the Partial Bridging Earths are fitted sufficiently far enough beyond the jumper to anchor clamp joint to allow re-connection of the jumper at this point.
Before hauling out any winch rope, the chassis of the winching vehicle shall be bonded to the tower steelwork or to an earthing spike by a Field Equipment Earth and the Equipotential Plate shall be bonded to the winch chassis Section 8 (2)

The Downleads can now be raised to the tower and as the Downlead approaches the crossarm the Short Bridging Earth shall be applied immediately prior to landing the Downlead.

10 Apply **Drain Earth(s)** to the Downleads at the Substation end.

This will normally be by connection to the Downdropper which, in turn, shall have been connected to the Downlead at ground level.

11 Raise the Downlead and connect to the Substation Gantry.

The Downdropper may be connected at the Busbar end before raising or after connection to the Gantry.

Before hauling out any winch rope, the chassis of the winch vehicle shall be bonded to the Substation earthing system and the Equipotential Plate shall be bonded to the winch chassis Section 8 (2)

A Mobile Elevated Working Platform may be required to connect the downleads to the Gantry. This vehicle shall also be bonded to the Substation earthing system.

Ensure that the earth tape to be connected to is not the “high frequency earth” and confirm that the earth tape is connected to substation mesh.

12 Re-connect jumpers on the terminal tower to the Downleads
Section 4, Scheme 7 - Removal and Replacement of downleads

- Sparrow Plate
- A type registered T connector shall be used to connect Sparrow Plate Connecting Bonds
- Drain Earths
- Busbar
- Dropper
- A type registered T connector shall be used to connect Sparrow Plate Connecting Bonds

Ensure Tower Bonded to Substation Earthing System

Apply as a minimum Single DrESS Earthing Scheme to this side of the tower

Alternative Scheme for Bridging Earth 5 & 6
Scheme 8

Lowering and Raising Phase Conductors at Suspension Towers without breaking connections

Lowering

1. Apply 1 Drain Earth to each sub conductor on each phase of the tower to be worked on and the nearest tower either side per diagram for Section 4, Scheme 1.

Where conductors are to be lowered complete with their insulator strings, a Bridging Earth shall be fitted across the insulator string to provide a connection through the winch bond to earth (Fig 3).

2. Before raising the winch bond to the crossarm and rigging to lower the conductor, the chassis of the winch vehicle shall be bonded to tower steelwork or to an Earthing Spike by means of a Field Equipment Earth.

3. Where conductors are to be lowered without their insulators, after taking the conductor weight on the winch bond, the conductor end clamp of the Drain Earth shall be removed from the conductor to be lowered at the point of lowering and the Drain Earth coiled back and secured to the crossarm (Fig 1).

4. After lowering the conductor and before the winch bond is disconnected, a Drain Earth shall be fitted to the conductor using a Type Registered 2500 mm earthing pole. This earth connection may be to tower steelwork or to an Earthing Spike.

Raising

5. Apply 1 Drain Earth to each sub conductor on each phase of the tower to be worked on and the nearest tower either side per diagram for Section 4, Scheme 1. Additional Drain Earth(s) shall also be fitted to the conductor(s) on the ground.

The additional Drain Earth(s) connected to the conductor on the ground shall be connected to the tower steelwork or to an Earthing Spike.

6. Where conductors are to be raised complete with their insulator strings (Fig 3), a Bridging Earth shall be fitted across the insulator string to provide a connection through the winch bond to earth.

Before raising the winch bond to the crossarm and rigging to lift the conductor, the chassis of the winch vehicle shall be bonded to tower steelwork or to an Earthing Spike by means of a Field Equipment Earth.

7. After taking up tension in the winch bond to lift the conductor clear of the ground, the conductor end clamp of the Drain Earth attached to tower steelwork or to an earthing spike shall be removed from the conductor at ground level using a Type Registered 2500 mm earthing pole.

8. When the conductor has been raised to the crossarm, a Drain Earth shall be attached to the conductor.
Section 4, Scheme 8 - Lowering and Raising Conductors at Suspension Towers without breaking connections
Scheme 9

Work on Earthwires not involving lowering / raising or affecting the sag of the Earthwire.

For any work which encroaches within 1 metre of the Earthwire, apply a single Short Drain Earth using a Type Registered 600mm earthing pole.

Note: On OPGW Earthwires, the tails that descend the tower shall be Ampacted together and these Ampacts shall also be bonded to the tower. In addition the associated splice box shall also be bonded to the tower. This bonding shall be readily visible from ground level and, if confirmed intact, will ensure there is no Danger approaching within 1 metre without the need for additional Drain Earthing. If the integrity of this bonding cannot be verified then apply a single Short Drain Earth using a Type Registered 600mm earthing pole.

Work not involving breaking the continuity of the Earthwire Conductor

1 For all tower designs, apply a single Short Drain Earth to the Earthwire using a Type Registered 600mm earthing pole.

Remaking or replacement of Permanent Earth Bonds

2 For remaking or replacement of Permanent Earth Bonds on suspension and tension towers, apply Short Drain Earths as shown in the drawing for this scheme Fig.1 and Fig. 2 using a Type Registered 600mm earthing pole.

Application of a Through Current Drain Earthing Scheme for the temporary disconnection of Jumpers on Earthwires.

3 Prior to the application of Drain Earth(s), fit one or two Sparrow Plates, as necessary, to the tower peak.

It is not necessary to fit Drain Earth(s) to the nearest tower either side of the tower to be worked on for Earthwire Work.

4 Apply Short Drain Earth(s) directly to the earthwire on either side of the tower peak in accordance with the drawing for this scheme using a Type Registered 600mm earthing pole.

A minimum of 3 Short Drain Earth(s) shall be fitted per side.
Section 4, Scheme 9 - Work on Earthwires not involving lowering/raising or affecting the sag of the Earthwire
### SECTION 5
OVERHEAD LINE TENSION STRINGING OF PHASE CONDUCTORS

**CONTENTS**

| 1 | General Requirements for Overhead Line Tension Stringing of Phase Conductors. | 2 |
| 2 | Additional Safety Requirements for Continuous Tension Stringing of Phase Conductors | 5 |
| 3 | Replacement of Overhead Line conductors, insulators and fittings using Tension Stringing Techniques | 8 |
### General Requirements for Overhead Line Tension Stringing of Phase Conductors

This section of NSI 4 details the requirements when phase conductors are to be replaced using the continuous tension stringing method and applies to work on any circuit subject to induced currents and/or voltages, arising from any other adjacent Live circuit(s).

#### 1.1 Basic Safety Requirements

**1.1.1** The safety requirements throughout this section shall be fully understood and implemented by a **Senior Authorised Person** and the **Competent Person**.

**1.1.2** Prior to agreement that the work can be undertaken, the **Senior Authorised Person** shall carry out an assessment of all sections of the overhead line.

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**1.1.1** The **Senior Authorised Person** shall have sufficient technical knowledge and experience of the work to be undertaken, the techniques to be employed and the **Safety from the System** implications to enable him to make the necessary arrangements and decisions for planning the work. He will also issue the appropriate **Safety Document(s)**. He shall be specifically appointed to Section 5 of NSI 4.

The **Competent Person** shall have sufficient technical knowledge and experience of the work to be undertaken, the techniques to be employed and the **Safety from the System** implications. He shall be present on site during the work with his attention dedicated to this task. His role is to satisfy himself that all appropriate measures are being taken to maintain **Safety from the System**. He shall be specifically appointed to Section 5 of NSI 4.

**1.1.2** The **Senior Authorised Person** shall produce a report identifying those towers or sections requiring special working arrangements, the requirements for circuit outages or any restrictions on the positioning of plant or on the equipment to be used for the work.

Pulling of phase conductors shall be completed within the working day. NB this statement refers to the actual process of pulling in the new conductor and does not include all the ancillary preparation or finalisation works e.g. inserting make-up lengths of conductor, catching off at tension towers, sagging, clamping in etc. However at the end of the working day all conductors shall be left overnight in a safe and secure state.

Form F10, Daily Check list for key activities, located in Section 10 shall be completed on a daily basis

Shall work be required to take place on an intermediate tower during a pulling operation involving insulated links, extra care shall be taken as currents up to 450 Amps may be present in any set of **Drain Earth(s)** applied to any intermediate tower in the section being pulled.

Reeving ropes (non-metallic) can be used to winch in the existing conductor(s) to the puller under the following conditions:-
1.1.2 Cont

- The reeving rope is inspected at every pull to gauge its condition and integrity.
- It shall only be raised up the tower and connected immediately prior to the pull once it has been agreed that the pull can commence.
- Under no circumstances shall the rope be left up the tower exceeding the normal working day, particularly overnight.

**Safety Warning:** Conductors stockings SHALL NOT be left in stationary contact with the running blocks.

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### Section 5

#### 1.2 Supervision and Competency of Staff

1.2.1 The Competent Person(s) in receipt of Safety Document(s) for this work shall be trained, assessed and authorised to the relevant sections of this NSI.

1.2.1 It is the responsibility of the employer of the staff carrying out the installation, to implement a satisfactory system of Supervision which identifies the person in charge of the work and the responsibilities of all other staff. In addition, he shall have a system of work which provides an adequate system of communication for controlling the activities.

Documentary evidence shall be available confirming the Competent Person(s) in receipt of Safety Document(s) for this work has been trained, assessed and authorised to the relevant sections of this NSI.

#### 1.3 Communications and Control

1.3.1 An effective and efficient communications system shall be in place prior to any work associated with these procedures.

1.3.1 The Competent Person shall be responsible for ensuring that communication is established between the site and the Control Person (Operation) using an effective communication channel.

Before the actual installation work is commenced, the site Personnel carrying out the work shall explain to the satisfaction of the Competent Person the method of communication, signalling and control that will be adopted. This communication system shall be checked each day before the start of work and immediately prior to the stringing operation. Work shall be stopped immediately if the communication system is found to be defective.

#### 1.4 Emergency Procedures

1.4.1 In the event of an unplanned action whereby the Phase Conductor or any other equipment or material, could potentially come within Safety Distance of a Live circuit, the Competent Person shall immediately arrange for the Live circuit to be switched out in order to recover the situation.
1.4.1 At the planning stage, ENCC shall consider emergency outages in the possible fault risk category. Following emergency circuit switch out, system security standards may not be met and therefore ENCC shall implement any planned action to restore security standards.

Each day before work commences, the Competent Person shall request the Control Person (Operation) to switch out the Delayed Auto Reclose (DAR) on the adjacent Live circuit. At the end of each day's work, the Competent Person will request the restoration of the DAR on the adjacent circuit. This will be carried out and recorded on the Daily Checklist Forms found in Section 10. In the event of the adjacent Live circuit tripping during the work, the Control Person (Operation) shall not initiate the re-closure of the circuit until he has obtained the agreement of the Competent Person on site.

Where a circuit has been subject to a fault, the integrity of Earthing Devices cannot be guaranteed. Therefore, following a fault on an adjacent circuit, all Earthing Devices shall be inspected before further work is carried out.

1.4.2 Personnel carrying out the work shall have a written emergency plan available on site to instruct all staff in the actions to be taken shall the Phase Conductor or any other equipment or material come within Safety Distance of the Live circuit. The plan shall include the following:

- All Personnel shall be withdrawn immediately to a distance greater than Safety Distance from the unsecured item.

- The immediate area shall be secured to prevent access.

- The Competent Person shall be informed.

Should the approved procedures fail, advice shall be sought from the Senior Authorised Person.

The Senior Authorised Person shall have an emergency plan which caters for the interface with all other Utilities, Emergency Services and the Control Person (Operation).
2 Additional Safety Requirements for Continuous Tension Stringing of Phase Conductors

Section 5 of this NSI details Safety from the System and Drain Earthing requirements for the continuous tension stringing of Phase Conductors, under single circuit outage conditions, on all 275 kV and 400 kV double circuit lattice tower construction, overhead lines designed pre-1991. Work on L3 design towers, ‘T’-off towers, junction and terminal towers, certain large angle towers, high river crossings, towers of special construction and future designs may need special consideration and additional documented procedures.

2.1 Safety Requirements for Continuous Tension Stringing

2.1.1 Ensure that the Delayed Auto Reclose is switched out during all Tension Stringing Operations.

2.1.2 Ensure all Safety from the System measures are in place prior to the commencement of Tension Stringing Operations and maintained during the Tension Stringing Operations.

Guidance

2.1.1 Before actual tension stringing is carried out, the Competent Person shall request the Control Person (Operation) to switch out the Delayed Auto Reclose (DAR) on the Live circuit. At the end of the restringing, the Competent Person will request the restoration of the DAR. This will be carried out and recorded on the daily check sheet.

In the event of the circuit tripping during the work, the Control Person (Operation) shall not initiate the re-closure of the circuit until he has obtained the agreement of the Competent Person on site.

2.1.2 Phase Conductor tension stringing shall not proceed until agreed by the Competent Person, who shall be present in the section to be worked on during the installation of the Phase Conductors with his attention dedicated to the task.

The Competent Person is responsible for ensuring that all appropriate measures are being taken to maintain Safety from the System. There shall be a high level of supervision provided for the work.

The Senior Authorised Person shall be readily contactable and available to deal with any emergencies. These arrangements shall be agreed by the Senior Authorised Person and the Competent Person before the Competent Person allows the work to commence.

During the tension stringing operation, using binoculars if necessary, the Phase Conductors and each running block shall be continuously monitored by trained staff in communication with the tensioner / puller operators. If damaged Phase Conductor, joints or repair sleeves are to be pulled through the running blocks, the puller operator shall be advised of the progress of the obstruction and the pulling speed reduced as necessary.

During the tension stringing process no Personnel shall be positioned underneath the Phase Conductors being restrung.
2.2 Basic Requirements to Safeguard Personnel

2.2.1 Ensure all Earth Bonding is in place prior to the Tension Stringing Operation.

2.2.2 Ensure all Drain Earth(s) have been applied in accordance with the Earthing Schedule.

2.2.3 The Senior Authorised Person shall satisfy himself that any scaffolding and/or Skycradles are so positioned as to be effective for the purpose.

2.2.4 The Senior Authorised Person shall agree and document the positioning of plant and equipment to ensure that Safety Distance is maintained at all times to the Live circuit.

2.2.5 At the end of the work period before Personnel leave site, the Phase Conductor section shall be pulled through and brought to approximately normal erection tension and terminated at appropriate towers to prevent excessive sags appearing.

2.2.1 At substation terminal towers, the integrity of the earth connection to the substations earth mats shall be checked prior to the work commencing.

2.2.2 The Senior Authorised Person shall make reference to the tables in Section 3 Schemes 1 and 2 for the correct number of Drain Earth(s) required for sub-conductors under this section.

A fully conductive system shall be capable of carrying a combined current of 450A, therefore any swivel/link shall be capable of carrying this maximum figure. This will only apply to bundled conductors i.e. two or more sub-conductors.

If temporary joints are not capable of carrying 450A, then use shall be made of insulated links to reduce the current that can pass through lifting equipment and machines.

If utilising the insulated pulling system, an insulated sheath shall be applied over the full length of the conductor stocking.

When using the insulated link, at no time shall a section of conductor between two insulated links be allowed to be Drain Earth(s) free. The insulated link is designed to withstand the passage of current and can not withstand high floating induced voltages.

For this reason during re-conductoring

- At a tension tower when inserting a make up length of conductor, only one insulated link shall be inserted per sub-conductor.

Safety Warning: To reduce to a minimum the time that current can flow through non current carrying temporary joints, it’s imperative that the Drain Earth(s) applied on the line side of any temporary joint is not removed until
Guidance
NSI 4 Section 5
2.2.2 Cont to 2.2.4

immediately prior to pulling the conductor.

- If a short single span is located in a long pulling section such that during the pulling operation that span would at any time become free of Drain Earth(s), then joints at one end shall be capable of carrying 450A.

All conductor running blocks shall comply with the requirements of TRL 2.2 part 5. All conductor running blocks at machine end towers shall be brushed.

2.2.4 To protect the operators of the tensioner / puller and Personnel working on the reel winders, drums and associated equipment against the effects of any rise in potential of the machines and equipment with respect to the ground they are standing on, an Equipotential Environment shall be provided. This shall be in accordance with Section 8 (2). Access to the machines and equipment in the Equipotential Zones by operators and other Personnel shall be controlled.

The Senior Authorised Person may need to refer to the appropriate overhead line design drawings.

When failure of a component (e.g. a running block or means of attachment at angle tower peaks) could allow the Phase Conductor to move towards the Live circuit, the method of working shall ensure that in the event of such a failure, the Phase Conductor is restrained and Safety Distance is not infringed.

2.3 Weather Conditions

2.3.1 Prior to work on tension stringing of the Phase Conductors, the Competent Person shall contact the appropriate local weather centre to ascertain the forecast on wind speed and precipitation and the NOC Response Management for lightning risk.

2.3.2 When the weather conditions are such that wind induced conductor movement could cause Safety Distance from the Live circuit to be infringed if conductor tension was lost during the stringing, then the work shall be stopped.

2.3.3 In the event of, or near approach of, a lightning storm, all work on the Phase Conductors shall cease.

2.3.4 Work shall also be discontinued if fog or poor visibility prevents observers from fulfilling their role.

Guidance
NSI 4 Section 5
2.3.1 to 2.3.3

2.3.1 The NOC Response Management team shall inform the Competent Person of any change in lightning risk that has reached level 1 severity or other weather conditions which could adversely affect the work.

2.3.3 The Control Person (Operation) may request that the DAR be restored on the Live circuit for the duration of the storm or until such time as it is agreed work can resume. Personnel shall also keep a minimum of 10 m away from the overhead line and the stringing equipment whilst a lightning storm is in the area.
## 3 Replacement of OHL conductors and fittings using OHL tension stringing techniques

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Activity 8 - Application & Movement of Drain Earths at Suspension Towers for Conductor Running

Layout of an Equipotential Zone
Activity 2 Initial Application of Drain Earth(s) at a Puller / Tensioner Tower

1. Prior to the application of Drain Earth(s) fit one or two Sparrow Plates, as necessary, to each crossarm (if two are fitted, fit one each side of the crossarm and connect them together using Sparrow Plate Connecting Bonds). Also fit one or two Sparrow Plates to the Earthwire peak. Sparrow Plate Connecting Bonds and Type Registered ‘T’ connectors (if required) shall then be connected between phase Sparrow Plates and, if fitted, the earthwire Sparrow Plate as necessary.

If the conductors are to be pulled using Insulated Links then Sparrow Plate Connecting Bonds shall then be connected between phase Sparrow Plates and the Earth Sparrow Plate or Plates (see Diagram A).

If the conductors are to be pulled using a fully conductive conductor system then Sparrow Plates need not be connected together. A fully conductive system shall be capable of carrying a combined current of 450 amps, therefore any swivel / link shall be capable of carrying this maximum figure. This will only apply to bundled conductors (2 or more sub conductors).

For the number of Sparrow Plate Connecting Bonds and Drain Earth(s) required see Section 3 Scheme 2, Table 2.

An additional Sparrow Plate Connecting Bond shall be bolted to one Sparrow Plate on each crossarm for later attachment to the Green Sparrow Plate.

In the event that sufficient Sparrow Plates are not available during the initial earthing process, induced voltage earthing can be applied allowing the de-spacering activity to proceed. Sparrow Plates shall then be fitted to the puller / tensioner positions per this scheme. The initial Drain Earth(s) can then be disconnected and coiled up in readiness for their re-application once the re-conductoring has been completed.

Equipotential Zones shall be established for all tensioner / puller sites in accordance with Section 8 (2).

2. Connect the earth end of all Drain Earth(s) to the Sparrow Plates.

Short Drain Earth(s) shall be applied to an earthwire.

3. Apply Drain Earth(s) to conductors as shown in the drawing for this activity.

Drain Earth(s) shall be applied to the Earthwire first, followed by the top phase, then the middle phase and finally the bottom phase.

Apply Drain Earth(s) to either side of the centre of the jumper to allow the jumper to be cut.

If the Earthwire is also to be pulled during the outage, then a minimum of a Partial DrESS would need to be applied between the Earthwire and one of the phases as per Section 3 Scheme 2.

See the following Table (3.2) for correct number of short Drain Earth(s).
## Table 3.2

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<tr>
<th>Earthwire to be Disconnected or Pulled</th>
<th>Number of Drain Earth(s) To be Installed</th>
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<tr>
<td>Yes</td>
<td>6</td>
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Uncontrolled when printed
Activity 2 - Initial Application of Drain Earths at a Puller/Tensioner Tower

Diagram 'A'

See Activity 2 Table 3.2 for Number of Short Drain Earths

Sparrow Plate

Sparrow Plate Connecting Bond

Two Sets of Drain Earths

A type registered T connector shall be used to connect Sparrow Plate Connecting Bonds

Additional Sparrow Plate Connecting Bond for later attachment to a Green Sparrow Plate

Earthing when using insulated links.

Diagram 'B'

Two Sets of Drain Earths

Additional Sparrow Plate Connecting Bond for later attachment to a Green Sparrow Plate

Earthing when using fully conductive system on Phase Conductors only
Activity 3  Initial Application of Drain Earth(s) at a Pull through Tower

1. Prior to the application of Drain Earth(s), fit one or two Sparrow Plates, as necessary, to each crossarm (if two are fitted, fit one each side of the crossarm and connect them together using Sparrow Plate Connecting Bonds).

   Note: For insulated pulling also fit one or two Sparrow Plates to the earthwire peak.

   For the number of Sparrow Plate Connecting Bonds and Drain Earth(s) required see Section 3, Scheme 2, Table 2.

   An additional Sparrow Plate Connecting Bond shall be bolted to one Sparrow Plate on each crossarm for later attachment to the Green Sparrow Plate.

2. Connect the earth end of all Drain Earth(s) to the Sparrow Plates.

3. Apply Drain Earth(s) to conductors as shown in the drawing for this activity.

   Drain Earth(s) shall be applied to the top phase first, followed by the middle phase and finally the bottom phase.

   Note: for conductive pulling initial earthing of phase conductors can to be carried out to Section 4 Scheme 1. One Drain Earth per sub conductor required.

   Apply Drain Earth(s) to either side of the centre of the jumper to allow the jumper to be cut.

   Note: If the jumpers are not to be cut prior to the application of the Platform Applied Earths, and after pulling, the jumpers are remade before the Platform Applied Earths are removed, then the initial earthing of phase conductors can be to Scheme 4 using a minimum of 3 earths per phase.
Activity 3 - Initial Application of Drain Earths at a Pull Through Tower
Activity 4  Application and Removal of Drain Earth(s) applied from a Platform at a Pull-Through Tower prior to pulling conductor

1 Ensure that the tower is **Earthed** to Section 5 (3) activity 3.3 and that the towers either side of the tower to be worked on are also **Earthed**.

   Only if using the Insulated Pulling technique, to facilitate landing of the platform, the jumpers can now be cut.

   **Safety Warning:** After raising the platform, apply a Platform Field Equipment Earth from the tower to the platform before releasing the lifting bond due to possible initial voltage charge on the platform.

2 Attach a Green Sparrow Plate to the crossarm and attach to the previously fitted Sparrow Plate Connecting Bond.

   The earth end of all Platform Applied Earths shall be connected to the Green Sparrow Plate. For the number of Platform Applied Earths required per side see Section 3 Scheme 2 Table 2.

   Using a Type Registered 600 mm earthing pole, apply the Platform Applied Earths to the conductors on the line side of the line terminations leaving sufficient room to fit the conductor clamps and stockings.

   Cut the jumpers at the line terminations.

3 Remove the line ends of the initially applied **Drain Earth(s)** on the jumpers.

   Lower the jumpers to the ground, coil the **Drain Earth(s)** up and tie them to the crossarm.

   After removing the insulators and cutting out the old terminations, position a conductor running block under the crossarm.

4 Apply 3 of the initially applied **Drain Earth(s)** to the running block earthing spigot.

   Feed the make up conductor through the conductor running block and attach to each end of the old conductor ensuring that either:

   - For Insulated Pulling the Insulated Link is positioned between one set of stockings and that the stockings are sheathed over their full length.
   - Or;
   - For Conductive Pulling the conductive swivels and associated conductive braids are inserted to form a through current connection.

   **Note:** If the temporary joints are capable of carrying 450 Amps, then an insulated link is not required (fully conductive system).

5 Remove the Platform Applied Earths from the conductors and tie them to the platform.

   **Safety Warning:** Use a Type Registered 600 mm earthing pole.

   When ALL the Platform Applied Earths have been removed from the conductors the Sparrow Plate Connecting Bond can be removed from the Green Sparrow Plate.

   The Platform Applied Earths and the Green Sparrow Plate can then be removed from the tower.
Activity 4 - Application & Removal of Drain Earths applied from a platform at a Pull Through Tower prior to pulling conductor
Activity 5  Application and Removal of Drain Earth(s) applied from a Platform at a Puller / Tensioner Tower prior to pulling conductor

1 Ensure that the tower is **Earthed** to Section 5 (3) activity 3.2 and that the towers either side of the tower to be worked on are also **Earthed**.

   If necessary, to facilitate landing of the platform the jumpers can now be cut.

   **Safety Warning:** After raising the platform, apply a Platform Field Equipment Earth from the tower to the platform before releasing the lifting bond due to possible initial voltage charge on the platform.

2 Attach a Green Sparrow Plate to the crossarm and attach to the previously fitted Sparrow Plate Connecting Bond.

   The earth end of all Platform Applied Earths shall be connected to the Green Sparrow Plate. For the number of Platform Applied Earths required per side see Section 3 Scheme 2 Table 2.

   Using a Type Registered 600 mm earthing pole, apply the Platform Applied Earths to the conductors on the line side of the line terminations leaving sufficient room to fit the conductor clamps and stockings.

   Cut the jumpers at the line terminations.

3 Remove the line ends of the initially applied **Drain Earth(s)** on the jumpers.

   Lower the jumpers to the ground. Apply one set of the initially applied **Drain Earth(s)** to the conductors that are not to be pulled and coil the other set up and secure to the crossarm.

   After removing the insulators and cutting out the old terminations, position a conductor running block under the crossarm.

4 Apply 3 of the initially applied **Drain Earth(s)** to the running block earthing spigot.

5 Raise the new / old conductor from the puller / tensioner and earth it by transferring the Platform Applied Earths from the conductor not to be pulled.

   **Safety Warning:** Use a Type Registered 600 mm earthing pole.

   Attach conductor or hauling rope to the end of the old conductor. Ensuring that for either:

   - For Insulated Pulling the Insulated Link / Swivel is positioned between the old and new conductor and that the stockings are sheathed over their full length at the tensioner end of the section.
   - Or;
   - For Conductive Pulling the conductive swivels and associated braids are inserted to form a through current connection at the tensioner end of the section.

6 Remove the Platform Applied Earths from the conductors.

   **Safety Warning:** Use a Type Registered 600 mm earthing pole.

   Coil and tie them to the platform. If rope is used at the puller end, then pull old conductor on to conductor running block before removing these earths.
7 When ALL the Platform Applied Earths have been removed from the conductors the Sparrow Plate Connecting Bond can be removed from the Green Sparrow Plate.

The Platform Applied Earths and the Green Sparrow Plate can then be removed from the tower.

8 When ALL the Platform Applied Earths have been removed from the conductors, the Sparrow Plate Connecting Bond can be removed from the Green Sparrow Plate.

The Platform Applied Earths and the Green Sparrow Plate can then be removed from the tower.
Activity 5 - Application & Removal of Drain Earths applied from a platform at a Puller/Tensioner prior to pulling conductor

SAFETY WARNING

Sparrow Plate Connecting Bonds are easy to be removed/attached to the Green Sparrow Plate

SAFETY WARNING

This Earth is not to be removed whilst men are working on the platform

Insulated Link must be fitted at the Tensioner End if not using a fully conductive system
Activity 6  Application and Removal of Earths at a Pull through Tower from a Platform after Pulling Conductor

1 Ensure that the tower is Earthed in accordance with initial conditions (to Section 5 (3) activity 3.3) and that the towers either side of the tower to be worked on are also Earthed.

   Safety Warning: After raising the platform, apply a Platform Field Equipment Earth from the tower to the platform before releasing the lifting bond due to possible initial voltage charge on the platform.

2 Attach a Green Sparrow Plate to the crossarm and attach to the previously fitted Sparrow Plate Connecting Bond.

   The earth end of all Platform Applied Earths shall be connected to the Green Sparrow Plate. For the number of Platform Applied Earths required per side see Section 3 Scheme 2 Table 2.

   Using a Type Registered 600 mm earthing pole, apply the Platform Applied Earths to the conductors on the line side of the line terminations leaving sufficient room to fit the conductor clamps.

   Sag the conductors and land the insulators.

3 Apply the initially applied Drain Earth(s) to the conductors on either side of the tower.

   Ensure that they will be on the line side of the jumper joint and also that they will be accessible when using a Type Registered earthing pole from the crossarm if applied to the jumpers.

4 Remove the Platform Applied Earths.

   Safety Warning: Use a Type Registered 600 mm earthing pole.

   Coil and tie them to the platform.

   When ALL the Platform Applied Earths have been removed from the conductors the Sparrow Plate Connecting Bond can be removed from the Green Sparrow Plate. The Platform Applied Earths and the Green Sparrow Plate can then be removed from the tower.

   On removal of the platform and when the weight has been taken by the winch bond, the Platform Field Equipment Earth can be removed.

   Safety Warning: Use a Type Registered 600 mm earthing pole.
Activity 6 - Application and Removal of Earths at a Pull Through Tower from a Platform after Pulling Conductor
Activity 7 Application and Removal of Drain Earth(s) at a Puller/Tensioner Tower from a Platform after Pulling

1. Ensure that the tower is Earthed in accordance with initial conditions (to Section 5 (3) activity 2) and that the towers either side of the tower to be worked on are also Earthed.

   Safety Warning: After raising the platform, apply a Platform Field Equipment Earth from the tower to the platform before releasing the lifting bond due to possible initial voltage charge on the platform.

2. Attach a Green Sparrow Plate to the crossarm and attach to the previously fitted Sparrow Plate Connecting Bond.

   The earth end of all Platform Applied Earths shall be connected to the Green Sparrow Plate. For the number of Platform Applied Earths required per side see Section 3 Scheme 2 Table 2.

   Using a Type Registered 600 mm earthing pole leaving sufficient room to fit the conductor clamps.

3. Apply the Platform Applied Earths to the conductors on the line side of the line terminations.

   Safety Warning: Use a Type Registered 600 mm earthing pole.

   Leave sufficient room to fit the conductor clamps.

4. Apply Platform Applied Earths to the conductors leading down to the puller/tensioner.

   Safety Warning: Use a Type Registered 600 mm earthing pole.

   Sag the conductors and land the insulators.

5. Transfer the initially applied Drain Earth(s) from the running out block to the jumper ensuring that they will be on the line side of the jumper joint. Also ensure that they will be accessible when using the Type Registered earthing pole from the crossarm.


   Safety Warning: Use a Type Registered 600 mm earthing pole.

   Coil and tie them to the platform.

   When ALL the Platform Applied Earths have been removed from the conductors, the Sparrow Plate Connecting Bond can be removed from the Green Sparrow Plate. The Platform Applied Earths and the Green Sparrow Plate can then be removed from the tower.

   On removal of the platform and when the weight has been taken by the winch bond, the Platform Field Equipment Earth can be removed.

   Safety Warning: Use a Type Registered 600 mm earthing pole.
Section 5 OH Line Tension Stringing of Phase Conductors

Activity 7 - Application and Removal of Drain Earths at a Puller/Tensioner Tower from a Platform after Pulling

SAFETY WARNING
Sparrow Plate Connecting Bonds are only to be removed/attached to the Green Sparrow Plate.
Activity 8  Application and movement of Drain Earth(s) at Suspension towers for conductor running, sagging and clamping a section

1  Apply **Drain Earth(s)** to all phases of all suspension towers in the section to be pulled.

To enable de-spacing / spacing to take place, all suspension towers shall be **Earthed** from each crossarm down to the conductors.

A minimum of 3 **Drain Earth(s)** shall be applied to each phase or 3 Short **Drain Earth(s)** to the earthwire and at least 1 per sub-conductor to all suspension towers in the section to be worked on.

De-spacing, spacing, clamping out and clamping in can now be carried out.

2  Transfer **Drain Earth(s)** between conductors and conductor running blocks.

A minimum of 3 **Drain Earth(s)** (or 3 Short **Drain Earth(s)** for the earthwire) shall be transferred to the earth spigot on every running block in the section using one of the following methods:

- a Type Registered earthing pole from the crossarm
- utilising the alternative procedure – a “traveller earth” is used to allow the progressive movement of each **Drain Earth** to facilitate various activities near the conductor suspension assemblies, conductor running blocks and spacing. This method is shown in stages 1 to 6 on the diagram for this activity.
Activity 8 - Application and movement of Earths at a Suspension tower for conductor running

**Stage 1**
Line swan on tower crossarm fits the Earth End clamp of the Green Working Earth to the tower steel work, tie then securely insert the Line End clamp of the Green Working Earth into a 600 mm, type approved, Earthing Pole at the crossarm. This is then strained to the person on the conductors, ensuring that the person on the conductor does not come into contact with the earth end or socket. The Green Working Earth is then applied to the conductor as shown.

**Stage 2**
On the sub-conductor where the Green Working Earth has been fitted, move the normal Drain Earth to the next sub-conductor at a position which will allow work at or near the bottom of the insulator string.

**Stage 3**
Repeat stage 2, moving the Drain Earth nearest the insulator string (on the sub-conductor with two Drain Earths fitted) to a position which will allow work at or near the bottom of the insulator string.

**Stage 4**
Repeat stage 3 for next sub-conductor.

**Stage 5**
Repeat stage 3 for fourth sub-conductor.

**Stage 6**
Using the type approved 600 mm Earthing Pole, transfer the Drain Earths that are on the same conductor as the Green Working Earth onto the running block. Once this is done, transfer all the other Drain Earths onto the Usaek. When all the Drain Earths have been transferred the Green Working Earth can be removed and tied up on the crossarm. Repeat stages 1 to 6 for each crossarm.

For clarity, the 'traveller' earth is shown in green. However this earth in practice will be a normal Drain Earth.
SECTION 6

OVERHEAD LINE TENSION STRINGING OF EARTHWIRES

CONTINUOUS TENSION STRINGING OF EARTHWIRES UNDER SINGLE CIRCUIT OUTAGE CONDITIONS ON 275 / 400 KV DOUBLE CIRCUIT OVERHEAD LINES

Page

1 General Safety Requirements for Tension Stringing of Earthwires 2

Additional Safety Requirements for Continuous Tension Stringing of Earthwires Under Single Circuit Outage Conditions on 275 / 400 kV Double Circuit Overhead Lines 5
1 General Safety Requirements for Tension Stringing of Earthwires

This section deals with the safety requirements when the work involves replacement of Earthwires using tension stringing techniques.

1.1 Basic Safety Requirements

1.1.1 The safety requirements throughout this section shall be fully understood and implemented by a Senior Authorised Person and the Competent Person.

1.1.2 Prior to agreement that the work can be undertaken, the Senior Authorised Person shall carry out an assessment of all sections of the overhead line.

1.1.1 The Senior Authorised Person shall have sufficient technical knowledge and experience of the work to be undertaken, the techniques to be employed and the Safety from the System implications to enable him to make the necessary arrangements and decisions for planning the work. He will also issue the appropriate Safety Document(s). He shall be specifically appointed to Section 6 of NSI 4.

The Competent Person shall have sufficient technical knowledge and experience of the work to be undertaken, the techniques to be employed and the Safety from the System implications. He shall be present on site during the work with his attention dedicated to this task. His role is to satisfy himself that all appropriate measures are being taken to maintain Safety from the System. He shall be specifically appointed to Section 6 of NSI 4.

1.1.2 The Senior Authorised Person shall produce a report identifying those towers or sections requiring special working arrangements, the requirements for double circuit outages or any restrictions on the positioning of plant or on the equipment to be used for the work.

1.2 Supervision and Competency of Staff

1.2.2 The Competent Person(s) in receipt of Safety Document(s) for this work shall be trained, assessed and authorised to the relevant sections of this NSI.

1.2.2 It is the responsibility of the employer of the staff carrying out the installation, to implement a satisfactory system of Supervision which identifies the person in charge of the work and the responsibilities of all other staff. In addition, he shall have a system of work which provides an adequate system of communication for controlling the activities.

Documentary evidence shall be available confirming the Competent Person(s) in receipt of Safety Document(s) for this work has been trained, assessed and authorised to the relevant sections of this NSI.
### 1.3 Communications and Control

#### 1.3.1 An effective and efficient communications system shall be in place prior to any work associated with these procedures.

1.3.1 The **Competent Person** shall be responsible for ensuring that communication is established between the site and the **Control Person (Operation)** using an effective communication channel.

Before the actual installation work is commenced, the site Personnel carrying out the work shall explain to the satisfaction of the **Competent Person** the method of communication, signalling and control that will be adopted. This communication system shall be checked each day before the start of work and immediately prior to the stringing operation. Work shall be stopped immediately if the communication system is found to be defective.

### 1.4 Emergency Procedures

#### 1.4.1 In the event of an unplanned action whereby the earthwire or any other equipment or material comes, or could potentially come, within **Safety Distance** of a **Live** circuit, the **Competent Person** shall immediately arrange for the **Live** circuit to be switched out in order to recover the situation.

1.4.2 The **Senior Authorised Person** shall have an emergency plan which caters for the interface with all other Utilities, Emergency Services and the **Control Person (Operation)**.

1.4.1 At the planning stage, ENCC shall consider emergency outages in the possible fault risk category. Following emergency circuit switch out, system security standards may not be met and therefore ENCC shall implement any planned action to restore security standards.

Each day before work commences, the **Competent Person** shall request the **Control Person (Operation)** to switch out the Delayed Auto Reclose (DAR) on the adjacent **Live** circuit. At the end of each day's work, the **Competent Person** will request the restoration of the DAR on the adjacent circuit. This will be carried out and recorded on the Daily Checklist Forms found in Section 10.

In the event of the adjacent **Live** circuit tripping during the work, the **Control Person (Operation)** shall not initiate the re-closure of the circuit until he has obtained the agreement of the **Competent Person** on site.

Where a circuit has been subject to a fault, the integrity of Earthing Devices cannot be guaranteed. Therefore, following a fault on an adjacent circuit, all **Earthing Devices** shall be inspected before further work is carried out.

1.4.2 **Personnel** carrying out the work shall have a written emergency plan available on site to instruct all staff in the actions to be taken shall the Earthwire or any other equipment or material come within **Safety Distance** of the **Live** circuit. The plan shall include the following:
Guidance
NSI 4
Section 6
1.4.2 Cont

- All Personnel shall be withdrawn immediately to a distance greater than Safety Distance from the unsecured item.
- The immediate area shall be secured to prevent access.
- The Competent Person shall be informed.

Should the approved procedures fail, advice shall be sought from the Senior Authorised Person.
2 Additional Safety Requirements for Continuous Tension Stringing of Earthwires under single circuit outage conditions on 275 / 400 kV double circuit Overhead Lines

Section 6 of this NSI details Safety from the System and Drain Earthing requirements for the continuous tension stringing of Earthwires, under single circuit outage conditions, on all 275 kV and 400 kV double circuit lattice tower construction, overhead lines designed pre-1991. Work on L3 design towers, ‘T’-off towers, junction and terminal towers, certain large angle towers, high river crossings, towers of special construction and future designs may need special consideration and additional documented procedures. The raising or lowering of complete spans of earthwire to or from the ground and the handling of long tails of optical earthwire are not covered by these safety requirements.

Planning

As a part of the planning process, consideration shall be given to the practicalities of completing the pull in one day. The length of the pull, number of intermediate angles and access to machine sites shall be clearly identified in order to estimate the approximate duration of the pull. It may be necessary to revise the scope of the works if there are insufficient daylight hours during the winter months preventing the pull from being completed in one day.

Checklists for Key Activities are in Section 10.

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<td>2.1.1 Before actual tension stringing is carried out, the Competent Person shall request the Control Person (Operation) to switch out the Delayed Auto Reclose (DAR) on the Live circuit. At the end of the restringing, the Competent Person will request the restoration of the DAR. This will be carried out and recorded on the daily check sheet.</td>
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<td>In the event of the circuit tripping during the work, the Control Person (Operation) shall not initiate the re-closure of the circuit until he has obtained the agreement of the Competent Person on site.</td>
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<td>2.1.2 Earthwire tension stringing shall not proceed until agreed by the Competent Person, who shall be present in the section to be worked on during the installation of the earthwire with his attention dedicated to the task.</td>
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<td>The Competent Person is responsible for ensuring that all appropriate measures are being taken to maintain Safety from the System. There shall be a high level of supervision provided for the work.</td>
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<tr>
<td>The Senior Authorised Person shall be readily contactable and available to deal with any emergencies. These arrangements shall</td>
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2.2 Basic Requirements to Safeguard Personnel

2.2.1 Ensure all Earth Bonding is in place prior to the Tension Stringing Operation.

2.2.2 Ensure all Drain Earth(s) have been applied in accordance with the Earthing Schedule.

2.2.3 The Senior Authorised Person shall satisfy himself that any scaffolding and / or Skycradles are so positioned as to be effective for the purpose.

2.2.4 The Senior Authorised Person shall agree and document the positioning of plant and equipment to ensure that Safety Distance is maintained at all times to the Live circuit.

2.2.5 At the end of the work period before Personnel leave site, the earthwire section shall be pulled through and brought to approximately normal erection tension and terminated at appropriate towers to prevent excessive sags appearing.

2.2.6 Brushed running blocks shall be used throughout the pulling section.

Guidance
NSI 4 Section 6
2.2.1 to 2.2.2

2.2.1 At substation terminal towers, the integrity of the earth connection to the substations earth mats shall be checked prior to the work commencing.

The integrity of the Permanent Earth Bonds on the earthwire shall be checked at the nearest towers on each side of the sections to be restrung and on the earthwire that will not be disconnected.

To protect the operators of the tensioner / puller and Personnel working on the reel winders, drums and associated equipment against the effects of any rise in potential of the machines and equipment with respect to the ground they are standing on, an Equipotential Environment shall be provided. This shall be in accordance with Section 8 (2). Access to the machines and equipment in the Equipotential Zones by operators and other Personnel shall be controlled.

2.2.2 Drain Earth(s) shall be applied in accordance with Section 5 (3). Drain Earth(s) shall be fitted to all phase conductors on the
Isolated and Earthed circuit at all towers in the section to be worked on and at the nearest towers on each side of the section.

The Drain Earth(s) shall remain in position for the duration of the work which will ensure the provision of the maximum number of parallel earth paths during the stringing operation.

No work shall be undertaken on the phase conductors, insulators or associated fittings in the section being worked on unless the earthwire is tensioned and permanently made off at both ends and electrically bonded to the towers in the section. This will ensure that earthwire continuity is maintained throughout the route. This statement shall be recorded in Section 2 of the Permit for Work.

2.2.4 The Senior Authorised Person may need to refer to the appropriate overhead line design drawings.

When failure of a component (e.g. a running block or means of attachment at angle tower peaks) could allow the earthwire to move towards the Live circuit, the method of working shall ensure that in the event of such a failure, the earthwire is restrained and Safety Distance is not infringed.

2.2.5 When, due to unforeseen circumstances this cannot be achieved, the earthwire shall be tensioned, as a minimum, to a position where, under all conditions, Safety Distance from the Live phase conductors will not be infringed. Again, it shall be terminated at appropriate towers to minimise the dependence on the temporary joints and the tensioner / puller machines and to prevent excessive sag. The Earthwire shall be caught off avoiding any stocking connections being positioned in the running block. If this is not possible, bridging earths shall be applied to reduce any burning of the stockings. At all intermediate connections, a temporary safety clamp shall be placed onto the Earthwire and secured to the tower with a metallic sling. Earth can then be applied outboard of the temporary clamps.

Note: In these circumstances, consideration of Induced Current Management shall be given by the Senior Authorised Person and Competent Person with respect to the final position of the Insulated Links.

2.3 Weather Conditions

2.3.1 Prior to work on tension stringing of the earthwire, the Competent Person shall contact the appropriate local weather centre to ascertain the forecast on wind speed and precipitation and the NOC Response Management for lightning risk.

2.3.2 When the weather conditions are such that wind induced conductor movement could cause Safety Distance from the Live circuit to be infringed if conductor tension was lost during the stringing, then the work shall be stopped.

2.3.3 In the event of, or near approach of, a lightning storm, all work on the earthwire shall cease.

2.3.4 Work shall also be discontinued if fog or poor visibility prevents...
2.3.4 Cont. observers from fulfilling their role.

2.3.1 The NOC Response Management team shall inform the Competent Person of any change in lightning risk that has reached level 1 severity or other weather conditions which could adversely affect the work.

2.3.2 Work shall not proceed if the mean average hourly wind speed is 15 mph or more, measured at a height of 10 metres above ground level.

2.3.3 The Control Person (Operation) may request that the DAR be restored on the Live circuit for the duration of the storm or until such time as it is agreed work can resume. Personnel shall also keep a minimum of 10 m away from the overhead line and the stringing equipment whilst a lightning storm is in the area.

2.4 Section 6 Earthwire Replacement

This scheme details the requirements when an earthwire conductor is to be replaced using the continuous tension stringing method and applies to work on any earthwire subject to induced currents and/or voltages arising from any associated adjacent Live circuit(s). At least one of the associated circuits in the section where the earthwire is to be replaced shall be switched out, Isolated and Earthed.

Form F12, in Section 10 - Forms details requirements to be fulfilled at the planning stage of the work.

2.4.1 General Requirements

- All Drain Earth(s) applied to the Earthwire shall where reasonably practicable be Short Drain Earth(s). Where this is not reasonably practicable, and following a suitable risk assessment, consideration can be given to the use of longer Drain Earth(s).

- Pulling of an earthwire conductor shall be completed within the working day. NB. This statement refers to the actual process of pulling in the new conductor and does not include all the ancillary preparation or finalisation works e.g. inserting make-up conductor, catching off at tension towers, sagging, clamping in etc. However at the end of the working day the earthwire shall be left overnight in a safe and secure state.

- Reference shall be made to the tables and / or methodology in Section 3 Schemes 1 and 2, Section 4 Scheme 9 and Section 5 for the correct number of Drain Earth(s) required for sub-conductors / Earthwire under this scheme

- All conductor running blocks shall comply with the requirements of TRL 2.2 Part 5

- Earthwire blocks shall be brushed throughout the pulling section.

- An insulated sheath shall be applied over the full length of all earthwire stockings
• When using Insulated Links, at no time may a section of conductor between two Insulated Links be allowed to be free of earth. The reason being that the Insulated Link is designed to prevent the passage of current and not to withstand a high floating induced voltage.

For this reason during re-conductoring:

• An Insulated Link shall be fitted at the Tensioner end.
• At a tension tower when inserting a make up length of conductor, only one Insulated Link shall be inserted.

Safety Warning To reduce to a minimum the time that current can flow through non current carrying temporary joints, it is imperative that the Drain Earth on the outboard side of any such joint is not removed until immediately prior to pulling the conductor.

• If a short single span is located in a long pulling section such that during the pulling operation that span would at any time become free of earth then the joints at one end of the section shall be capable of carrying 450A.

• Any conductor pull shall be completed within the working day.
• Should work be required to take place on an intermediate tower during a pulling operation involving Insulated Links, extra care shall be taken as currents of up to 450 Amps may be present in any set of Drain Earth(s) applied to any intermediate tower in the section being pulled.

• Earthwire blocks shall be brushed throughout the pulling section.
• Reeving ropes (non metallic) can be used to winch in the existing earthwire to the puller under the following conditions:-

  • The reeving rope is inspected at every pull to gauge its condition and integrity.
  • It shall only be raised up the tower and connected immediately prior to the pull, once it has been agreed that the pull can commence.
  • Under no circumstance shall the rope be left up the tower exceeding the normal working day, particularly overnight.

Safety Warning: Conductor stockings SHALL NOT be left in stationary contact with running blocks.

• SQUARE RIGGING earthwire conductor operations at Puller or Tensioner towers shall require the application of additional Drain Earth(s). Specifically this is required at the Puller tower where the insulated link is to be disconnected prior to pulling through the running block on the tower peak. This is also required when connecting old and new conductors via the insulated link at the Tensioner tower on the line side of the running block. Reference shall be made to drawing in Section 6 2.4.2.

Safety Warning: Before any contact is made to the earthwire conductor on the line side of an insulated link Drain Earth(s) shall be applied.
- Fully Conductive pulling operations – where the insulated link/swivel is omitted, work shall only be undertaken following Approval via Form F1 – OHL Engineers Report on a route specific basis only.

The report shall specify the magnitude of earthwire currents and if necessary detailed requirements for limiting and managing earthwire currents for conductor pulling operations.
Section 6 OHL Tension Stringing of Earthwires - Overall Layout

Layout of an Equipotential Zone (Ensure Positioned to Maximise Clearance to Adjacent Live Circuit)

Minimum of Partial DfESS (Section 3, Scheme 2)

Section 6.2.4.3 - Tension Stringing of Earthwire - Earthing at Intermediate Tension Towers
(Only 1 Insulated Link to be inserted)

Phase Conductors on All Intermediate Towers Earthed (Section 5, Activity 8 Minimum of 3 Drain Earths Per Phase)

Minimum of Partial DfESS (Section 3, Scheme 2)
2.4.2  Initial Application of Drain Earths at a Puller / Tensioner Tower

2.4.2.1 Apply a minimum of a Partial DrESS at the Puller and Tensioner towers between the Earthwire and top phase to Section 3 Scheme 2. **Drain Earth(s)** shall be applied to the Earthwire first, followed by the top phase then the middle phase and finally the bottom phase.

2.4.2.2 Equipotential Zones shall be established for all tensioner / puller sites in accordance with Section 8.
2.4.3 Initial Application of Drain Earths at Intermediate or Pull-Through Tower

2.4.3.1 Prior to the application of Drain Earth(s) fit one or two Sparrow Plates, as necessary, to the earthwire peak.

2.4.3.2 Connect the earth end of all Drain Earth(s) to the Sparrow Plates.

2.4.3.3 Apply Drain Earths to the Earthwire as shown in drawing Section 6 2.4.3

2.4.3.4 Apply Drain Earths to the phase wire in accordance with Section 5 Activity 8.
Section 6.2.4.3 – Tension Stringing of Earthwire (Insulated Pulling), Initial Application of Drain Earth(s) at Intermediate or Pull-through Towers
SECTION 7
FIBRE OPTIC WRAP

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</table>
1 General Requirements

This section deals with the safety requirements when the work involves installation, removal or replacement of optical cable using the wrap technique.

1.1 Basic Safety Requirements

1.1.1 The safety requirements throughout this section shall be fully understood and implemented by a Senior Authorised Person and the Competent Person.

1.1.2 Prior to agreement that the work can be undertaken, the Senior Authorised Person shall carry out an assessment of all sections of the overhead line.

1.1.1 The Senior Authorised Person shall have sufficient technical knowledge and experience of the work to be undertaken, the techniques to be employed and the Safety from the System implications to enable him to make the necessary arrangements and decisions for planning the work. He will also issue the appropriate Safety Documents. He shall be specifically appointed to Section 7 of NSI 4.

The Competent Person shall have sufficient technical knowledge and experience of the work to be undertaken, the techniques to be employed and the Safety from the System implications. He shall be present on site during the work with his attention dedicated to this task. His role is to satisfy himself that all appropriate measures are being taken to maintain Safety from the System. He shall be specifically appointed to section 7 of NSI 4.

1.1.2 The Senior Authorised Person shall produce a report identifying those towers or sections requiring special working arrangements, the requirements for double circuit outages or any restrictions on the positioning of plant or on the equipment to be used for the work.

1.2 Supervision and Competency of Staff

1.2.1 The Competent Person(s) in receipt of Safety Document(s) for this work shall be trained, assessed and authorised to the relevant sections of this NSI.

1.2.1 It is the responsibility of the employer of the staff carrying out the installation, to implement a satisfactory system of Supervision which identifies the person in charge of the work and the responsibilities of all other staff. In addition, he shall have a system of work which provides an adequate system of communication for controlling the activities.

Documentary evidence shall be available confirming the Competent Person(s) in receipt of Safety Document(s) for this work has been trained, assessed and authorised to the relevant sections of this NSI.
### Guidance

**NSI 4**  
Section 7  
1.2.1 Cont.

The installation, removal or replacement of optical cable using the wrap technique, will be carried out under a minimum of a **Limited Access Certificate**.

---

### 1.3 Communications and Control

#### 1.3.1

An effective and efficient communications system shall be in place prior to any work associated with these procedures.

---

### Guidance

**NSI 4**  
Section 7  
1.3.1

The **Competent Person** shall be responsible for ensuring that communication is established between the site and the **Control Person (Operation)** using an effective communication channel.

Before the actual installation work is commenced, the site **Personnel** carrying out the work shall explain to the satisfaction of the **Competent Person** the method of communication, signalling and control that will be adopted. This communication system shall be checked each day before the start of work and immediately prior to the **wrapping operation**. Work shall be stopped immediately if the communication system is found to be defective.

---

### 1.4 Emergency Procedures

#### 1.4.1

In the event of an unplanned action whereby the earthwire or any other equipment or material comes, or could potentially come, within **Safety Distance** of a **Live** circuit, the **Competent Person** shall immediately arrange for the **Live** circuit to be switched out in order to recover the situation.

#### 1.4.2

The **Senior Authorised Person** shall have an emergency plan which caters for the interface with all other Utilities, Emergency Services and the **Control Person (Operation)**.

---

### Guidance

**NSI 4**  
Section 7  
1.4.1

At the planning stage, ENCC shall consider emergency outages in the possible fault risk category. Following emergency circuit switch out, system security standards may not be met and therefore ENCC shall implement any planned action to restore security standards.

Each day before work commences, the **Competent Person** shall request the **Control Person (Operation)** to switch out the Delayed Auto Reclose (DAR) on the single or both **Live** circuits.

At the end of each day's work, the **Competent Person** will request the restoration of the DAR on the single or both circuits. This will be carried out and recorded on the Daily Checklist Forms found in Section 10.

In the event of either circuit tripping during the work, the **Control Person (Operation)** shall not initiate the re-closure.
Where a circuit has been subject to a fault, the integrity of Earthing Devices cannot be guaranteed. Therefore, following a fault on an adjacent circuit, all Earthing Devices shall be inspected before further work is carried out.

1.4.2 The Personnel carrying out the work shall have a written emergency plan available on site to instruct all staff in the actions to be taken shall the Earthwire or any other equipment or material come within Safety Distance of the Live circuit. The plan shall include the following:

All Personnel shall be withdrawn immediately to a distance greater than Safety Distance from the unsecured item.

The immediate area shall be secured to prevent access.

The Competent Person shall be informed.

Shall approved procedures fail advice shall be sought from the Senior Authorised Person.
2 Additional Requirements for Installation of Fibre Optic Wrap on Earthwires

This section deals with the Safety from the System requirements specifically for the installation of Fibre Optic Wrap cable on Earthwires, with both circuits Live, on 275 kV and 400 kV double circuit, lattice tower construction, overhead lines designed pre-1991. Overhead Lines of L3 design, Tee-off towers, junction and terminal towers, large angle towers above D30, high river crossings, towers of special construction and future designs may need special consideration and additional documented procedures. Checklists for Key Activities are in Section 10.

2.1 Safety Requirements for Optical Cable Installation Wrap-On Technique

2.1.1 Earthwire sag and span lengths shall be verified prior to installing the Optical Cable.

2.1.2 Ensure that the design capability of the wrapping equipment, Optical Cable and Earthwire will not be exceeded.

2.1.3 Prior to wrapping optical cable over roads, motorways, railways, navigable waterways or power lines, the Senior Authorised Person shall satisfy himself that all necessary agreements have been obtained and that the Competent Person is aware of all such agreements.

2.1.4 Ensure that the Delayed Auto Re-close (DAR) is switched out on both Live Circuits before work commences.

2.1.5 Verify retrieval system for tug(s).

2.1.1 The OHL Delivery Engineer shall ensure that the sag of the Earthwire, relative to the top phase conductors, is visually checked. The span lengths of the Earthwire shall be checked for compliance to records and design limits to ensure that accurate information can be supplied to the manufacturer of the cable. The results of this survey shall be documented and passed to the potential Contractors.

2.1.2 The following constraints shall be considered prior to the installation of wrap-on Optical Cable:

- The maximum incline of the earthwire likely to be encountered in relation to the maximum working angle of the tug and wrapping machine.
- The pulling of the tug not to be greater than 50% of the Ultimate Tensile Strength (UTS) of the optical cable.
- Under no circumstances shall the maximum tension in the earthwire exceed 45% of its UTS. The combined weight of the tug, spinning machine (complete with optical cable) and recovery tug and ancillary equipment shall not exceed the maximum loads, related to conductor temperature
- To safeguard against the optical cable detaching from a
cassette in mid-span, from the use of a cassette containing insufficient cable, the Contractor’s Project Quality Plan shall ensure cassettes are checked for cable length and identified to the appropriate Spinning Towers and direction of wrap.

- Procedures used for rigging of Spinning Towers, Splice Towers and transfer at Intermediate Towers will be supplied by the wrapping machine manufactures.

2.1.4 Each day before work commences, the Competent Person shall request the Control Person (Operation) to switch out the Delayed Auto Reclose (DAR) on both Live circuits.

At the end of each day’s work, the Competent Person will request the restoration of the DAR on both circuits. This will be carried out and recorded on the Daily Checklist.

In the event of either circuit tripping during the work, the Control Person (Operation) shall not initiate the re-closure of the circuit until he has obtained the agreement of the Competent Person on site.

2.1.5 The Contractor shall have demonstrated to the satisfaction of NG and have agreement for his proposed method of retrieving a failed tug and / or wrapping machine.

The retrieval equipment shall be readily available for use.

Shall a tug and / or wrapping machine fail, the Competent Person shall be informed.

Shall remote retrieval methods fail, then the Senior Authorised Person shall be informed and other action considered which may include a retrieval method involving circuit outage(s).

2.2 Basic Requirements to Safeguard Personnel

2.2.1 The integrity of the tower peak to Earthwire Bonding shall be verified before commencing work on the Earthwire.

2.2.2 Ensure that Safety from the System and the elimination / minimisation of the effects of induced Voltages are maintained at all times. Apply Short Drain Earth(s) to the Earthwire of every tower in the section to be worked on.

2.2.3 All equipment and materials shall be raised to the earthwire under controlled conditions so that under no circumstances can Safety Distance be infringed.

2.2.2 During the installation of the optical cable, using binoculars if necessary, the passage of the tug and wrapping machine shall be continuously monitored by trained staff in communication with the tug operator.

Capacitive induced voltages may cause discomfort to staff – adequate means of minimising such discomfort shall be provided for all Personnel involved in this work.
## Guidance

### NSI 4

#### Section 7

#### 2.2.3

All ropes used externally to the tower shall be in clean and dry condition and be inspected immediately prior to each separate application. The **Senior Authorised Person** will designate the climbing leg having due regard to Safety Distance and wind direction.

Raising or lowering any equipment or materials external to the tower shall be undertaken by following M1 Manual Procedure **EW-2**.

The method of working shall ensure that in the event of a failure of the lifting equipment, the **Safety Distance** is not infringed.

### NSI 4

#### Section 7

#### 2.3 Weather Conditions

#### 2.3.1

Prior to wrap-on Optical Cable installation, the **Competent Person** shall contact the appropriate local weather centre to ascertain the forecast on wind speed and precipitation and the NOC Response Management for lightning risk.

#### 2.3.2

In the event of, or near approach of, a lightning storm, all work on the earthwire shall cease.

#### 2.3.3

Work shall also be discontinued if fog or poor visibility prevents observers from fulfilling their role.

### Guidance

#### NSI 4

#### Section 7

#### 2.3.1 to 2.3.2

The NOC Response Management team shall inform the **Competent Person** of any change in lightning risk that has reached level 1 severity or other weather conditions which could adversely affect the work.

#### 2.3.2

The **Control Person (Operation)** may request that the DAR be restored on both **Live** circuits for the duration of the storm or until such time as it is agreed work can resume. As a minimum, **Personnel** shall also keep 10 m away from the overhead line and connected equipment.
SECTION 8
ADDITIONAL GUIDANCE

1 Use of Mobile Elevated Platforms (MEWPs) and Working Platforms suspended from Cranes.

2 Equipotential Zone Environments for all Overhead Line Works

3 Tree Cutting within Safety Distance but no Nearer than 1 Metre from the Overhead Line Conductor(s)

4 Cross-Jumpering

5 OHL Primary Earth andDisconnected circuits
1 USE OF MEWPs

Guidance on the Deployment and Use of Mobile Elevated Platforms (MEWPs) and Working Platforms suspended from Cranes.

1 Scope

The purpose of this appendix is to set out the fundamental requirements for the use of MEWPs and Man Riding Cages suspended from Mobile Cranes for access to conductors insulators and fittings of Isolated circuits and Earthwires.

2 Definitions

<table>
<thead>
<tr>
<th>Title</th>
<th>Definition</th>
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<tbody>
<tr>
<td>Operator</td>
<td>An individual, who has been trained, assessed and authorised to use specific types of MEWP’s or Cranes.</td>
</tr>
<tr>
<td>Appointed Person</td>
<td>An individual, who has been trained, assessed and authorised to establish and implement the safe system of work for lifting operations in accordance with BS 7121, Safe use of Cranes.</td>
</tr>
<tr>
<td>Working Platform Applied Earth</td>
<td>Type Registered Earth specifically designed for use on MEWP platforms or working platforms suspended from a Crane. It will have an automatic or quick release mechanism to disconnect from a conductor under a sudden, unplanned movement of the cage.</td>
</tr>
</tbody>
</table>

3 General Requirements

3.1 No MEWP or Crane shall be operated over an adjacent Live Circuit to gain access to the work area.

3.2 A Senior Authorised Person shall ensure that a survey of the site detailing the positioning of the MEWP or Crane is carried out. This shall also be detailed in the RAMS for the work.

3.3 A Senior Authorised Person shall assess the risks from System derived hazards and prepare a written risk assessment and method statement for the work. This may include;

- The requirement for proximity outages on adjacent circuits or other utilities’ circuits
- The potential to infringe Safety Distance if the MEWP or Crane controls malfunction – the use of movement limiting devices fitted to the MEWP or Crane may be considered when addressing this issue

The risk assessment shall also include evidence that that consideration has been given to using the correct size MEWP or Crane.
3.4 Where an Appointed Person is required to be present on site or to provide input to the operations then this Appointed Person shall provide an additional risk assessment which will be reviewed by the Senior Authorised Person.

3.5 For work being carried out under CDM Regulations, the Principal Contractor shall ensure that a risk assessment is carried out and method statement produced. These documents shall be reviewed by the Senior Authorised Person to ensure Safety from the System.

3.6 Adequate and effective communications between ground crew, MEWP / Crane operators, and personnel working in the cage shall be established prior to commencement of any operations.

3.7 A weather forecast for the day(s) that the MEWP or Crane will be operating shall be obtained to give predicted wind speeds. The wind speed will also be monitored on site and shall it exceed 12.5 m per second (30 mph) all work shall stop and the MEWP or Crane manoeuvred into a safe position.

3.8 The working platforms of all MEWPs supplied to National Grid shall be bonded down the length of the boom to the MEWP chassis.

3.9 MEWPs or Cranes shall be bonded from the chassis to the substation earth system or nearest tower where possible. However if the MEWP or Crane is too far away to use either of these methods a Type Registered earthing spike shall be used.

3.10 If operating a MEWP at ground level, the operator shall be standing on an Equipotential Plate bonded to the chassis of the MEWP. This will not be necessary if the operator is on the MEWP chassis at all times during the operation of the boom.

4 Work at a tower (tension or suspension)

4.1 Work at tension or suspension towers; e.g. jumper repairs / replacement, cross-jumpering, fittings repair / replacement etc.

4.2 Drain Earths will be fitted to the tower to be worked on and, if necessary, towers either side, depending on the work to be carried out in accordance with the relevant earthing scheme(s).

4.3 The C(PIC) shall ensure that the MEWP or Crane is sited in the position identified from the survey prior to commencement of the works. At this stage the MEWP or Crane shall be Earthed via a Field Equipment Earth, either to the tower steelwork or a Type Registered earthing spike.

4.4 Demarcation will then be erected around the MEWP or Crane to ensure no personnel can enter the working area during operations. A defined access / egress point shall be established to this demarcated area.

4.5 Personnel can now be raised to the point of work via the MEWP or Crane as appropriate.

4.6 Work may now proceed.

5 Mid-span working

5.1 Mid-span working; e.g. conductor repairs, cross-jumpering, spacer replacement mid-span joint repairs / replacement and removal of foreign objects from conductor(s)
5.2 **Drain Earths** will be fitted to towers either side of the span to be worked in, in accordance with the relevant earthing scheme(s).

5.3 The **Competent Person** in charge of the work shall ensure that the MEWP or Crane is sited in the position identified from the survey prior to commencement of the works. At this stage the MEWP or Crane shall be **Earthed** via a Field Equipment Earth to a Type Registered earthing spike.

5.4 On approach to the point of work the earth end of a Working Platform Applied Earth will be fixed to an appropriate point on the working platform. The conductor end will then be applied to the conductor being worked on using a Type Registered 600mm earthing pole.

Note: One Working Platform Applied Earth shall be applied to every sub-conductor on bundled conductor configurations. 
**Safety Note:** The Working Platform Applied Earth shall not be used as a primary means of discharging induced currents or voltages. Its role is to provide an equipotential environment and remove the likelihood of micro-shocks for personnel when working from the working platform.

5.5 Work may now proceed, however if it is necessary during the course of the work to move the working platform to a position where the Working Platform Applied Earth requires re-positioning then this shall be carried out as follows;

- Ensure that the Working Platform is not in contact with the conductor(s)
- Remove the conductor end of the Working Platform Applied Earth using a Type Registered 600mm earthing pole
- Move the Working Platform to the new working position
- Re-apply the Working Platform Applied Earth using a Type Registered 600mm earthing pole
- Work may now continue

6 **Work on Downleads and Down Droppers**

6.1 Work on Downleads and Down Droppers; e.g. Repairs / replacement of Downleads and down Droppers, removal of Downleads or Down Droppers for temporary **Isolation**.

6.2 **Drain Earths** will be fitted either to the terminal tower, Downleads, Downdroppers or substation gantry, in accordance with the relevant earthing scheme(s).

6.3 The **Competent Person** in charge of the work shall ensure that the MEWP or Crane is sited in the position identified from the survey prior to commencement of the works. At this stage the MEWP or Crane shall be **Earthed** via a Field Equipment Earth, either to the terminal tower steelwork, a Type Approved earthing spike or, if sited in the substation, to a substation earth tape.

Note: If the MEWP or Crane is sited within the substation then the requirements of NSI 6 and 8 will apply.

6.4 Work may now proceed.
7 Work on Earthwires

7.1 Work on Earthwires; e.g. mid-span joint repairs / replacement, repairs / recovery of Fibre Optic wrap and removal of foreign objects from conductor(s)

7.2 An outage will be required on the circuit(s) that the jib of the MEWP or Crane will traverse when giving access to the Earthwire.

7.3 An assessment shall be carried out by a Senior Authorised Person to determine the Drain Earthing requirements on the circuit(s) that is Isolated in addition to the Earthwire, to carry out the work.

7.4 The C(PIC) shall ensure that the MEWP or Crane is sited in the position identified from the survey prior to commencement of the works. At this stage the MEWP or Crane shall be Earthed via a Field Equipment Earth, either to the tower steelwork or a Type Approved earthing spike.

7.5 Work may now commence at this stage and personnel raised to the point of work via the MEWP or Crane as appropriate.

Safety Note: At this stage the Operator shall ensure that the working platform does not come into contact with the Earthwire before a Working Platform Applied Earth is applied and that the jib or boom of the MEWP or Crane does not come into contact with the phase conductors.

7.6 On approach to the point of work the earth end of a Working Platform Applied Earth will be fixed to an appropriate point on the working platform. The conductor end will then be applied to the Earthwire using a Type Registered 600mm earthing pole.

Safety Note: The Working Platform Applied Earth shall not be used as a primary means of discharging induced currents or voltages. Its role is to provide an Equipotential environment and remove the likelihood of micro-shocks for personnel when working from the Working Platform.

7.7 Work may now proceed, however if it is necessary during the course of the work to move the Working Platform to a position where the Working Platform Applied Earth requires re-positioning, then this shall be carried out as follows;

- Ensure that the Working Platform is not in contact with the Earthwire
- Remove the conductor end of the Working Platform Applied Earth using a Type Registered 600mm earthing pole
- Move the Working Platform to the new working position
- Re-apply the Working Platform Applied Earth using a Type Registered 600mm earthing pole
- Work may now continue
2 EQUIPOTENTIAL ZONE ENVIRONMENTS FOR ALL OVERHEAD LINE WORKS

Requirements for Equipotential Environments

This guidance provides the requirements for the provision and maintenance of an Equipotential Zone Environment when Tension Stringing, raising or lowering Overhead Line Phase Conductors and Earthwire, Metallic Access Roads, Winching, raising or lowering long objects on the outside of a tower, use of Mobile Elevated Work Platforms (MEWPs) or Work Platforms suspended from cranes.

It is based on advice published in Technical Guidance Note TGN (T) 87, The Establishment of Equipotential Zones prior to Restringsing Overhead Line Conductors near Live circuits.

Basic Principles

Access to machines and equipment within Equipotential Environments by operators and Personnel shall be controlled.

Equipotential Environments are established to provide protection to Personnel from the effects of potential differences that may arise whilst carrying out various OHL maintenance or refurbishment activities.

An Equipotential Environment is an arrangement designed to ensure that, during fault conditions, dangerous potential differences do not appear across the body of Personnel working near ground-based machinery.

Items of equipment are placed on conducting metal footplates and all items are electrically bonded with Equipotential Zone Bonds to a common earthing bus welded to the footplate, or an Equipotential Plate bonded to an Earthed item of plant for the operator to stand on.

Establishing Equipotential Zones

1 Establish a “footplate” of sufficient size to accommodate all the equipment required at each location (e.g. at a single winch site this may be a single plate for the operator to stand on or at a more complicated tensioner / puller site several plates will be connected together).

Where an Equipotential Plate is installed, a conducting metallic footplate is electrically bonded with a Field Equipment Earth to the item of ground-based machinery which, in turn, is electrically bonded to earth with an Earth Spike and a Field Equipment Earth.

- This arrangement is used for conductor and earthwire winching operations specifically identified in Section 4, Schemes 4, 7 and 8 and when lifting long objects on the outside of a tower.
- The Equipotential Plate shall be positioned so that operators shall remain on the plate when operating the machinery.

When several pieces of equipment are in use, it is equally acceptable to use either one footplate for all of them or to use separate footplates. When separate footplates are used, each shall be treated as an entirely separate Equipotential Zone. Zones shall not be electrically bonded to each other and each zone shall be provided with its own earth spike.
An arrangement of conducting metallic panels will be laid out to form a larger footplate. Closely butted together, the panels shall be bonded by short Equipotential Zone Bonds or Aluminium strips (which shall be as short as practically possible with dimensions of no less than 35mm x 3mm) so that they form an electrically common footplate. Where interlocking type metallic panels are used there is no requirement for Equipotential Zone Bonds to be fitted between any panels that are positively interlocked together.

Each Equipotential Zone shall have just one common earthing bus which shall be permanently welded to a colour-coded, dedicated master panel.

All items of equipment shall be bonded to the Earthing Bus

Each Earthing Bus shall be connected to an earthing spike with an Equipotential Zone Bond.

Physical protection, in the form of a substantial cover shall be provided for the earthing bus, or the earthing bus shall be countersunk into the master panel to prevent damage by vehicles etc

Only Type Registered Running Earths shall be connected to the earthing bus.

A Running Earth shall be applied to each sub-conductor between the machine and the drum

Equipotential Zone Bonds shall be bolted to the plates and earthing bus. To achieve a low resistance connection, surfaces shall be cleaned and, where they are aluminium, scratch-brushed. The bolts shall be tightened with a torque spanner (setting 50 Nm) with an adequately sized washer under the nut.

The master panel and the earthing bus shall be positioned as close to the main items of equipment as is practicable, so as to minimise the lengths of the Equipotential Zone Bonds.

The Earthing Spike shall be positioned on the side of the machine remote from the controls as a precaution in the unlikely event of the spike being ejected under fault conditions. The Earthing Bus shall not be connected to tower steelwork if the Equipotential Zone is greater than 10m away from the tower leg

Operators and other site Personnel shall understand the restrictions for access and egress onto the Equipotential Plate.

Personnel shall be trained in establishing, maintaining and operating Equipotential Zones. An Equipotential Zone Check List form shall be filled out for each Equipotential Zone that is set up.

When operating the equipment, operators shall remain on the footplate. Personnel not involved in operating the equipment shall not breach the Equipotential Zone. Personnel shall not stand on or otherwise touch the Equipotential Plate or the equipment.

Barriers shall be erected to control access to the Equipotential Zone. Inner barriers shall always be of solid construction but outer barriers can be of rope and cone / post or similar construction. Equipotential Zone access and egress points shall be clearly identified.

Access and egress to the Equipotential Zone shall only be allowed when conductors are stationary and caught-off.
Adequate provision for the establishment of vehicle access points using insulated panels shall be provided. These access points shall be clearly identified.
Layout for Equipotential Zone for Tension Stinging of Earthwire
Layout for Equipotential Zone for Tension Stinging of Phase Conductors
Section 8 (2).1 - Layout of Winch Earthing and Equipotential operator plate
3 Establishing Metallic Roads

Installation of Temporary Metallic Roads to Towers

3.1 Access and egress to Overhead Line sites, via conducting metallic roads, shall be set up to eliminate Rise of Earth Potential (ROEP) causing a Danger to Personnel entering and leaving the site.

Where a conducting metallic road is laid to a tower or and Equipotential Zone then, to prevent a Rise of Earth Potential appearing on the temporary roadway:-

- A 2 m separation gap shall be maintained between the roadway and any Equipotential Zone.
- If the roadway encroaches within 10m of the tower then a 2 m separation gap shall be maintained in the roadway at a point no more than 10 – 12 m from the tower.
- The gap may only be bridged by a vehicle in transit.

If the conditions above cannot be met, then a site specific risk assessment shall be undertaken.

Temporary roadway panels made from non metallic material present an insignificant risk from Rise of Earth Potential (ROEP) so are exempt from these requirements.

Guidance to complete the site specific risk assessment may be obtained from Electricity Network Investment.
Section 8 (2.2) - Work area within 10-11m of Tower

Work area Trackway panels to be bonded to the same standard as Equipotential Zones. They will also be bonded to the tower via a Sparrow Plate Connecting Bond. The tower may require scraping and / or wire brushing to provide a good electrical connection. Whilst conductors are being pulled, everyone must either be excluded from the work area or remain on it.
Section 8.2.3 - Work area spreading across the 10-12m radius away from the Tower

Work area Trackway panels to be bonded to the same standard as Equipotential Zones. They will also be bonded to the tower via a Sparrow Plate Connecting Bond. The tower may require scraping and/or wire brushing to provide a good electrical connection. Whilst conductors are being pulled, everyone must either be excluded from the work area or remain on it.
Section 8 (2).4 - Trackway passing through tower area

Trackway panels inside 10-12 m radius to be bonded to the same standard as Equipotential Zones. They will also be bonded to the tower via a Sparrow Plate Connecting Bond. The tower may require scraping and / or wire brushing to provide a good electrical connection. Whilst conductors are being pulled, everyone must either be excluded from the work area or remain on it.
3 TREE CUTTING WITHIN SAFETY DISTANCE BUT NO NEARER THAN 1 METRE FROM THE OVERHEAD LINE CONDUCTOR(S)

1. Scope

This guidance details the procedure for cutting trees that are at a distance of, or when cut could fall, between 1 metre and the appropriate Safety Distance plus Risk Margin from the Overhead Line Conductor. Under these circumstances, Danger from induced voltages does not arise and the application of Drain Earth(s) is not required.

With the circuit Isolated and Primary Earth(s) directly connected to the overhead line at the substation ends, the voltage on the phase conductors is at most 5000V. By providing a minimum distance of 1 metre to the conductor there is no risk of Injury to people. In comparison, the risk associated with the application of Drain Earth(s) has been demonstrated to be significantly higher. When work is as defined in this guidance, the application of this procedure reduces the risk to staff.

2. Procedure

2.1 Before the commencement of the work the Senior Authorised Person shall ensure a suitable and sufficient Risk Assessment (including Arboricultural risks) is undertaken and an appropriate Method Statement prepared.

2.2 Apply Primary Earth(s) to the Overhead Line.

Primary Earth(s) shall be applied directly to the overhead line conductors at all circuit ends via the normal substation line earthing arrangements.

These Primary Earth(s) shall be quoted as the Primary Earth(s) on the Safety Document.

The overhead line shall remain connected to the Primary Earth(s) at all times.

2.3 Issue a Safety Document on site.

The Senior Authorised Person shall issue the Safety Document on site and identify the trees to be felled.

He shall either mark every tree to be cut or mark the area where the trees are to be cut if Personal Supervision is not given to the felling.

2.4 The Senior Authorised Person shall identify the Isolated circuit to the Competent Person responsible for cutting the trees.

One of the following methods may be used to identify the Isolated circuit:

- If the tower is visible from the point of work, make a positive identification with the naked eye or optical instrument of the colour plate on one of the adjacent towers.

- Identify the circuit at the tower (if the circuit identification plates have faded a flag stick may be used) and then walk under the line to the point of work.

- If it is not possible to walk from one of the towers to the point of work but the top of the tower is visible, order the fitting of red pennants on the Live side top crossarm. If the Live side is not visible, order the fitting of green flags on the Isolated side top crossarm.
• In extreme circumstances, where none of the above can be carried out, using a detailed map clearly showing the isolated side of the line, make a positive identification on site of the correct side by the use of basic tools such as a compass or land marks.

• If a positive identification cannot be made then a Double Circuit outage shall be arranged before any work is carried out.

2.5 All site Personnel shall be briefed and fully understand the extent of the work.

The Competent Person who has received the Safety Document shall ensure that:

• All members of the Working Party are fully briefed on all aspects of the work, hazards and their roles.

• The Working Party Register is completed.

• He and the Senior Authorised Person are in full agreement concerning the trees that can be cut.

• The clearance between the overhead line and the tree(s) is no less than that specified in the Method Statement.

• During the course of the work the clearances specified in the Method Statement are maintained as a minimum.

Safety Warning: Shall, due to unforeseen circumstances, a tree make contact with the phase conductor(s) under which work is being carried out, the tree shall not be approached until the earthing requirements in NSI 4 have been fully complied with. A full Risk Assessment will be carried out by the Senior Authorised Person who will decide on the level of Drain Earthing required to continue the work. This may involve applying Drain Earths at the nearest tower to the tree or, if necessary, earthing towers in the span or spans concerned.

In the event, or the near approach of, a lightning storm, all work near the overhead lines shall cease immediately and staff are to withdraw a minimum of 10m away from the towers and any connected equipment.
4 CROSSJUMPERING

Cross-Jumpering

For Re-energisation of circuits in a double circuit formation at the Cross-Jumper position. Examples of the possible configurations are shown below.

Example 1 – Turn circuit through 180°, isolate 2 parallel circuits

Example 2 – Cross-over to adjacent circuit, isolate 1 section of circuit

Example 3 – Turn 1 double circuit into 1 single circuit.

Cross-Jumpering shall be carried out using Mobile Elevated Working Platform(s) as the preferred option (Section 8, 5A). If due to access difficulties this is not possible then the alternative Section 8, 5B using Forks Bars shall be used.
4A – MEWP Access

The Mobile Elevated Working Platform(s) shall be Earthed in accordance with Section 8, 1

4A.1 Apply Drain Earth(s) to the nearest tower either side in accordance with Section 4, 1 both circuits and all conductors.

4A.2 Prior to the application of Drain Earth(s) on the tension tower where the cross-jumpering will take place, fit sparrow plates, as necessary, to each crossarm.

If more than one sparrow plate is required on each crossarm, they shall be connected together using sparrow plate connecting bonds.

4A.3 The earth ends of all Drain Earth(s) and Bridging Earths shall be connected to the sparrow plates.

4A.4 At the tension tower to be worked on apply Drain Earth(s) to the jumpers to both circuits and all conductors.

4A.5 At the tower where the Cross-Jumpering will be carried out, apply Bridging Earths to all phases and all conductors on both circuits.

Fit all Earth ends of the Bridging Earths at each crossarm before applying the conductor ends.

A linesman can then traverse the tension insulator strings to a position where he can apply the conductor ends of the Bridging Earths using a Type Registered 600 mm operating pole. Note: To facilitate removal of the Bridging Earths on the side of the tower that will become energised, ensure that these earths are fitted such that the conductor end clamps can be removed using a Mobile Elevated Working Platform using a Type Registered 600 mm operating pole.

4A.6 Remove Drain Earth(s) from the jumpers of the tower where the Cross-Jumpering will be carried out, on both circuits and all phases.

The earth ends of these Drain Earth(s) shall remain attached to the crossarms and the earth leads coiled back and secured.

All jumpers can now be removed, labelled and moved to a secure location until required for reconnection.

Install Cross-Jumpers.

4A.7 Ensure phasing is correct for the cross-jumpers.

The preferred method is to connect the cross-jumpers using the original jumper “flags” on the conductor “Dead End” clamps. This will only be possible when phasing of both circuits is the same (i.e. top is, say, red on both circuits, middle – yellow both circuits and bottom – blue both circuits).

Where phasing is not the same on both circuits, a site specific assessment shall be made prior to the Cross-Jumpering operation to establish where existing jumper “flags” can be used and where alternative arrangements shall be made.

4A.8 Install Jumper Earthing kits to the conductors / phases that will remain Dead when the circuits are re-energised.
See Section 8, 6 for details of Jumper Earthing kit. These earths will become **Primary Earth(s)**.

4A.9 Remove conductor ends of the Bridging Earths on the conductors where the Jumper Earthing kits have been installed.

Remove using a Type Registered 600 mm operating pole. The earth ends of these **Drain Earth(s)** shall remain attached to the crossarms at this time and the earth leads coiled back and secured.

4A.10 Remove conductor ends of the Bridging Earths on the conductors to be energised.

This shall be carried out from Mobile Elevated Working Platform(s) using a Type Registered 600 mm operating pole. Each conductor end clamp shall be removed, the Bridging Earth taken back to the crossarm and then secured. This shall be repeated for all Bridging Earths.

Once all Bridging Earths have been disconnected at the conductor ends and coiled back all **Drain Earth(s)** can then be removed at this tower.

4A.11 Remove **Drain Earth(s)** from the towers either side of the tower where the Cross-Jumpering has been made.

The newly created circuit is now available for service

**Removal of Cross-Jumpers**

4A.12 Apply **Drain Earth(s)** to the nearest tower either side in accordance with Section 4, 1 to both circuits and all conductors.

4A.13 Prior to the application of **Drain Earth(s)** on the tension tower where the cross-jumpering will take place, fit sparrow plates, as necessary, to each crossarm.

If more than one sparrow plate is required on each crossarm, they shall be connected together using sparrow plate connecting bonds.

4A.14 At the tower where the Cross-Jumpering will be removed, apply Bridging Earths to all phases and all conductors on both circuits.

Fit all Earth ends of the Bridging Earths at each crossarm before applying the conductor ends.

On the side of the tower where the Jumper Earthing Kits are fitted, a linesman can then traverse the tension insulator strings to a position where he can apply the conductor ends of the Bridging Earths using a Type Registered 600 mm operating pole.

Using a Mobile Elevated Working Platform apply the remaining Bridging Earths using a Type Registered 600 mm operating pole.

4A.15 Remove Cross-Jumpers and Jumper Earthing Kits.

4A.16 Re-fit original jumpers and apply **Drain Earth(s)** to these jumpers.

4A.17 Remove all Bridging Earths.

Remove using a Type Registered 600 mm operating pole. The earth ends of these **Drain Earth(s)** shall remain attached to the crossarms at this time and the earth leads coiled back and secured.
4A.18 Remove **Drain Earth(s)** from the jumpers.

All **Drain Earth(s)** can now be removed from this tower.

4A.19 Remove the remaining **Drain Earth(s)** from the towers either side.

**4B - Non-MEWP access using a ‘Forks Bar’**

**Definition**

Forks Bar – A modified line end arcing horn that allows the fitting of **Drain Earth(s)** to it using an approved operating pole.

4B.1 Apply **Drain Earth(s)** to the nearest tower either side in accordance with Section 4 Scheme 1 to both circuits and all conductors.

4B.2 Prior to the application of **Drain Earth(s)** on the tension tower where the cross-jumpering will take place, fit sparrow plates, as necessary, to each crossarm.

If more than one sparrow plate is required on each crossarm, they shall be connected together using sparrow plate connecting bonds.

4B.3 At the tension tower where the cross-jumpering will be carried out on apply **Drain Earths(s)** to the jumpers to both circuits and all conductors.

4B.4 At the tower where the cross-jumpering will be carried out, apply Bridging Earths to both circuits, and all conductors on both the side that is to remain **Dead** and the side that is having the cross-jumpers fitted to. On the side that is having the cross-jumpers fitted, fit one additional Bridging Earth on both circuits and all phases to allow fitting to the Forks Bar.

Fit all Earth ends of the Bridging Earths at each crossarm before applying the conductor ends.

A linesman can then traverse the tension insulator strings to a position where he can apply the conductor ends of the Bridging Earths using a Type Registered 600 mm operating pole.

4B.5 Remove the existing jumpers completely on both sides and all phases, these jumpers can now be removed, labelled and moved to a secure location until required for reconnection.

4B.6 Install Jumper Earthing kits to the conductors / phases that will remain **Dead** when the circuits are re-energised.

See Section 8, 6 for details of Jumper Earthing kit. These earths will become **Primary Earth(s)**.

4B.7 Remove conductor ends of the Bridging Earths from the conductors on the side with the Jumper Earthing kits fitted.

Remove using a Type Registered 600 mm operating pole. The earth ends of these **Drain Earth(s)** shall remain attached to the crossarms at this time and the earth leads coiled back and secured.
4B.8 On the side that is having the cross-jumpers fitted, replace the line end arcing horns with Forks Bars on both circuits and all phases. Then using a Type Registered 600 mm operating pole fit the addition Bridging Earth to the all the Forks Bars.

**Install cross-jumpers.**

4B.9 The preferred method is to connect the cross-jumpers using the original jumper “flags” on the conductor “Dead End” clamps. This will only be possible when phasing of both circuits is the same (i.e. top is, say, red on both circuits, middle – yellow both circuits and bottom – blue both circuits).

Where phasing is not the same on both circuits, a site specific assessment shall be made prior to the Cross-Jumpering operation to establish where existing jumper “flags” can be used and where alternative arrangements shall be made.

4B.10 Remove conductor ends of the Bridging Earths on the conductors where cross-jumpers are fitted, using a Type Registered 600 mm operating pole. The earth ends of these Drain Earth(s) shall remain attached to the crossarms at this time and the earth leads coiled back and secured.

4B.11 Remove the Bridging Earth from the Forks Bar using a Type Registered operating pole positioned on the cross arm or if this is not possible due to distance, from the insulator sets.

**Safety Warning** - this operation shall not be done using a 600mm operating pole.

4B.12 Once all Drain Earth(s) have been disconnected from all conductors they can then be removed at this tower.

4B.13 Remove Drain Earth(s) from the towers either side of the tower where the Cross-Jumpering has been made.

The newly created circuit is now available for service.

**Removal of Cross-Jumpers**

4B.14 Apply Drain Earth(s) to the nearest tower either side in accordance with Section 4, Scheme 1 to both circuits and all conductors.

4B.15 Prior to the application of Drain Earth(s) on the tension tower where the cross jumpering will take place, fit sparrow plates, as necessary, to each crossarm.

If more than one sparrow plate is required on each crossarm, they shall be connected together using sparrow plate connecting bonds.

4B.16 At the tower where the cross-jumpers have been installed, apply Bridging Earths to all phases on the side that has the Jumper Earthing kits installed.

Fit all Earth ends of the Bridging Earths at each crossarm before applying the conductor ends.

A linesman can then traverse the tension insulator strings to a position where he can fit the conductor ends of the Bridging Earths using a Type Registered 600 mm operating pole.

4B.17 On the side with the cross jumpers installed fit sufficient Bridging Earths for the conductors and the Forks Bar. Then using a Type Registered operating pole positioned on the cross arm or if this is not possible due to distance from the insulator sets fit one Bridging Earth to the Forks Bar.
**Safety Warning**- this operation shall not be done using a 600mm operating pole.

4B.18 A linesman can then traverse the tension insulator strings to a position where he can fit Bridging Earths to each sub conductor using a Type Registered 600 mm operating pole.

4B.19 Remove cross jumpers

4B.20 Remove Jumper Earthing kit.

4B.21 Re-fit the jumpers completely

4B.22 Apply **Drain Earth(s)** to the jumpers.

4B.23 Remove conductor ends of the Bridging Earths from the conductors and **Forks Bar**.

Remove using a Type Registered 600 mm operating pole. The earth ends of these **Drain Earth(s)** shall remain attached to the crossarms at this time and the earth leads coiled back and secured.

4B.24 Remove the Forks Bars and replace with normal arcing horns

4B.25 Remove the **Drain Earth(s)** from the jumpers. Once all **Drain Earth(s)** have been disconnected from all conductors they can then be removed at this tower

4B.26 Remove **Drain Earth(s)** from the towers either side of the tower where the Cross-Jumpers has been made.

The newly created circuit is now available for service
FIG. 1

Cross-Jumper to be in this Span

Earthing Position Before Removal of Jumpers

FIG. 2

Cross-Jumpers Fitted

Section 8 (9) - Cross-Jumping on Double Circuit Tension Towers
5 OHL PRIMARY EARTH(S) AND DISCONNECTED CIRCUITS

1 Scope

2 General Requirement for the application of OHL Primary Earth(s)

3 General Requirement for establishing OHL disconnections

4 Permanently Disconnected OHL Circuits

5 Sectionalised OHL Circuits

6 Field Guidance Options
   6.1 Option 1
   6.2 Option 2

Table 1 – Details of OHL Primary Earth Requirements

Table 2 – Number of Substation Applied DrESS Earths Required to Form an Overhead Line Primary Earth

Fig A – Details of Connecting Plate Assembly

Fig B – Photographs of a Typical Installation

Fig C – Details of Non-Conforming Plate

Fig D – Permanently Disconnected OHL Circuits

Fig E – Sectionalised OHL Circuits
1. **Scope**

The purpose of this appendix is to set out the fundamental requirements for the management of redundant OHL circuits disconnected from the System whilst remaining under the National Grid Safety Rules.

This appendix also provides guidance on best practices for temporary disconnection to sectionalise circuits and spans in order to facilitate the return to service of part of the circuit, including the application and removal of Earthing Devices for given tasks.

To simplify and provide a common understanding of the principles, this appendix provides guidance on the following topics:

- General Application of OHL Primary Earth(s)
- Permanently Disconnected OHL Circuits
- Sectionalised OHL Circuits

2. **General Requirement for the application of OHL Primary Earth(s)**

2.1 An OHL Primary Earth can be fitted either on an OHL tower or in a substation.

2.2 On an OHL tower, the OHL Primary Earth(s) shall consist of multiple overhead line Drain Earth(s) connected to all sub conductors of each phase and earthwire. These Drain Earth(s) shall be connected to Sparrow Plates which shall be bonded together. The total cross sectional area of the Drain Earth(s) used shall be sufficient to match the cross sectional area of the Earthing Device(s) applied to the circuit at the substation ends, as detailed in Table 1. This configuration is also adequate to manage circulating currents induced by adjacent Live circuits.

2.3 In a substation a Substation Applied DrESS shall be applied which shall consist of multiple overhead line Drain Earth(s) offering a connection between all sub conductors of each phase and the substation earth system. The total cross sectional area of the Drain Earth(s) used shall be sufficient to match the cross sectional area of the Earthing Device(s) applied to the circuit at the substation ends, as detailed in Table 2. This configuration is also adequate to manage circulating currents induced by adjacent Live circuits.

Information regarding the number of portable Earthing Device(s) required per phase at each substation can be found in Management Procedure - NSI2 Earthing High Voltage Equipment Appendix A - Substation Multiple Primary Earth Requirements.

2.4 The OHL Primary Earth shall have a National Grid Portable Primary Earth “No unauthorised interference” notice affixed to it to ensure it is readily identifiable as a Primary Earth.

3. **General requirements for establishing OHL disconnections.**

The requirement to carry out this type of modification to a circuit configuration is a specific and unique request, it is therefore fundamental at the design / planning stage, that dialogue takes place with the NOC and the Senior Authorised Person, to establish a programme to safely manage the full execution of the work, including restoration on completion of the work.

3.1 All disconnections shall be carried out under a Permit for Work. Primary Earth(s) shall be fitted as detailed in Management Procedure - NSI2 Earthing High Voltage Equipment on the line side of the Point(s) of Isolation.
When **Primary Earth(s)** are fitted, circulating currents flow in the **Dead** conductors. The management of the induced currents is detailed in the main body of this NSI. OHL **Primary Earth(s)** are so designed to be capable of safely discharging fault current due to any inadvertent energisation and have the capability to safely carry any induced currents.

3.2 When the application of an OHL **Primary Earth(s)** is required, the OHL **Senior Authorised Person** shall consult with an OHL Delivery Engineer and the NOC **Control Person (Safety)**, where required, to determine the safest system of work.

3.3 When an OHL **Safety Document** is cancelled, any **Earthing Devices** left applied to the OHL shall be declared by the OHL **Senior Authorised Person** to the NOC **Control Person (Safety)**. All confirmations will be done via a logged statement.

When a physical disconnection (i.e. by the removal of the jumpers at a tower) is used as a **Point(s) of Isolation**, consideration shall be given to the most appropriate method to lock and caution the disconnection to establish a **Point(s) of Isolation**.

For further guidance see the current edition of the National Grid Electricity Transmission Safety Rules.

4 Permanently Disconnected OHL Circuits

4.1 Scope

When an OHL circuit becomes redundant but is to remain under National Grid Safety Rules, it is often permanently disconnected from its associated HV Substations and fixed **Primary Earth**.

In the case of a Permanently Disconnected OHL Circuit, there are usually no physical **Point(s) of Isolation** as the circuit contains no source of in feed and as such is classified as a “no System connection”.

However there is a requirement to maintain and repair conductors and insulators. In order to meet the requirements of the Safety Rules permanently disconnected sections shall have a **Primary Earth(s)** applied at each end.

Once an OHL circuit has been permanently disconnected in this manner, it shall be classified as a Permanently Disconnected OHL circuit. (See FIG E for an example of a Permanently Disconnected OHL Circuit).

4.2 When a circuit is classified as a Permanently Disconnected OHL circuit, the circuit shall be fitted with a permanent connection between the terminal joints at the line end and the tower steelwork, of a design assessed to be suitable to act as a **Primary Earth(s)** in accordance with Management Procedure - NSI 2 Earthing **High Voltage Equipment**. The connection arrangement used in this appendix has been assessed in accordance with National Grid’s Type Registration policy and fulfils the General Requirements of a **Primary Earth(s)** as defined in Management Procedure - NSI 2 Earthing **High Voltage Equipment**. This connection shall be defined as a Disconnected Circuit **Primary Earth(s)** and is shown in FIG A.

4.3 Application of a Disconnected Circuit **Primary Earth(s)**

This earth shall be fitted under a **Permit for Work**, during the course of the work to establish the permanent disconnection.

On completion of the work the OHL **Senior Authorised Person** shall declare on the **Permit for Work** to the NOC **Control Person (Safety)** that the disconnection has been established and the Permanently Disconnected Circuit Earth fitted, detailing the fixing point.

The NOC **Control Person (Safety)** shall duly log this earth on the IEMS System.
4.4 Further guidance

An OHL Disconnected Circuit Primary Earth(s) can only be applied / removed under a Permit for Work.

The tower (earth end) connection plates can be ordered via National Stores at Didcot under commodity code number 43/24/424. This commodity code covers the plate assembly as shown in FIG A, extra straight jumper terminal joints of the correct conductor size will also need to be ordered. It shall be noted that the cross plate attached to the crossarm shall be secured with a minimum of one bolt and one Lindapter assembly, however two bolts are the preferred method of attachment.

Towers with the Disconnected Circuit Primary Earth(s) installed shall have a Disconnected Circuit Notice attached at the relevant climbing leg. The plate shall be in accordance with FIG D.

The Permanently Disconnected OHL Circuit shall be clearly indicated on all relevant Operational Diagrams and Route Drawings and OHL Technical Data sheets.

FIG C shows photographs for reference purposes of an installation completed on an L2 terminal tower at Bradwell.

5 Sectionalised OHL Circuits

5.1 Scope

The requirement to sectionalise an OHL circuit could be to provide a temporary disconnection from one of the connected legs on a three ended circuit enabling part of the circuit to be returned to operational service (see FIG F for an example).

It is a requirement that in order to work on the newly formed disconnected section of the sectionalised circuit, the disconnection used to establish the Point(s) of Isolation shall be of adequate physical separation and suitable as a Point(s) of Isolation.

Only when the newly formed Point(s) of Isolation is established, shall the remaining part of the Sectionalised OHL circuit be returned to service.

5.2 If the disconnected section of the Sectionalised OHL circuit is to be worked upon, then OHL Primary Earth(s) shall be applied to both ends of this remaining Dead section of line, thus enabling a Safety Document to be issued while the remaining part of the circuit is returned to service.

6. Field Guidance Options

When OHL Primary Earth(s) are required on any OHL circuit, one of the subsequent field guidance options may be adopted.

6.1 Option 1

A Permit for Work is taken out to establish a disconnection on an OHL circuit. As part of the work, a DrESS suitably rated as an OHL Primary Earth shall be applied on the line side of the disconnection. (The earthing requirements are listed in Table 1 and Table 2).

On completion, the Permit for Work shall be cancelled with the DrESS quoted in the Clearance Section of the PFW as being suitably rated to be used as an OHL Primary Earth(s) quoted as an exception to the NOC.

A Permit for Work can then be issued on the circuit to carry out further work, quoting the declared OHL Primary Earth(s).
6.2 **Option 2**

If the OHL **Primary Earth(s)** is to be used for longer than 12 weeks then an alternative method is to use a Disconnected Circuit **Primary Earth(s)**, which may be installed on any OHL circuit as part of the work to be done under a **Permit for Work**.
### TABLE 1  DETAIL OF OVERHEAD LINE PRIMARY EARTH REQUIREMENTS FOR 275 kV AND 400 kV CIRCUITS (1 second rating)

<table>
<thead>
<tr>
<th>No. of Substation PPE’s applied per phase on line end equipment</th>
<th>No. of Conductor Configuration</th>
<th>No. of Drain Earth(s) per Phase</th>
<th>No. of Drain Earth(s) per Sub Conductor</th>
<th>No. of Sparrow Plates per Phase</th>
<th>No. of Sparrow Plate Connecting Bonds</th>
<th>No. of 50mm Earthwire Earths Req.</th>
<th>No. of Earthwire Sparrow Plates Required</th>
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<tbody>
<tr>
<td>2</td>
<td>Single</td>
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<td>6</td>
<td>2</td>
<td>2</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Twin</td>
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<td>3</td>
<td></td>
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<td></td>
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<td></td>
<td>Triple</td>
<td>6</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
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<td></td>
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<td>2</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Twin</td>
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<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
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<td>8</td>
<td>2</td>
<td></td>
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</table>

**Note:** Wherever possible each Sparrow Plate shall have an equal number of **Drain Earths** attached.
### TABLE 2  NUMBER OF SUBSTATION APPLIED DRESS EARTHS REQUIRED TO FORM AN OHL PRIMARY EARTH

<table>
<thead>
<tr>
<th>No. of Substation PPE’s applied per phase on line end equipment</th>
<th>Conductor Configuration</th>
<th>No. of Duplex (50mm$^2$) Drain earths per sub conductor</th>
<th>No. of 150mm$^2$ Drain Earths per sub conductor</th>
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</thead>
<tbody>
<tr>
<td>2</td>
<td>Single</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
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<tr>
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<td>2</td>
<td>1</td>
</tr>
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</table>

**Notes:**

i) A Substation Applied Dress is required to carry fault currents and manage circulating currents of up to 450A.

ii) The figures quoted in table 2 are per sub conductor.

iii) The ratings for the 150mm$^2$ and 50mm$^2$ Aluflex leads are as follows:

- **150mm$^2$**
  - Short Circuit – 25kA for 1 second
  - Continuous Current – 225A

- **Duplex**
  - Short Circuit – 8kA for 1 second
  - Continuous Current – 150A

iv) The figures in table 2 above for the 50mm$^2$ Aluflex leads relate to the number of line end clamps applied per sub conductor. It is acceptable to use a duplex pair as two separate earths.

* When duplex drain earths are used on triple conductor the remaining ‘extra’ line end clamp can be applied to any of the three sub conductors.
The conductor between the earth bond plate and the jumper connecting plate shall be a minimum of 400mm² (Zebra).
FIG B  PHOTOGRAPHS OF A TYPICAL INSTALLATION
FIG C  DETAIL OF NON CONFORMITY PLATE

NON STANDARD DESIGN

REFER TO A SENIOR AUTHORISED PERSON BEFORE WORKING ON THIS TOWER
### FIG D PERMANENTLY DISCONNECTED OHL CIRCUIT

**PERMANENTLY DISCONNECTED OHL CIRCUIT**

**NOTE:** THIS CIRCUIT HAS NO CONNECTION TO ANY SUBSTATIONS/INFEEDS, THUS EITHER END CAN BE STATED AS "NO SYSTEM CONNECTION".

**DISCONNECTED CIRCUIT PRIMARY EARTHS**

### FIG E SECTIONALISED OHL CIRCUIT

**SECTIONALISED OHL CIRCUIT**

*POI = POINT OF ISOLATION*

**KEY**

- **POI** = POINT OF ISOLATION
- **↓** = FIXED PRIMARY EARTH
- **=** = ISOLATING DEVICE
- **↓** = S/S BOUNDARY

A DISCONNECTION HAS BEEN MADE ON THIS TEED CCT, THUS CREATING A SECTIONALISED OHL CIRCUIT

THIS DISCONNECTION SHALL BE QUOTED AS A POINT OF ISOLATION (POI) FOR FUTURE USE.

THIS OHL PRIMARY EARTH MAYBE ONE OF THE FOLLOWING:
1) A SUITABLY RATED DRAIN EARTH THAT HAS BEEN CONVERTED TO A OHL PRIMARY EARTH.
2) A SUITABLY RATED PRIMARY EARTH FOR USE ON AN OHL CIRCUIT (i.e. A DISCONNECTED CCT PRIMARY EARTH)
SECTION 9
APPENDICES

A Overhead Line Tower Clearance Templates and Guidance
B Tower Demarcation Templates
### Tower Clearances

#### L2 Towers with 275kV Insulators

#### Notes

1. Measurements are in Metres
2. The measurements are from the tower body to the centre of the jumper bundle.
3. Clearances are based on the length of the insulation installed not the actual voltage of the circuit.
4. Care shall be taken when setting personnel to work on tower(s) with the same length insulation on each circuit but operating at different voltages.
5. The measurements are considered to be still air conditions
6. The measurements do not take into consideration the fitting of pilot sets or other devices to increase jumper clearances
7. These measurement’s shall be taken as indicative only and are generic of each tower type
8. The tower exactly bisects the angle of deviation between the back and front spans of the tower
9. The insulators on tension towers are horizontal
10. The D30 and D60 Towers are modelled with the minimum deviation and maximum deviation found for this tower type
11. This information is not to be used by third parties without permission from National Grid PLC

<table>
<thead>
<tr>
<th>Tower Type</th>
<th>Cross</th>
<th>Clearance Min</th>
<th>Clearance Mean</th>
<th>Clearance Max</th>
<th>Clearance Deviation</th>
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Tower Clearances
L2 Towers with 400kV Insulators

Notes

1. Measurements are in Metres

2. The measurement is from the tower body to the centre of the jumper bundle.

3. Clearances are based on the length of the Insulation installed not the actual voltage of the circuit.

4. Care shall be taken when setting personnel to work on tower(s) with the same length insulation on each circuit but operating at different voltages.

5. The measurement does not take into consideration Arcing Horns or jumper spacing

6. The measurements do not take into consideration the fitting of pilot sets or other devices to increase jumper clearances

7. These measurements shall be taken as indicative only and are generic of each tower type

8. These measurements shall be taken as indicative only and are generic of each tower type

9. The tower exactly bisects the angle of deviation between the back and front spans of the tower

10. The insulators on tension towers are horizontal

11. The D30 and D60 Towers are modelled with the minimum deviation and maximum deviation found for this tower type

12. This information is not to be used by third parties without permission from National Grid

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**Notes**

1. Measurements are in Metres
2. The measurement is from the tower body to the centre of the jumper bundle.
3. Clearances are based on the length of the insulation installed not the actual voltage of the circuit.
4. Care shall be taken when setting personnel to work on tower(s) with the same length insulation on each circuit but operating at different voltages.
5. The measurement does not take into consideration Arcing Horns or jumper spacing
6. The measurements are considered to be in still air conditions
7. The measurements do not take into consideration the fitting of pilot sets or other devices to increase jumper clearances
8. These measurements shall be taken as indicative only and are generic of each tower type
9. The tower exactly bisects the angle of deviation between the back and front spans of the tower
10. The insulators on tension towers are horizontal
11. This information is not to be used by third parties without permission from National Grid PLC
Tower Clearances
L6 Towers with 275kV Insulators

Notes

1. Measurements are in Metres
2. The measurement is from the tower body to the centre of the jumper bundle.
3. Clearances are based on the length of the insulation installed not the actual voltage of the circuit.
4. Care shall be taken when setting personnel to work on tower(s) with the same length insulation on each circuit but operating at different voltages.
5. The measurement does not take into consideration Arcing Horns or jumper spacing.
6. The measurements are considered to be in still air conditions.
7. The measurements do not take into consideration the fitting of pilot sets or other devices to increase jumper clearances.
8. These measurements shall be taken as indicative only and are generic of each tower type.
9. The tower exactly bisects the angle of deviation between the back and front spans of the tower.
10. The insulators on tension towers are horizontal.
11. The clearances given are the worst case scenario across the L6 family of towers of all manufacturers.
12. This information is not to be used by third parties without permission from National Grid plc.

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Notes

1. Measurements are in Metres
2. The measurement is from the tower body to the centre of the jumper bundle.

3. Clearances are based on the length of the Insulation installed not the actual voltage of the circuit.
4. Care shall be taken when setting personnel to work on tower(s) with the same length insulation on each circuit but operating at different voltages.
5. The measurement does not take into consideration Arcing Horns or jumper spacing
6. The measurements are considered to be in still air conditions
7. The measurements do not take into consideration the fitting of pilot sets or other devices to increase jumper clearances
8. These measurements shall be taken as indicative only and are generic of each tower type
9. The tower exactly bisects the angle of deviation between the back and front spans of the tower
10. The insulators on tension towers are horizontal
11. The clearances given are worst case scenario across the L6 family of towers of all manufacturers
12. This information is not to be used by third parties without permission from National Grid
**Tower Clearances**

**L8 Towers with 275kV Insulators**

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6. The measurements are considered to be in still air conditions.
7. The measurements do not take into consideration the fitting of pilot sets or other devices to increase jumper clearances.
8. These measurements shall be taken as indicative only and are generic of each tower type.
9. The tower exactly bisects the angle of deviation between the back and front spans of the tower.
10. The insulators on tension towers are horizontal.
11. This information is not to be used by third parties without permission from National Grid PLC.
**Tower Clearances**

**L8 Towers with 400kV Insulators**

**Notes**

1. Measurements are in Metres
2. The measurement is from the tower body to the centre of the jumper bundle.
3. Clearances are based on the length of the insulation installed not the actual voltage of the circuit.
4. Care shall be taken when setting personnel to work on tower(s) with the same length insulation on each circuit but operating at different voltages.
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9. The tower exactly bisects the angle of deviation between the back and front spans of the tower.
10. The insulators on tension towers are horizontal.
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<td></td>
<td>E 7.4</td>
<td>7.9</td>
<td>8.3</td>
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<td></td>
<td>F 4.7</td>
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<td>B 6.8</td>
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<td>C 4.1</td>
<td>3.6</td>
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<td></td>
<td>D 5.3</td>
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<td>E 7.8</td>
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<td>D40</td>
<td>A 4.3</td>
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<td>B 7.4</td>
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<td>C 3.7</td>
<td>3.0</td>
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<td>D 5.2</td>
<td>5.9</td>
<td>6.6</td>
<td></td>
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<td></td>
<td>E 8.4</td>
<td>9.1</td>
<td>9.8</td>
<td></td>
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<tr>
<td></td>
<td>F 4.7</td>
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<td>D45</td>
<td>A 4.7</td>
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<td></td>
<td>B 7.8</td>
<td>7.5</td>
<td>7.1</td>
<td></td>
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<tr>
<td></td>
<td>C 4.8</td>
<td>4.5</td>
<td>4.1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>D 5.1</td>
<td>5.4</td>
<td>5.7</td>
<td></td>
</tr>
<tr>
<td></td>
<td>E 4.6</td>
<td>4.9</td>
<td>5.3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>F 3.9</td>
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<td>D60</td>
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<td></td>
<td>B 6.1</td>
<td>5.4</td>
<td>4.7</td>
<td></td>
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<td></td>
<td>C 4.6</td>
<td>3.9</td>
<td>3.3</td>
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<td></td>
<td>D 5.0</td>
<td>5.7</td>
<td>6.3</td>
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<td>E 6.8</td>
<td>7.3</td>
<td>7.9</td>
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<tr>
<td>D90</td>
<td>A 5.2</td>
<td>4.5</td>
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<tr>
<td></td>
<td>B 9.4</td>
<td>8.8</td>
<td>8.2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>C 4.7</td>
<td>4.1</td>
<td>3.6</td>
<td></td>
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<tr>
<td></td>
<td>D 4.5</td>
<td>5.1</td>
<td>5.6</td>
<td></td>
</tr>
<tr>
<td></td>
<td>E 6.8</td>
<td>7.4</td>
<td>7.9</td>
<td></td>
</tr>
<tr>
<td></td>
<td>F 3.4</td>
<td>4.0</td>
<td>4.3</td>
<td></td>
</tr>
</tbody>
</table>
Appendix B
Tower Demarcation Template

<table>
<thead>
<tr>
<th>TOWER NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>
SECTION 10
FORMS

F1 Overhead Line Delivery Engineer’s Report

F2 DEC 1 Form – Application and removal of Drain Earth(s)

F3 DEC 2 Form – Site Earthing Register

F4 DEC 3 Form – Tower Earthing Final Inspection Record

F5 Equipotential Zone Checklist

F6 Not in Use

F7 Daily Check List for key activities during Continuous Tension Stringing of Earthwires under Single Circuit outage conditions on Double Circuit 275 / 400 kV Overhead Lines

F8 Daily Check List for key activities for additional Safety from the System requirements for Optical Cable Installation on the Earthwire of 275 / 400 kV Double Circuit Overhead Lines with both circuits Live - Wrap-on technique

F9 Daily Check List for key activities for additional Safety from the System requirements for Optical Earthwire Installation on 275 / 400 kV Double Circuit Overhead Lines with both circuits Live – CSS technique

F10 Daily Check List for key activities when Lowering Off, Raising or Pulling Conductors by Tension Stringing for 275 /400 kV Double Circuit Overhead Lines with Adjacent Circuit Live

F11 Planning Stage Check List of Key Activities for:
   • Optical Cable Installation on Earthwires – CSS Technique
   • Optical Cable Installation on Earthwires – Wrap-On Technique
   On Double Circuit 275 / 400 kV Overhead Lines with both Circuits Live

F12 Planning Stage Check List for Continuous Tension Stringing of Earthwires under Single Circuit outage conditions on Double Circuit 275 / 400 kV Overhead Lines
### F1 – OVERHEAD LINE DELIVERY ENGINEER’S REPORT

**REQUEST:**

To: 

From:         Date: 

Please provide an OHL Delivery Engineer’s Report for the following:

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Scope of Works:</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Reasons why NSI 4 cannot be applied to these works:</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Hazards identified throughout the course of the works:</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Agreed Method Statement:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Number:                                      Date:</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Date of works:</td>
<td></td>
</tr>
</tbody>
</table>

**REPORT:**

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Recommendations:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Continue on additional sheets if required</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>NSI 4 revision required?</td>
<td>Yes / No</td>
</tr>
<tr>
<td>3</td>
<td>Approval:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Name of OHL Delivery Engineer:</td>
<td>Signature</td>
</tr>
<tr>
<td></td>
<td>Name of NE Engineer</td>
<td>Signature</td>
</tr>
</tbody>
</table>
OVERHEAD LINE DELIVERY ENGINEER’S REPORT

Guidance Notes

To request an OHL Delivery Engineer’s Report, the F1 form will be completed by the Senior Authorised Person:

- At least 6 weeks before works are due to commence
- be supplied with an appropriate Method Statement
- when appropriate, be identified as a requirement in Health and Safety Plans
- If the work does not progress as expected or circumstances change such as additional work being required: then a new OHL Delivery Engineer’s Report will be required to manage the work.

The OHL Delivery Engineer’s Report will:

- be produced by the OHL Delivery Engineer, in collaboration with the Senior Authorised Person
- provide an overview of the electrical aspects of the work and explain principles, rather than merely reference to Schemes from NS1 4
- highlight any induced current related features that are non-standard or that may be easily overlooked
- suggest methods, including alternatives, for safely managing induced currents. These methods shall be clearly explained.
- be countersigned by an appropriate ENI Engineer. This ensures technical support is provided which is independent from MDE.
- be allocated a unique number by OHL Delivery Engineer preparing the report

Note: The Senior Authorised Person has the responsibility for the final earthing arrangements
F2 - Form DEC1 – Application and removal of Drain Earth(s)

<table>
<thead>
<tr>
<th>TOWER NUMBER</th>
<th>EARTHS APPLIED BY</th>
<th>DATE</th>
<th>EARTHS REMOVED BY</th>
<th>DATE</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
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</tbody>
</table>

Note: this column not to be completed if ANY earths remain on tower.
### F3 - Form DEC2 – Site Earthing Register

**TRANSFER INFORMATION TO SITE EARTHING LOG DAILY**

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</thead>
<tbody>
<tr>
<td>Name:</td>
<td></td>
</tr>
<tr>
<td>Circuit ID numbers/letters:</td>
<td></td>
</tr>
<tr>
<td>Circuit ID colours:</td>
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</table>

<table>
<thead>
<tr>
<th>TOWER NO</th>
<th>EARTHED</th>
<th>DE-EARTHED</th>
<th>COMMENTS</th>
<th>TOWER NO</th>
<th>EARTHED</th>
<th>DE-EARTHED</th>
<th>COMMENTS</th>
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</tbody>
</table>
F4 - Form DEC3 – Tower Earthing Final Inspection Record

Route: 
Name: 
Circuit ID numbers/letters: 
Circuit ID colours: 

<table>
<thead>
<tr>
<th>TOWER NUMBER</th>
<th>SPAN</th>
<th>Have ALL earths been removed and is the tower and span clear of ALL equipment?</th>
<th>DATE</th>
<th>NAME</th>
<th>SIGNATURE</th>
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**F5 - EQUIPOTENTIAL ZONE CHECK LIST**

<table>
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<tr>
<th>Route:</th>
<th>Circuit:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tower Number:</td>
<td>Section:</td>
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</tbody>
</table>

**Earthwire Tension Stringing / Optical Wire Catenary Support System (CSS)**

**Phase Wire Tension Stringing Top / Middle / Bottom Phase**

**Other Please Specify -**

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Equipotential Zone Bonds or Aluminium Straps connecting panels together</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Equipotential Zone Bonds from earthing bus to Equipotential Zone</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Running Earths connected to earthing bus</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Earth spike connected to Equipotential Zone</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Equipotential Zone Bonds from drums to earthing bus</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Equipotential Zone Bonds from machines to earthing bus</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Equipotential Zone Bonds from tower to Equipotential Zone (if appropriate)</td>
<td></td>
</tr>
</tbody>
</table>

**Security of fencing/Barriers**

**Check:**

<p>| | |</p>
<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Inner Barrier 0.5m away from edge of Equipotential Zone</td>
</tr>
<tr>
<td>2</td>
<td>Equipotential Zone isolated from other metallic Trackways by 2m (if appropriate)</td>
</tr>
<tr>
<td>3</td>
<td>Outer Barrier secured at least 2m away from Equipotential Zone</td>
</tr>
<tr>
<td>4</td>
<td>Access/Egress point clearly identified</td>
</tr>
</tbody>
</table>

I confirm that all Earth connections have been examined and found to be in serviceable condition and that all fences surrounding the Equipotential Zone are secure.

**Any additional precautions taken:**

..................................................................................................................................................
..................................................................................................................................................
..................................................................................................................................................
..................................................................................................................................................

**Competent Person in charge of work:**

Name: ........................................... Date: .....................

Signed: ........................................... Company: .............................................

*Delete as appropriate. N/A if Not Applicable
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### F 7 - Daily Check List of key activities for additional Safety from the System requirements during Continuous Tension Stringing of Earthwires under Single Circuit outage conditions on Double Circuit 275 / 400 kV Overhead Lines

<table>
<thead>
<tr>
<th>Route:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Tower Numbers:</td>
<td></td>
</tr>
<tr>
<td>Circuit Switched out Isolated and Earthed:</td>
<td></td>
</tr>
<tr>
<td>Circuit Identification:</td>
<td></td>
</tr>
<tr>
<td>Adjacent Live Circuit:</td>
<td></td>
</tr>
<tr>
<td>Circuit Identification:</td>
<td></td>
</tr>
<tr>
<td>Designated DAR Contact Name &amp; Contact No</td>
<td></td>
</tr>
</tbody>
</table>

**Daily Checks**

<table>
<thead>
<tr>
<th>Daily Checks</th>
<th>Date:</th>
<th>CP to Confirm Y/N</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Check that planning stage check sheet has been completed.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Confirm earthing in section and E/W Bonds on adjacent towers are correct</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Confirm all persons are on site, at suitable positions and understand their roles</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Confirm only work agreed by the Site Supervisor is being carried out in the section to be pulled or on the adjacent towers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Check position and earthing of Puller / Tensioner.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Confirm that Earthwire restraints are fitted as required.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Check local and long term weather:- Wind Speed - Wind Direction - Visibility - Precipitation -</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Check actual wind speed at 10 metres above ground level mph</td>
<td></td>
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<tr>
<td>9</td>
<td>N.B. Work shall not proceed if average hourly wind speed is 15mph or more.</td>
<td></td>
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<tr>
<td>10</td>
<td>Check local communication systems.</td>
<td></td>
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<tr>
<td>11</td>
<td>Contact the Control Person (Operation) for:- Communication link. Confirmation that the DAR has been switched out on adjacent circuit. Identification:- Confirm Lightning Risk.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Check puller/tensioner settings.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>The Senior Authorised Person has agreed that the preparations and methods of work for each section of the line are satisfactory.</td>
<td></td>
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</tr>
<tr>
<td>14</td>
<td>Monitor wind speed.</td>
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<tr>
<td>15</td>
<td>Earthwire sagged and landed in all sections.</td>
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<tr>
<td>16</td>
<td>Earthwire tails secured at tower.</td>
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<tr>
<td>17</td>
<td>Earthwire bonding complete.</td>
<td></td>
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</tr>
<tr>
<td>18</td>
<td>Inform the Control Person (Operation) that work has been completed / suspended and that the DAR can be restored.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>Confirm C(PIC) s of all working parties for this work have been informed of (18) above in accordance with Section 1, Guidance 4.10 and 10.1</td>
<td></td>
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</tr>
</tbody>
</table>

The Competent Person shall be present on site during the installation of the conductor with his attention dedicated to this task. His role is to satisfy himself that all appropriate measures are being taken to maintain Safety from the System. The Senior Authorised Person shall be readily contactable and available to deal with any emergencies.
**F 8 - Daily Check List of key activities for additional Safety from the System requirements for Optical Cable Installation on Earthwires of 275 / 400 kV Double Circuit Overhead Lines with both Circuits Live, wrap-on Technique.**

<table>
<thead>
<tr>
<th>Route:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Tower Numbers:</td>
<td></td>
</tr>
<tr>
<td>Circuit:</td>
<td>I.D:</td>
</tr>
<tr>
<td>Circuit:</td>
<td>I.D:</td>
</tr>
<tr>
<td>Designated DAR Contact Name &amp; Contact No</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Daily Checks</th>
<th>Date:</th>
<th>CP to Confirm</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Check that planning stage check sheet has been completed.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Confirm all persons are on site and have been assessed and appointed. They are deployed at suitable positions and understand their roles</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Check local and long term weather:-</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Wind Speed -</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Wind Direction -</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Visibility -</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Precipitation -</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Check local communication systems.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Contact the <strong>Control Person (Operation)</strong> for:-</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Communication link.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Confirmation that the DAR has been switched out on both circuits</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Confirm Lightning Risk.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Confirm C(PIC) s of all working parties for this work have been informed of (5) above in accordance with Section 1, Guidance 4.10 and 10.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Check actual wind speed at 10 metres above ground level mph</td>
<td>Y/N</td>
<td></td>
</tr>
<tr>
<td></td>
<td>N.B. Work shall not proceed if average hourly wind speed is 20 mph or more,</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Instruct operations to start.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Monitor wind speed throughout</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Inform the <strong>Control Person (Operation)</strong> that work has been completed / suspended and that the DAR can be restored on both circuits.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Confirm C(PIC) s of all working parties for this work have been informed of (10) above in accordance with Section 1, Guidance 4.10 and 10.1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The **Competent Person** shall be present on site during the installation of the conductor with his attention dedicated to this task. His role is to satisfy himself that all appropriate measures are being taken to maintain **Safety from the System**. The **Senior Authorised Person** shall be readily contactable and available to deal with any emergencies.
### Daily Check List of key activities for additional Safety from the System requirements for Optical Earthwire Installation on 275 / 400 kV Double Circuit Overhead Lines with both Circuits Live, CSS Technique.

**Route:**

**Tower Numbers:**

<table>
<thead>
<tr>
<th>Circuit</th>
<th>I.D:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Designated DAR</th>
<th>CONTACT</th>
<th>Name &amp; Contact No</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Daily Checks</th>
<th>Date:</th>
<th>CP to Confirm</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Check that planning stage check sheet has been completed.</td>
<td>Y/N</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Confirm all persons are on site and have been assessed and appointed. They are deployed at suitable Positions and understand their roles</td>
<td>Y/N</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Check local and long term weather:-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wind Speed</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wind Direction</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Visibility</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Precipitation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Jointing Certificates checked</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Confirm Earthwire restraints are fitted where necessary</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Check local communication systems.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Trained observers positioned in each span to observe Earthwire, ropes and Cradle Blocks</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Contact the <strong>Control Person (Operation)</strong> for: -</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Communication link.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Confirmation that the DAR has been switched out on both circuits</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Confirm Lightning Risk.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Confirm C(PIC)’s of all working parties for this work have been informed of (8) above in accordance with Section 1, Guidance 4.10 and 10.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Check puller / tensioner settings if necessary</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Check and monitor actual wind speed at 10 metres above ground level in mph. N.B. Maximum wind speed is 20 mph for deployment or retrieval of cradle blocks or maximum speed of 15 mph for raising / lowering equipment outside the body of the tower.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Instruct Cradle Block Team to start work</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Inform the <strong>Control Person (Operation)</strong> that work has been completed / suspended and that the DAR can be restored.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Confirm C(PIC)’s of all working parties for this work have been informed of (13) above in accordance with Section 1, Guidance 4.10 and 10.1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The **Competent Person** shall be present on site during the installation of the conductor with his attention dedicated to this task. His role is to satisfy himself that all appropriate measures are being taken to maintain **Safety from the System**. The **Senior Authorised Person** shall be readily contactable and available to deal with any emergencies.
### F10 - Daily Check List of key activities when Lowering Off, Raising or Pulling Conductors by Tension Stringing for 275 /400 kV Double Circuit Overhead Lines with Adjacent Circuit Live

| Route: |  |
| Tower Numbers: |  |
| Cct Switched, Isolated and Earthed: |  |
| Circuit Identification: |  |
| Adjacent Live Circuit: |  |
| Circuit Identification: |  |
| Designated DAR Contact Name & Contact No |  |

#### Daily Checks

<table>
<thead>
<tr>
<th>Daily Checks</th>
<th>Date:</th>
<th>CP to Confirm Y/N</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Check local and long term weather:-</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wind Speed -</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wind Direction -</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Visibility -</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Precipitation -</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 Confirm earthing in section and on adjacent towers is present and correct.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 Confirm all persons are on site, at suitable positions and understand their roles</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 Confirm only work agreed by the Site Supervisor is being carried out in the section to be pulled or on the adjacent towers</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 Check position and earthing of Puller / Tensioner / winch.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 Check local communication systems.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7 Check Puller / Tensioner/winch settings.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8 Contact <strong>Control Person (Operation)</strong> for:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Communication Link.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Confirmation that the DAR has been switched out on adjacent circuit.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Identification:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Confirm Lightning Risk.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9 Confirm C(PIC)s of all working parties for this work have been informed of (8) above in accordance with Section 1, Guidance 4.10 and 10.1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 Start operation.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11 Monitor Wind Speed.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12 Conductor secured at towers.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13 Inform the <strong>Control Person (Operation)</strong> that work has been completed / suspended and that the DAR can be restored.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14 Confirm C(PIC)s of all working parties for this work have been informed of (13) above in accordance with Section 1, Guidance 4.10 and 10.1</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The **Competent Person** shall be present on site during the installation of the conductor with his attention dedicated to this task. His role is to satisfy himself that all appropriate measures are being taken to maintain **Safety from the System**. The **Senior Authorised Person** shall be readily contactable and available to deal with any emergencies.
### F11 - Planning Stage Check List of Key Activities for:

- **Optical Cable Installation on Earthwires – CSS Technique**
- **Optical Cable Installation on Earthwires – Wrap-On Technique**

**On Double Circuit 275 / 400 kV Overhead Lines with both Circuits Live**

<table>
<thead>
<tr>
<th>Route:</th>
<th>Tower Numbers:</th>
<th>Circuit:</th>
<th>I.D:</th>
<th>Circuit:</th>
<th>I.D:</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
<th>Paragraph</th>
<th>Signature</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Report produced by <strong>Senior Authorised Person</strong> listing all towers and sections requiring special working arrangements</td>
<td>1.1.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>The Contractor is aware of the condition of the existing earthwire and the position of any damage, mid span joints and repair sleeves, displaced dampers and bird flight deflectors. All damage has been repaired.</td>
<td>1.1.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td><strong>The Senior Authorised Person</strong> and the <strong>Competent Person</strong> have a copy, or access to a copy, of the Contractor’s method statement and project quality plan, with particular reference to the site quality plan and note any deficiencies in its implementation</td>
<td>N/A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Overhead line managers and Contractor’s emergency plans</td>
<td>Section 7, 1.4.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Tug/Cradle Block/Wrapping Machine retrieval has been demonstrated to NG satisfaction *Note 1</td>
<td>Section 7, 2.1.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>At all towers the integrity of the earth bonding connections has been checked. The integrity of the earth connections between the terminal towers and substation earth mats has been checked</td>
<td>Section 7, 2.2.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td><strong>The Senior Authorised Person</strong> has agreed that the Contractor’s preparations and methods of work for each section of the line are satisfactory</td>
<td>N/A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>All staff on site have been assessed and nominated as competent to carry out the specific work</td>
<td>Section 7, 1.2.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Contractor’s <strong>Competent Persons</strong> have been appointed</td>
<td>Section 7, 1.2.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Temporary jointing procedures have been submitted and are in accordance with technical guidance *Note 2</td>
<td>N/A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Contractor’s staff available to control movement of people, vehicles, farm machinery, animals etc</td>
<td>N/A</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Notes:**

1. Applies to CSS and Wrap-On techniques only
2. Applies to CSS Technique only

---

The **Competent Person** shall be present on site during the period of the installation of the Optical Earthwire / Optical Cable with his attention dedicated to this task. His role is to satisfy himself that all appropriate measures are being taken to maintain **Safety from the System**. The **Senior Authorised Person** shall be readily contactable and available to deal with any emergencies.
### F 12 - Planning Stage Check List for Continuous Tension Stringing of Earthwires under Single Circuit outage conditions on Double Circuit 275 / 400 kV Overhead Lines

<table>
<thead>
<tr>
<th>Route:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Tower Numbers:</td>
<td></td>
</tr>
<tr>
<td>Circuit Switched out Isolated and Earthed:</td>
<td></td>
</tr>
<tr>
<td>Circuit Identification:</td>
<td></td>
</tr>
<tr>
<td>Adjacent Live Circuit:</td>
<td></td>
</tr>
<tr>
<td>Circuit Identification:</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Paragraph</th>
<th>Signature</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Report produced by <strong>Senior Authorised Person</strong> listing all towers and sections requiring special working arrangements</td>
<td>1.1.1</td>
</tr>
<tr>
<td>2</td>
<td>The Contractor is aware of the condition of the existing earth wire and the position of any damage, mid span joints and repair sleeves, displaced dampers and bird flight deflectors</td>
<td>1.1.2</td>
</tr>
<tr>
<td>3</td>
<td>The <strong>Senior Authorised Person</strong> and the <strong>Competent Person</strong> have a copy, or access to a copy, of the Contractor’s method statement and project quality plan, with particular reference to the site quality plan and note any deficiencies in its implementation</td>
<td>N/A</td>
</tr>
<tr>
<td>4</td>
<td>At substation terminal towers the integrity of the earth connections to the sub station earth mats have been checked</td>
<td>2.2.1</td>
</tr>
<tr>
<td>5</td>
<td>The <strong>Senior Authorised Person</strong> has agreed that the Contractor’s preparations and methods of work for each section of the line are satisfactory</td>
<td>2.2.4</td>
</tr>
<tr>
<td>6</td>
<td>The <strong>Senior Authorised Person</strong> has satisfied himself regarding the position of scaffolds, Skycracles, plant and equipment</td>
<td>2.2.3</td>
</tr>
<tr>
<td>7</td>
<td>All staff on site have been assessed and nominated as competent to carry out the earthwire replacement work</td>
<td>2.1.1</td>
</tr>
<tr>
<td>8</td>
<td>Contractor’s <strong>Competent Persons</strong> have been appointed</td>
<td>2.1.1</td>
</tr>
<tr>
<td>9</td>
<td>No work shall be undertaken on the phase conductors, insulators or associated fittings in the sections being worked on</td>
<td>2.2.2</td>
</tr>
<tr>
<td>10</td>
<td>Drain Earth(s) are fitted to all phase conductors on the circuit out of commission at all towers in the section to be worked on and at the nearest tower on each side of the section</td>
<td>2.2.2</td>
</tr>
<tr>
<td>11</td>
<td>The integrity of the Permanent Earth Bonds has been checked and the earth continuity of the earthwire is being maintained</td>
<td>2.2.1</td>
</tr>
<tr>
<td>12</td>
<td>Trained observers in position to observe earthwire at each tower</td>
<td>2.1.2</td>
</tr>
<tr>
<td>13</td>
<td>Contractor’s staff available to control movement of people, vehicles, farm machinery, animals etc</td>
<td>N/A</td>
</tr>
<tr>
<td>14</td>
<td>The <strong>Senior Authorised Person</strong> has confirmed that the Contractor has an emergency plan in place</td>
<td>1.4.1</td>
</tr>
<tr>
<td>15</td>
<td>Temporary jointing procedures have been submitted and are in accordance with technical guidance</td>
<td>N/A</td>
</tr>
</tbody>
</table>

The **Competent Person** shall be present on site during the period of the installation of the Earthwire with his attention dedicated to this task. His role is to satisfy himself that all appropriate measures are being taken to maintain **Safety from the System**. The **Senior Authorised Person** shall be readily contactable and available to deal with any emergencies.
## NSI 4 Authorisation Matrices for Personnel

### National Grid Senior Authorised Person Authorisations (Core)

<table>
<thead>
<tr>
<th>Senior Authorised Person Authorisation</th>
<th>Required theory of Sections</th>
<th>Authorised to Section(s)</th>
<th>Authorised to NSI 4 Earthing schemes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Senior Authorised Person Core</td>
<td>Section 1: All</td>
<td>Section 1-All</td>
<td>Section 3 Drain Earthing Shorting Schemes - All</td>
</tr>
<tr>
<td></td>
<td>Section 2: All</td>
<td>Section 2-All</td>
<td>Section 4 OHL Maintenance schemes - All</td>
</tr>
<tr>
<td></td>
<td>Section 3: All</td>
<td>Section 3-All</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Section 4: All</td>
<td>Section 4-All</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Section 8- 1, 2, 3, 5 &amp; 6</td>
<td>Section 8- 1, 2, 3, 5 &amp; 6</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Section 9- All</td>
<td>Section 9- All</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Section 10- F1,F2, F3, F4 &amp; F5</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Additional Authorisations

<table>
<thead>
<tr>
<th>Senior Authorised Person Additional Authorisations</th>
<th>Section 5: All</th>
<th>Section 5: All</th>
<th>Section 5: All activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Section 6: All</td>
<td></td>
<td></td>
<td>Section 6: 2</td>
</tr>
<tr>
<td>Section 7: All</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Section 8: 4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Section 10- F7, F8, F10, F11 &amp; F12</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
# National Grid Competent Person Authorisations

<table>
<thead>
<tr>
<th>CP Authorisation</th>
<th>Required theory of Sections</th>
<th>Authorised to Section(s)</th>
<th>Authorised to NSI 4 Earthing schemes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Competent Person Core</td>
<td>Section 1: All</td>
<td>Section 1-All</td>
<td>Section 3 Drain Earthing Shorting Schemes - All</td>
</tr>
<tr>
<td></td>
<td>Section 2: All</td>
<td>Section 2-All</td>
<td>Section 4 OHL Maintenance schemes - All</td>
</tr>
<tr>
<td></td>
<td>Section 3: All</td>
<td>Section 3-All</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Section 4: All</td>
<td>Section 4-All</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Section 8- 1, 2, 3, 5 &amp; 6</td>
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<td>Section 5: All activities</td>
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<td>Section 7: All</td>
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<td>Section 10- F7, F8, F10</td>
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Note: Section 6 – 3 CSS authorisation has not been included as this is still under development.
## Contractors Competent Person Authorisations

<table>
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<tr>
<th>CP Authorisation</th>
<th>Required theory of Sections</th>
<th>Authorised to Section(s)</th>
<th>Authorised to NSI 4 Earthing schemes</th>
</tr>
</thead>
</table>
| **CP A. (LAC only)**  
Non application of Drain Earths | Section 1-1,2,3,4,5,7,9&10 | Section 1-1,2,3,4,5,7,9&10 | None |
| **CP B (LAC & PFW)**  
Non application of Drain Earths | Section 1:All  
Section 3: Scheme 1  
Section 4: Schemes 1. 1.1 & 1.3  
Section 4: Scheme 9. 9.1  
Section 8: 3 | Section 1-All  
Section 8-3 | None |
| **CP C (LAC & PFW)**  
Application of Drain Earths  
(No access onto Conductors) | Section 1: All  
Section 2: All  
Section 3: Scheme 1  
Section 4: Schemes 1. 1.1 & 1.3  
Section 4: Scheme 9. 9.1  
Section 8: 3  
Section 9- All  
Section 10- F2, F3, F4 | Section 1-All  
Section 2-All  
Section 8-3 | Section 4 OHL Maintenance schemes 1.1, 1.3 & 9.1 |
| **CP D (LAC & PFW)**  
Application of Drain Earths  
(Work on Conductors) | Section 1: All  
Section 2: All  
Section 3: All  
Section 4: All  
Section 5: All  
Section 6: 1 & 2  
Section 8- 1, 2, 4, 5, 6  
Section 9- All  
Section 10- F2, F3, F4, F5, F7, F10, F12 | Section 1-All  
Section 2-All  
Section 3-All  
Section 4-All  
Section 5: All  
Section 6: 1 & 2  
Section 8- 1, 2, 4, 5 & 6 | Section 3 Drain Earthing Shorting Schemes - All  
Section 4 OHL Maintenance schemes - All  
Section 5: All activities  
Section 6: 2 |
### Contractors Additional CP Authorisations

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<th>Authorised to NSI 4 Earthing schemes</th>
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<td>WRAP</td>
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