PR-NET-OSM-062

ACCESS AND WORK ON HIGH VOLTAGE UNDERGROUND CABLES

OPERATIONAL SAFETY MANUAL - SECTION 8.1

Scottish & Southern Electricity Networks

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1 Introduction

1.1 **High Voltage** underground cables are those cables operating at a voltage above 1000V AC or 1500V DC within **SSEN-D**.

1.2 This document defines the operational requirements for access to and work on **High Voltage** underground cables within **SSEN-D** to ensure work on such cables can be completed in a controlled manner, whilst limiting risk to all persons involved.

2 Scope

2.1 The scope of this document relates to operational requirements for access to and work on **High Voltage** underground cables under the **Operational Safety Rules (OSR).**

2.2 It applies to all persons employed by or working on behalf of **SSEN-D** who are authorised to work on **High Voltage** cables.

2.3 This **Approved** procedure is provided to help ensure that, following appropriate risk assessment, any work on **High Voltage** underground cables is undertaken safely, with correct equipment and PPE, and is in compliance with **OSR** and relevant legislation.

2.4 It covers work on **High Voltage** underground cables in proximity to other **High Voltage** cables or overhead lines which could be affected by induced voltages.

2.5 It also covers any work on **High Voltage** underground cables that are part of a third party owned **System** if that work is undertaken by persons on the behalf of **SSEN-D**.

2.6 This scope does not apply to:

- Cable ancillary systems (e.g., pilots)
- Procedures for dealing with **High Voltage** underground cable faults
- Submarine cables
- Third party work near cables (see section 12 (Network and Public Safety) of the OSM).

3 References

The documents detailed in Table 3.1 - Scottish and Southern Electricity Networks Documents, and Table 3.2 - External Documents, should be used in conjunction with this document.

Table 3.1 - Scottish and Southern Electricity Networks Documents

Reference	Title
PR-NET-OSM-006	SSEN Distribution Operational Safety Rules – Operational Safety Manual – Section 1.1
PR-NET-OSM-028	Switching Terminology and Approved Abbreviations - Operational Safety Manual - Section 4.4
PR-NET-OSM-099	Management of Live Working Activities on the High Voltage System – Operational Safety Manual – Section 15.1
PR-NET-OSM-026	High Voltage Switching and Earthing - Operational Safety Manual – Section 4.2
PR-NET-OSM-065	Testing of High Voltage Apparatus - Operational Safety Manual – Section 9.1
PR-NET-OSM-030	Identification of Apparatus - Operational Safety Manual – Section 4.6
PR-NET-OSM-063	Access and Work on High Voltage Underground Cable Ancillary Systems – Operational Safety Manual – Section 8.2

Reference	Title
TG-NET-ENG-016	Supply, Calibration and Servicing Requirements for Approved Test Instruments
TG-NET-OPS-004	Safe Excavation Practices Around Buried Services
WI-NET-CAB-401	Dealing with Damaged LV and HV Cables up to and including 33kV
WI-NET-CAB-122	Work Element Process 5. Safety Requirements for Low Voltage Jointing Works
WI-NET-CAB-400	Identification, Phase Checking and Setting to Work on 11 kV, 33 kV and 132 kV Cable Circuits
WI-NET-OSM-002	Personal Protective Equipment and Workwear for Live Environments
N/A	SSEN SHE Handbook (Held in Safety, Health and Wellbeing SharePoint Site)

Table 3.2 - External Documents

Reference	Title
ENA ER C55	Insulated Sheath Power Cable Systems
ENA ER C99	Guidance for Working on Cables Under Induced Voltage Conditions
ENA ER S37	Code of Practice for the Safe Working on Pilot, Auxiliary and Communication Cables
ENA ER C135	Guidance for the Operation and Management of Fluid Filled Cables

4 Definitions

4.1 The words printed in bold text within this document are either headings or definitions. Definitions used within this **Approved** Procedure are defined within the list presented immediately below, or within section 2 of the **OSR**.

4.2 **Operational Safety Rules (OSR)**

The **SSEN-D** Distribution set of rules, as read with related documents and procedures, that provide generic safe systems of work on the **System** therefore ensuring the health and safety of all who are liable to be affected by any **Danger** that might arise from the **System.**

4.3 **Shorting Cap**

Cable end seal to prevent the ingress of moisture and provide a short-circuit to **Earth** for the **Conductors** of a disconnected or abandoned cable.

5 General Responsibilities

5.1 All work must be done in compliance with **SSEN-D** Safety, Health and Environmental policy and procedures, including the **OSR**.

5.2 Persons who are required to operate and undertake work on the **System** or part thereof, **Shall** have a thorough understanding of the work and ensure that on site risks are suitably assessed and that appropriate control measures are put in place before, during and immediately after all activities.

5.3 The procedures and instructions in this **Approved** procedure must only be carried out by suitably trained and authorised persons.

5.4 Persons must ensure that at all times during the work (or associated testing) **General Safety** arrangements are maintained and that other work areas are not adversely affected by the activities for which they are responsible.

6 Authorisation

6.1 All personnel involved in operations and work on **High Voltage** underground cables **Shall** hold the requisite competence for the operations and work to be undertaken.

6.2 Competence and authorisation certificates **Shall** be retained personally and be made available upon request.

7 Personal Protective Equipment

7.1 When excavating on or near to any underground cables, Approved PPE **Shall** be worn, (Class 2, which **Shall** be buttoned up to neck with sleeves fully rolled down), gloves and safety footwear, unless specific on-site risk assessment indicates that the requirement for full Class 2 clothing can be relaxed to Class 1 for all or part of the excavation.

7.2 As a minimum, PPE **Shall** meet the requirements of WI-NET-OSM-002.

8 Dangers from High Voltage Cables

The main **Dangers** to personnel working on **High Voltage** cables are electric shock, burns, asphyxiation or falls arising from:

- Mistaking **Live High Voltage** cables for those on which it is safe to work
- Voltage difference between cables with separate **Earthing** zones when a fault occurs in one of these **Earthing** zones
- Induced voltages on the cable being worked on
- Contact with adjacent exposed **Live Conductors**, other cables or services
- Physical conditions in the vicinity of the point of work due to deep excavations or working at a height
- Chemicals and fumes from fluxes and other sources
- The sudden release of gas from pressurised cables.

9 General Requirements for Work on High Voltage Cables

9.1 All persons who work on **High Voltage** cables **Shall** have the correct authorisation and training for the work required.

9.2 Work must not commence on any **High Voltage** cable unless the person in charge of the work is in receipt of the correct **Safety Document** and has been personally instructed at the point of work by the **Senior Authorised Person** issuing the **Safety Document**.

9.3 Unless the work is restricted to that which can be done under a **Limitation-of-Access** or the cable has not yet been connected to the **System** (or has been disconnected from the **System**), the circuit must be **Isolated**, **Earthed** and identified at the point of work in accordance with **OSR** and following the procedure in Appendix A of this **Approved** procedure, prior to the issue of a **Permit-to-Work**.

9.4 All cables **Shall** be treated as **Live** (especially cables which are either damaged, or have exposed **Conductors),** until proved **Dead** by an **Approved** procedure. No person **Shall**

touch the insulation which covers any **Conductor** subject to **High Voltage** unless the **Conductor** has been made safe in accordance with **OSR** 4.1.1.

9.5 Care should be taken to avoid damage to other **Apparatus** during excavations. If damage to other **Apparatus** is suspected e.g., **Low Voltage** cable, work **Shall** stop until the damage has been made safe and an **Authorised Person** confirms it is safe to recommence excavations.

10 High Voltage Circuit Identification

10.1 **High Voltage** circuits on which work or testing is to be carried out must be readily identifiable, or have a means of identification fixed to them, that will remain effective throughout the course of the work.

10.2 **High Voltage** cables may be identified at their terminations by means of labels, plans or circuit numbers.

11 Excavation to Expose High Voltage Cables

11.1 When excavation work is carried out by **SSEN-D** or its contractors in the proximity of, or in order to expose, underground cables which have not been proven **Dead**, then all excavation **Shall** be done in accordance with an **Approved** procedure (see PR-NET-OSM-099 Management of **Live** Working Activities on the **High Voltage** System - Operational Safety Manual - Section 15.1 & TG-NET-OPS-004 - Safe Excavation Practices around Buried Services) and in accordance with HSE Publication HS(G) 47 'Avoiding Danger from Underground Services'. Excavation(s) **Shall** be subject to a prior and ongoing risk assessment.

11.2 All excavation works **Shall** be carried out in accordance with the New Roads and Street Works Act (NRSWA) and, where applicable, traffic management **Shall** comply with the requirements of the Traffic Management Act 2004 (TMA). Where excavation works are not subject to these legal requirements, e.g., private ground, they **Shall** be carried out in accordance with the principles and good working practices specified in the Act.

11.3 To minimise the possibility of accidently striking cables or other services during excavation work, wherever possible, up-to-date cable records showing all cable routes, position and type etc, **Shall** be made available on site to the **Working Party** prior to excavation. In addition, the appropriate authorities and other utilities should be consulted, and their plans made available to personnel on site prior to excavation.

11.4 If there is any difficulty in relating the various available records to the site situation, personnel within the **Working Party Shall** consult their supervisor.

11.5 **Approved** cable location devices, which are fit for use, **Shall** be used to locate or confirm the position of cables and other services, prior to the start of excavation.

11.6 Where cable records indicate multiple cables in the near vicinity of the proposed works, all adjacent cables in the work area should be exposed as necessary to aid with positive identification of the cable to be worked on.

11.7 Careful excavation with hand tools (spades and shovels) is the preferred method of excavation near any underground cables or other services. Picks and pins may only be used with care to break hard layers or free lumps of stone but not in soft ground or near cables and other services.

11.8 Where practicable handheld power tools **Shall** not be used within 0.5m of the indicated line of a cable or other services buried in or below a hard surface. Further excavation, using

hand tools, **Shall** be carried out by undermining the hard surface to fully identify all services or confirm their absence.

11.9 Use of power tools may recommence once all utility services are located (or proved to be absent from the proposed excavation) and there is no risk of damage to the services.

11.10 Mechanical excavators should only be used in specific circumstances, these are listed in Appendix C.

11.11 WI-NET-CAB-122 Work Element Process 5. Safety Requirements for **Low Voltage** Jointing Works) gives further detailed guidance on safe excavation.

11.12 At all times, all members of the **Working Party Shall** be made aware that if they encounter any problems or any signs of a cable fault (e.g., the smell or visual signs of carbon), excavation **Shall** cease immediately, **Working Party** members **Shall** retreat to a safe distance and a supervisor **Shall** be consulted for advice.

11.13 Where additional hazards exist, a **Limitation-of-Access** may be issued, prior to an excavation commencing, to specify any limitations or precautions to be taken to avoid **Danger**.

11.14 Special precautions **Shall** be taken where excavations are in or on high volume public highways or pedestrian walkways, or where known security risks are present. All excavations **Shall** be guarded and signed in an **Approved** manner to safeguard the **Working Party**, other personnel and the general public.

11.15 As excavations progress, precautions **Shall** be taken to prevent collapse of the trench or hole by shuttering or similar means. Attention should be given to supporting excavations in the vicinity of walls, particularly retaining walls, where a landslip, whether it is initiated by the digging of a trench or not, may cause **Danger**. Where shuttering is required, it **Shall** be installed and inspected in accordance with the **Approved** procedure for safe excavations (see PR-NET-OSM-099 Management of **Live Working** Activities on the **High Voltage System** - Operational Safety Manual – Section 15.1).

11.16 When excavating adjacent to equipment or structures such as street furniture, poles, scaffold, walls, or trees care **Shall** be taken to ensure that sufficient ground remains around the base of these or additional precautions taken, so there is no risk of them falling or becoming unstable. Additional control measures may be required, including temporary removal of street furniture or physical temporary supports if practicable.

11.17 The person in charge of the **Working Party Shall** ensure that the excavation is of adequate size to expose all the cables, pipes and ducts necessary to allow identification and spiking of the relevant cable(s), and to carry out the required work. Where necessary confirmation from the **Senior Authorised Person** may be sought.

11.18 If cable tiles or other cable markers or protectors are exposed during excavation, it should not be assumed that they are in their correct position directly above the cable(s) they were originally intended to protect. Previous excavations and careless backfilling could have misplaced such markers or protectors. The exact position of a cable is not certain until it is uncovered and identified.

11.19 All damaged cables or cables with exposed **Conductors Shall** be treated as **Live** until positively identified and proved **Dead** in accordance with this **Approved** procedure.

11.20 On completion of excavation, any cable to be worked upon **Shall** be identified in accordance with **Approved** procedures (see Sections 12 and 13).

12 Identification of High Voltage Cables

12.1 To comply with **OSR**, **High Voltage** cables **Shall** be positively identified at the point of work before the cable is worked on. The identification of **High Voltage** cables **Shall**, where reasonably practicable, be witnessed by the person who will eventually receive the **Safety Document** to carry out the work.

12.2 Once the required cable is exposed, initial identification may be made by checking the design of the exposed cable to establish it is **High Voltage** cable rather than **Low Voltage**.

12.3 Typical 'positive proofs' of a **High Voltage** cable include:

- PVC outer sheath embossed with '11,000 Volt' or other typical **High Voltage** figure
- Visually tracing the cable to its termination into a piece of **High Voltage** equipment

12.4 Further supporting evidence of a **High Voltage** cable includes:

- Cable records
- Cross reference the type of cable with records, many older **High Voltage** cables are steel wire armoured (SWA) design. However, some SWA designs of older **Low Voltage** cables do still exist
- **High Voltage** cables are normally laid at a greater depth than **Low Voltage** cables
- In the case of a **High Voltage** cable fault, a large number of customers may be off supply and no **Low Voltage** fuses would have operated in the source distribution substation.

12.5 Caution must be exercised where plain lead and tape armoured **High Voltage** cables exist with similarly sheathed **Low Voltage** cables, such that the cable to be worked on is correctly identified.

12.6 Any single 'positive proof' is clear proof of cable type and no other proof or supporting evidence would normally be required. Where no 'positive proofs' can be found, visual identification **Shall** be made on the balance of supporting evidence and extreme caution **Shall** be taken in such circumstances. Generally, at least 3 items of supporting evidence should be found to visually identify the operating voltage of a cable but it is always safer to provide more supporting evidence if available.

12.7 Once the initial identification process has been completed, the **High Voltage** cable to be worked on **Shall** be **Isolated**, **Earthed** and then a **Sanction-for-Test Shall** be issued before formal cable identification is commenced using an injected signal tone.

12.8 Subject to the requirements of 12.7, The **Circuit Main Earths** may then be removed and formal positive identification of the cable by injected signal tone **Shall** be carried out using **Approved** cable identifying equipment under the **Sanction-for-Test**. **Approved** cable identifiers are listed in TG-NET-ENG-016.

12.9 The procedures for formally identifying **High Voltage** cables injected signal tone can be found in Appendix A.

12.10 Further guidance on the procedures for the identification of **High Voltage** cables can also be found in of WI-NET-CAB-400.

13 Spiking of High Voltage Cables

13.1 After the cable has been positively identified and marked, as per Section 12, it **Shall**, unless subject to a special conditions waiver, be spiked at the point of work by the **Senior**

Authorised Person issuing the **Safety Document**. The special conditions under which the requirement for spiking may be waived are listed below.

13.2 Spiking can be omitted if it is possible to establish that there can be no error in the identification of the cable by it being visually or physically traced over its whole length from the point of work to:

- A termination where either a **Circuit Main Earth** or **Additional Earth** has been applied, or
- A point on the cable that has recently been identified, the **Conductors** worked on and the points of isolation have not been disturbed

13.3 If the cable is hidden from view for any distance, visual tracing is not acceptable, and the cable **Shall** be physically traced using a running noose.

13.4 Spiking may also be omitted when to do so would cause unacceptable damage to the cable (e.g., fluid filled cables). In this case there must be no doubt about the identification by using an injected tone signal and dispensation has been given by the **Control Engineer** and in accordance with the waiver.

13.5 Where a cable is to be spiked, this **Shall** be carried out with an **Approved** spiking tool, with the **Control Engineers** agreement, at those points at which the cable has been positively identified and is to be worked upon. The sequence given in Appendix B **Shall** be followed.

13.6 Further guidance on the procedures for the spiking of **High Voltage** cables prior to working on them are detailed in WI-NET-CAB-400 and details and instruction in the use and maintenance of the **Approved** spiking tool can be found in the same document.

13.7 After the cable has been spiked, the **Senior Authorised Person Shall** be responsible for the reapplication of the **Circuit Main Earths** to all phase **Conductors** at the circuit ends prior to the removal of the cable identifier and any test prods. The spiking tool must not be removed unless all **Circuit Main Earths** have been applied (or reapplied).

13.8 Where work on a **High Voltage** cable is to be carried out and the cable is not to be spiked, then the **Switching** schedule must include at the appropriate point – 'Request dispensation from cable spiking' and the justification provided (e.g., cable traced from a **Circuit Main Earth** etc). If satisfied, the **Control Engineer** will indicate that dispensation has been granted on the **Switching** schedule. The **Senior Authorised Person Shall** ensure that dispensation by the **Control Engineer** has been given before proceeding.

14 Phase Identification

14.1 If phase identification tests are required, the **Senior Authorised Person Shall** suspend or cancel the **Permit-to-Work**, issue / reissue a **Sanction-for-Test** for application of phase identification equipment and **Shall** remove the minimum number of **Circuit Main Earths** required to complete the test.

14.2 Once testing is complete, the **Senior Authorised Person Shall** ensure that all **Circuit Main Earths** are reapplied on all phase **Conductors** and any test prods are removed and **Shall** then cancel the **Sanction-for-Test** used for cable and phase identification.

14.3 Prior to work resuming, the **Senior Authorised Person** issuing the **Permit-to-Work Shall** confirm that the safety precautions achieving safety from the **System** are in place.

14.4 The **Conductor** phase identity should be recorded on the rear of the appropriate **Permit-to-Work,** or an appropriate phasing diagram provided and the **Senior Authorised Person Shall** confirm that the **Competent Person** who is to carry out the jointing understands the information.

15 Restoration of High Voltage Cables to Service

15.1 On completion of all works on the **High Voltage** cable, all members of the **Working Party** and any other persons **Shall** be cleared from the vicinity of the work and the **Permit-to-Work Shall** be cancelled or suspended.

15.2 The **Senior Authorised Person Shall** then remove all **Circuit Main Earths** in order to carry out continuity and overvoltage (pressure) tests on the cable following **Approved** procedures (as detailed in PR-NET-OSM-065 Testing of High Voltage Apparatus - Operational Safety Manual – Section 9.1) under a **Sanction-for-Test**.

15.3 Any **High Voltage** cable which has been worked on **Shall** only be reconnected to the **System** and reenergised after it has successfully passed a test for the prescribed period (See PR-NET-OSM-065 Testing of High Voltage Apparatus - Operational Safety Manual – Section 9.1).

15.4 Following satisfactory testing, so far as reasonably practicable, all **High Voltage** cables directly installed in the ground should be backfilled with either sand, stone dust or another **Approved** aggregate and marked using an **Approved** cable marking system (tiles or tape for example) before any part of the cable is energised via another part of the **System**.

15.5 In addition to the requirements in 15.1 to 15.4 above, the **Senior Authorised Person** responsible for energising the **High Voltage** cable **Shall**:

- Ensure that the reinstatement is completed at the earliest opportunity
- Consider the use of additional road signs and barriers to warn / guard the general public
- Use **Danger Notices** fixed to the cable at various intervals (no more than 10m apart) throughout the length of the open excavation
- Decide if increased inspections of the work area are required
- Consider on-site security if there is deemed to be an increased risk of interference

16 Movement of Cables

16.1 **High Voltage** cables **Shall** be made **Dead** before any attempt is made to physically move them.

16.2 Where there is any doubt about a **High Voltage** cables identification, it **Shall** be made safe in accordance with **OSR** 4.1.1 and a **Sanction-for-Test** issued for identification.

16.3 The Person in charge of the **Working Party Shall** participate in the identification procedure and confirm the signal is lost at the point of work when disconnected at source.

16.4 There is no requirement to spike **High Voltage** cables where the only activity taking place is to physically move them.

17 Work on Cables in the Vicinity of or Connected to Overhead Lines

17.1 Where work on **High Voltage** underground cables takes place within 15m of an overhead tower line or 9m of a wood pole line, then information about the presence of the line **Shall** be made available to the **Working Party** and they **Shall** be instructed by a supervisor or manager on the precautions that need to be taken before any work commences.

17.2 Further guidance can be found in WI-NET-CAB-122.

18 Induced Voltages on High Voltage Underground Cables

18.1 Where work is to be carried out on any **High Voltage** cable or associated ancillary equipment which may be subjected to induced voltages from other **Live** circuits in their proximity, then such work **Shall** require additional precautions to be taken to prevent **Danger** from these voltages, in accordance with **Approved** procedures and to comply with clause 8.3.2 of the **OSR**.

18.2 Such **High Voltage** cables and associated ancillary equipment (e.g., auxiliary cables), even when **Isolated** from the **System** and **Earthed**, can be subject to dangerous **High Voltages** by induction from adjacent **Live** cables, especially if high fault currents flow, and also due to induction from overhead lines connected to or nearby the cable being worked on or from other natural phenomena.

NOTE: Ancillary equipment is covered in detail in PR-NET-OSM-063 Access and Work on **High Voltage** Underground Cable Ancillary Systems – Operational Safety Manual – Section 8.2.

18.3 When work is to be done on a **High Voltage** underground cable or cable termination which is directly connected to an overhead line, **Danger** from induced voltage on the overhead line may exist. This **Shall** be excluded by applying the **Circuit Main Earth** or **Additional Earth** as close as possible to the point of work.

18.4 Danger from induced voltages and rise of **Earth** potential should be avoided by employing either Insulated Working or **Earthed** Working methods, or in certain circumstances, a combination of both methods. It **Shall** not be assumed that a **High Voltage** cable is safe to work on merely because the cable is **Earthed** at one or more terminals.

18.5 Where **High Voltage** gradients can appear across the break in a **Conductor**, when that **Conductor** is **Isolated** and **Earthed** at its remote ends, then the use of **Approved Conductor** continuity bonds should be used to prevent **Danger**.

18.6 Induced voltage working procedures need not be applied in the following circumstances:

- Where it has been established by calculation, test or existing knowledge that there is no possibility of dangerous voltages arising (see note below)
- When all adjacent circuits are limited to **Systems** having resistance **Earthing** in which the fault level does not exceed 2.5kA
- When working on third-party telecommunication cables where other codes of practice apply

NOTE: Dangerous voltages are considered to be voltages above the following recommended limits:

- 60 volts for steady state, i.e., continuous induced voltages
- 650 volts for fault conditions where the fault current can be cleared within 0.2 seconds, or
- 430 volts where the clearance times are more than 0.2 seconds

18.7 In most cases, it is unnecessary to implement induced voltage precautions when completing work on cables which are normally fed from the same source of supply (i.e., sited wholly within one **Earthed** system). However, there are situations where circuits within the same **Earthed** system can, under certain conditions, produce induced voltages in excess of the recommended limits. These situations and all cable circuits, to which induced voltage working conditions apply, should be identified, listed and made available to those working on such circuits.

19 Insulated Sheath Cables

19.1 Where work is to be carried out on the insulated sheath system of a **High Voltage** cable installation, additional precautions to prevent **Danger** from any sheath voltages **Shall** be taken in accordance with **Approved** procedures.

19.2 Work or testing on the sheath **Shall** not be carried out unless a suitable **Safety Document** has been issued.

19.3 The cable **Shall** be identified in accordance with **Approved** procedures (see sections 12 and 13) prior to the issue of a **Permit-to-Work** for serving or sheath repairs.

19.4 **Earth** link boxes **Shall** be identified by their position and labelling. (see PR-NET-OSM-030 Identification of Apparatus - Operational Safety Manual – Section 4.6).

19.5 The links providing the **Earth** connection to the sheath **Shall**, where practicable, be removed after the testing equipment has been connected to the sheath and replaced before the test equipment is disconnected.

20 Disconnected or Abandoned Cables

20.1 Disconnected or abandoned cables, which have been cut and declared as removed from the **System**, **Shall** have their **Conductors** shorted and connected to the cable sheath at the cap end position using an **Approved Shorting Cap**.

20.2 Disconnected or abandoned **High Voltage** cables which are no longer in use **Shall** be retained on **SSEN-D** cable records and labelled ‘OOS’ (Out of Service).

20.3 Disconnected or abandoned **High Voltage** cables may be worked upon provided they are identified, as far as reasonably practicable, in accordance with Sections 12 and 13.

20.4 For disconnected or abandoned **High Voltage** cables, a **Limitation-of-Access Shall** be issued for any work required on them after spiking to prove them **Dead**.

20.5 When spiking disconnected or abandoned cables which have not been definitely identified, as well as the **Control Engineer**, the dispatcher or call centre **Shall** be informed to verify no problems arise on the **Low Voltage System**.

20.6 If an abandoned cable is to be removed, lengths of the cable may be cut and removed under a **Limitation-of-Access** without further re-spiking of the cable provided that:

- The cable is initially cut at the point of spiking
- The cable can be visually traced from the point where it was previously cut; and
- The **Competent Person** in receipt of the **Limitation-of-Access** remains on site following spiking of the cable and personally identifies the cable on each occasion the cable is to be cut.

20.7 Where work takes place over a series of working days or is not continuous, a **Shorting Cap**, or similar means of bonding the cores to **Earth**, **Shall** be fitted to the cut cable ends remaining in situ.

21 Revision History

No	Overview of Amendments	Previous Document	Revision	Authorisation
01	New document created	NA	1.00	Richard Gough
02	Minor revisions made	PR-NET-OSM-062 (Rev1.00)	1.01	Richard Gough
03				

Appendix A Cable Identification by Injected Signal Tone

Once exposed and following initial identification of the correct type and voltage of cable, the cable to be worked on **Shall** be positively identified by injected tone using the following procedures:

1. Firstly, a test of core insulation and continuity **Shall** be carried out. This test can be omitted in cases where the cable was energised and has been switched out immediately prior to identification. The test can also be omitted where the cable is recorded as abandoned or the cable cannot be identified.
2. If insulation and continuity values are found to be adequate, the **Conductors** of the cable can be joined together at a point beyond the work position: a **Circuit Main Earth** may be used for this purpose. A cable identifier Signal Generator can then be connected to the cable **Conductors** at a point before the work position and the cable identified at the point of work with the instrument receiver.
3. Identification by the clear detection of a 'rise and fall' in the signal by moving the detector along the length of the cable and around its circumference, is essential before the spiking tool is fixed to the cable.
4. Where other cables have been exposed at the point of work, the detector **Shall** be used on each cable to provide further confirmation that the correct cable has been identified.
5. Where it was not possible to identify the cable to be worked on then:
   - At the remote end, two of the phase **Conductors** should be connected together and the third phase connected to **Earth** using an **Approved** lead
   - Following the application of these shorts, all other **Circuit Main Earths** should be removed
   - Then, the **Approved** cable identifier can be connected to the two cable cores which are free from **Earth** (but connected together) and then the cable should be able to be identified at the point of work.
6. The **High Voltage** cable to be worked on, having been identified at the point of work, **Shall** be suitably marked, i.e., with coloured tape, by the **Senior Authorised Person** issuing the **Safety Document** prior to spiking.
7. **Danger Notices Shall** be attached to any other exposed cables in the work area and additional mechanical protection should be applied where considered necessary.
8. Identification by injected signal tone is <u>not</u> required when:
   - The cable can be visually traced along its entire length or physically traced using a running noose, from the intended point of work to a termination where a Circuit Main Earth or Additional Earth has been applied, or
   - The cable can be visually traced along its entire length or physically traced using a running noose, from the intended point of work to a point on the cable that has recently been identified, the Conductors worked on and the points of Isolation have not been disturbed; or
   - It is known that at least two Conductors of the cable are damaged or it has a capped or pot ended, making it unsuitable for identification. In these cases, the cable must be spiked in accordance with the spiking procedure in Appendix B, omitting the identification by injected tone procedure; or
   - The cable is abandoned or cannot be identified. In this case the cable must be spiked in accordance with the spiking procedure in Appendix B, omitting the identification by injected tone procedure.

NOTE: If the cable is hidden from view for any distance, visual tracing is not acceptable, and the cable **Shall** be physically traced using a running noose.

Appendix B Cable Spiking Procedure

Where a **High Voltage** cable has to be spiked, the following sequence **Shall** be followed:

1. Where the cable has been identified by the identification procedure in Appendix A, the identifier signal should remain on the cable with the **Sanction-for-Test** in force whilst spiking is carried out.
2. The **Senior Authorised Person Shall** visually inspect the cable spiking tool before use and ensure that it is of an **Approved** type and has been maintained in accordance with **Approved** procedures.
3. Cartridges should be in the custody of the **Senior Authorised Person** prior to the operation. The **Senior Authorised Person** should select the correct grade of cartridge for the type of cable being spiked.
4. The spiking tool should be fitted under the **Personal Supervision** of the **Senior Authorised Person**.
5. Correct fitting of the spiking gun with the necessary packing for smaller cables, the use of a dummy core for triplex cables and the correct choice of cartridge is essential to achieve the satisfactory spiking of all **Conductors**.
6. Immediately prior to spiking the cable, the **Senior Authorised Person Shall** notify the **Control Engineer** that it is now their intention to spike the cable.
7. The **Senior Authorised Person Shall** ensure that all personnel are at a safe distance before spiking the cable. With the identifier still connected, the **Senior Authorised Person** will fire the spiking gun using a lanyard.
8. The **Senior Authorised Person Shall** immediately inform the **Control Engineer** that the cable has been spiked. The **Control Engineer Shall** log the time of spiking and relate this to any indications, alarms or **System** occurrences that may have arisen after a prescribed period of time (3 mins) and advise the **Senior Authorised Person** accordingly.
9. The **Senior Authorised Person Shall** confirm that spiking has been completed correctly by checking for the identifier signal on each side of the spike: the signal should disappear or diminish on the side of the spike remote from the identifier transmitter.
10. Work on the cable, should commence only after the cable has been proven to have been positively spiked, all **Circuit Main Earths** have been replaced, and the **Sanction-for-Test** suspended or cancelled, and following the issue of a **Permit-to-Work**.
11. If the **Senior Authorised Person** is in any doubt as to whether the spiking tool has correctly operated, the following procedure must be used:
    a) With the Sanction-for-Test still in force, ensure all Earths and phase to phase connections are removed and test the insulation resistance of the cable.
    b) As the cable was shown to be healthy prior to identification, if the cores now indicate a connection to Earth or are shorted together it can be reasonably assumed that the spiking tool has operated correctly and the cable satisfactorily spiked.
    c) If such a connection is not indicated, it must be assumed that the spiking tool has not operated correctly. The used spiking tool **Shall** remain in place and the whole spiking procedure repeated using another spiking tool.

NOTE: When spiking has been carried out on an abandoned or unidentified cable it will not be possible to carry out the tests detailed above.

Appendix C Use of Mechanical Excavators

Mechanical excavators may only be used to excavate near underground cables or other buried services under the following conditions:

1. Follow New Roads and Street Works Act (NRSWA) guidance to identify other services, consult cable records and use **Approved** cable locating devices.
2. Confirm location of services by consulting directly with appropriate authorities and other utilities.
3. Where appropriate excavate trial holes by hand.
4. All personnel must keep clear of moving parts while an excavator is in use.
5. Mechanical excavators may be used up to 0.5m of the indicated line of a cable with a 'banksman' in attendance to look out for obstacles and other **Dangers.**
6. Further excavation may be carried out using hand tools once difficult ground or large obstacles have been removed by the mechanical excavators.
7. When safe to do so (i.e., all underground services have been either exposed or proven to be absent), mechanical excavation may recommence.
8. If a cable is damaged during mechanical excavation, it **Shall** be treated as **Live** until proved **Dead**. The driver must remain in the cab or jump clear to avoid possible touch potentials. Where it is safe to do so, the machine should be moved from the area.