Identification of LV Cables

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Date 09 July 2018

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Revision Record

<table>
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<tr>
<td>9.0</td>
<td>Full Review of DSR 01 018 due to the use of new LV cable identifiers. 1st paragraph of section 8.4.1 - Positive electrical Identification using an approved signal device reworded regarding the use of new LV cable identifiers and the term Grumbler has been replaced with 'LV cable identifier'. DSR 01 018a (now v4.0) reviewed, no changes.</td>
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<tr>
<td>Date published</td>
<td>10/07/2018</td>
</tr>
<tr>
<td>Next review date</td>
<td>10/07/2021</td>
</tr>
<tr>
<td>Prepared by</td>
<td>D. Daintree</td>
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<td>8.0</td>
<td>Full Review for 2016 version of the DSRS. Changes to decision marking flowchart to all a 'No' decision from 'Can You Positively identify the LV cable at the work location?’ DSR 01 018a reviewed, no changes.</td>
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<tr>
<td>Date published</td>
<td>01/05/2016</td>
</tr>
<tr>
<td>Next review date</td>
<td>01/05/2019</td>
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<tr>
<td>7.0</td>
<td>Changes to the 'Decision Making Flowchart' on Page 11 to show a 'No' from 'Is it a black plastic cable CLEARLY embossed 600/1000V?' to 'You MUST use another method to identify the LV cable or seek advice’ Section 8.4 Grammatical changes to all of this section to ensure it reads correctly. No changes to DSR 01 018a.</td>
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<tr>
<td>Date published</td>
<td>08/07/2015</td>
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<tr>
<td>Next review date</td>
<td>24/01/2019</td>
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<tr>
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<td>D. Daintree</td>
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1.0 Introduction and Purpose

There is a significant risk of opening a high voltage cable in error during low voltage jointing work. As any high voltage cable is likely to be live there is a high risk of injury from electric shock or burns.

Due to the fact that Cable manufacturers have used the same construction for both LV and HV cables the voltage of a cable cannot be identified from the type of armour and because Cable records are not always accurate this procedure shall be followed.

This procedure describes how to positively identify low voltage cables before they are opened. This positive identification will significantly reduce the probability of opening a live HV cable. By using the electrical identification method a specific LV cable can also be identified where more than one exists.

It does not attempt to reduce the severity of any injuries that may happen if a live HV cable is opened. Jointers are expected to open cables with care and to follow the jointing procedures, including using appropriate PPE.

2.0 Scope

- The procedure applies to any person working on any network owned or operated by UK Power Networks.
- The procedure applies to all work where it is intended to remove the cable sheath and expose the insulation on a low voltage cable that has not been proved dead at the point of work.
- Excavation around all cables and additional precautions when working near defective cables is covered in DSR 01 014.

3.0 Objective

To reduce the probability of opening live HV cables.

4.0 References

<table>
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<th>Reference</th>
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<tr>
<td>DSR 01 018a</td>
<td>Low Voltage Cable Identification Checklist</td>
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<tr>
<td>DSR 01 014</td>
<td>Excavating near Electricity Cables</td>
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<tr>
<td>HSS 40 045</td>
<td>Basic Requirements for Live Working on LV Apparatus</td>
</tr>
<tr>
<td>GTRA JLV 03</td>
<td>LV Jointing (including cable identification, stripping and preparation)</td>
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<td>HSS 40 029</td>
<td>Unidentified Cables</td>
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UK Power Networks Distribution Safety Rules

Cable Jointing Manual

LV Operations Handbook

Excavation and Cable Installation Manual
5.0 Definitions

<table>
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<tr>
<th>Positive identification</th>
<th>Identification using one or more of the methods detailed in this procedure.</th>
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<tr>
<td>Exposed cable</td>
<td>For the purposes of this procedure a cable is exposed when any identification instrument can be moved around the whole circumference of the cable being tested and along the cable a sufficient distance to detect the lay of the cores.</td>
</tr>
<tr>
<td>Cable Identification marker tape</td>
<td>A sticky back silver foil tape that wraps around the cable and is then stuck together at the ends. It states on the tape that “This cable has been identified as an LV cable”. If the two ends are peeled apart, the word “Void” appears on the surface of the tape.</td>
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<tr>
<td>Approved signal device</td>
<td>A device that will create a detectable signal in a live LV cable and is suitable for cable identification.</td>
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<tr>
<td>Vicinity</td>
<td>Where there is more than one cable all the cables in the work area shall be exposed. It is acceptable in circumstances where there is a clear separation of at least a metre shown on the plans of different cable runs, or groups of cables, that, providing the onsite conditions agree with the plans, only the group of cables specific to the work site need be exposed. The correct cables would then need to be Identified following this procedure. If there is any doubt or ambiguity then more cables may have to be exposed.</td>
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<tr>
<td>LV Cable Identification Check Sheet</td>
<td>A form (DSR 01 018a) which shall be completed before opening any LV cable. Completing this form acts as a check that the appropriate identification has been completed.</td>
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6.0 Responsibilities

**Work Issuer**

The person who issues the work has the responsibility to ensure that all relevant plans and information are given to the person in charge of the work on site. This must include checking for EHV and other cables and arranging for plans of these cables to be provided.

Person responsible for cable identification by signal injection shall:
- have an appropriate Authorisation (Identify LV Cable by Signal Injection)
- use a signal injection instrument that is approved for this purpose.
- ensure that the required actions are taken to identify the correct cable.
- complete the appropriate section of the LV Cable Identification Check Sheet
Person in charge of work on site shall be responsible for ensuring that:

- the cable has been positively identified. This responsibility will either be undertaken personally, or where appropriate will be in conjunction with the Person responsible for cable identification by signal injection.
- the LV Cable Identification Check Sheet is completed, before the insulation is exposed.

7.0 Records

A record of the method of identification used shall be kept in the job file or where there is no job file to be kept available for audit by the appropriate manager.

8.0 Process Detail

8.1 For planned work LV cable identification shall start at the design stage.

Whenever possible the designer will indicate the probable method of cable identification and incorporate it into the design.

Whoever is responsible for putting the team to work shall ensure that the task instruction indicates the intended method of identifying the LV cable in line with one of the approved methods detailed in this procedure.

This is to ensure that wherever possible the jointing team are provided with sufficient resources to enable correct identification of the cable. These resources may be for a positive electrical identification or to allow sufficient ground to be excavated to trace to a known low voltage item, such as a service joint.

8.2 Task Instructions, Cable Plans and Records

Anybody carrying out jointing work should have a written or electronic task instruction prior to undertaking work. Each task instruction shall:

- State the expected approved method of LV cable identification which is to be used
- Include adequate plans with detail of at least 1:500 scale. These plans should include all cables, irrespective of voltage, that are recorded to be in the work area, together with associated sections.
- Include relevant LV schematic diagrams showing source supply points, open points and stop ends.
- Include all other relevant information such as plans of any power cables that do not belong to UK Power Networks but are known to be in the work area.

8.3 Cable Avoidance Tools

Cable Avoidance Tools (CATs) shall not be used to identify cables. They can only be used to locate cables in conjunction with cable plans and records.

Operatives should always “sweep” the area of work with a CAT to confirm that all cables at the work location have been exposed in the joint hole. Where possible this sweep should extend at least 2 metres either side of the centre line of the joint hole.
8.4 Cable Identification Methods

There are only four approved methods of identifying an LV cable. One or more of these methods shall be used to positively identify the cable before starting work on it:

a. Positive electrical identification using an approved signal device (See 8.4.1).

b. Where the construction of the cable(s) is such that it can be clearly identified I.E. 600V/1000V Plastic embossed outer sheath of a cable (See 8.4.2).

c. Locating a service joint or other identifiable LV Apparatus on the required LV cable (See 8.4.3) or clear identification as a service cable (See 8.4.4)

d. Use of current records and plans (8.4.5)

8.4.1 - Positive electrical Identification using an approved signal device

When using the LV cable identifier, the preferred method is to connect between two phases of the cable to be tested (this is to avoid signals in the neutral and earth that could transfer to the sheath or armour of adjacent HV cables). The point of work is then between the connection point and the source.

However, when using the Fameca FC5300 and Ariadna CI it is possible to identify from a single-phase connection point following the manufacturer's instructions and guidelines.

Mobile phones should be switched off during the use of the approved signal devices as signals can also sometimes be replicated if a mobile phone is in close proximity to the listening device.

If there is more than one cable in the vicinity then all cables must be exposed in the joint hole. The signal detection/listening device should be applied to each cable in turn. A number of errors have occurred when it is thought that there is a good signal but it is subsequently found that there is a stronger signal in another cable.

Cable identifier’s have different characteristics, when confirming the signal ensure you are following the correct method for the device you are using.

Further confidence in the correct identification may be demonstrated by switching the signal device on and off proving the signal disappears from the identified cable.

When the correct cable has been identified the cable should, if the work is not continuous, be marked using approved cable identification marker tape, which should also be signed and dated. All other cables should be checked to ensure no old markers are present.

When using an LV cable identifier it may be necessary to remove steel tape armour where the armour shields the signal from the detector. Careful removal of the tape armours is permitted.

In some circumstances, on isolated LV cables it may be beneficial to use an HV cable identifier as a method of providing a positive identification. Fused leads must be used to make the connection due to the risk from connected customers.
If the LV cable to be worked upon finishes at a stop end, there may not be a suitable point to connect the transmitter beyond the point where it is hoped to confirm identification. If there is no suitable link box or three phase cut-out then the transmitter can be connected by opening the same LV cable at a convenient point beyond the work location. This point must have been proven to be on an LV cable by one of the other approved identification methods.

The identified LV cable should be opened using approved methods. The crocodile clips on the ends of the signalling device leads can then be applied to two phase conductors. Two cores must not be exposed at the same time and as soon as one crocodile clip is connected to the conductor, it must be insulated using a joint connector insulating patch. When identification is complete the connections will be removed one at a time and the exposed core covered with a patch before the second core is removed.

### 8.4.2 - Cable sheath identification

If an LV cable has a black plastic embossed outer sheath which has the embossing 600/1000V and is clearly visible on the sheath, this can be used as positive identification. Care must be taken to ensure that the embossing states 600/1000V as EHV cables can have black plastic embossed outer sheaths.

When the required cable has been positively identified by this method it is not necessary to expose other cables for identification.

Where the construction of the cable(s) is such that it can be clearly identified as an HV Cable i.e. red sheathed and embossed single core/triplex polymeric, or red sheathed CAS or PICAS type cables then their construction can be used to eliminate them if they are exposed and confirmed at the point of work.
8.4.3 - Digging back and locating a service joint or other identifiable LV apparatus on the LV mains cable

Excavation for cable identification can stop when the required cable has been positively identified by either of the following methods.

(1) Identification using a service joint

The LV cable to be worked upon must be exposed along its length until a service joint is exposed. To be positively identified as a service joint the service cable exiting the joint must be of the size and construction expected, the joint fully exposed and the service cable be clearly seen as going from the joint to either a house boundary or to street furniture.

Where it is not reasonably practicable to trace the service cable to a house boundary or street furniture then subject to the agreement of an appropriately experienced Field Engineer the cable may be identified as LV.

Careful examination of the cable plans must also be undertaken to ensure that no small section HV cables are present in the area.

Exposure of an LV plastic joint mould is not positive identification because LV joint moulds have been used to repair HV cable sheaths.

If there is any doubt whether the found joint is an LV joint then seek advice.

The cable between the identified service joint and the point of work must be fully exposed such that a running noose may be pulled between the two points.

(2) Identification using identifiable low voltage apparatus

Where there is identifiable low voltage apparatus such as a LV pillar etc., link box or cut-out in the vicinity of the point of work then this may be used as a method of identification. The cable between the point of entry to the identifiable low voltage apparatus and the point of work must be fully exposed such that a running noose may be pulled between the two points.

8.4.4 - Identification of cables supplying domestic properties or street furniture

It will often be possible to identify domestic or street furniture services as being low voltage cables by their markings (plastic embossed 600/1000V) or by the absence of HV cables (see Section 8.8).

Where work is to be undertaken on a service cable it is acceptable to use one of the following methods of identification.

- The cable is single phase, or connects to a single phase cut-out, and is within the boundaries of a domestic property.
- There are no high voltage cables shown in the immediate area which because of their small size could be confused with low voltage single phase service cables.
There will be circumstances when it is necessary to work on a service cable which cannot be identified by either of the above two methods or by positive identification by the methods summarised in Section 8.4.

In this case, or where there is any doubt about identification, the jointer will contact a UKPN appropriately experienced Field Engineer for advice. The Field Engineer shall check on site and endorse the LV Cable Identification Check Sheet to indicate that the cable has been identified as a low voltage cable.

8.4.5 - Use of current records and plans

This method shall only be used where there can be no doubt that the exposed cable is actually a low voltage cable.

Examples of this are

- In a rural area where the high voltage system is completely overhead and it is known that the only underground cables are low voltage

- On a housing estate with only low voltage cables and where any HV cables are in a different road to the proposed work.

It is important that full plans are available as it would be misleading if LV only plans are provided.

A cable may be positively identified as a LV cable if:

Complete cable plans and sections show only LV cables in the vicinity,

And

a thorough "CAT sweep" of the work area has revealed no other cables,

And

the excavated cable is in the position and depth indicated on the plan

Whenever this method of LV cable identification is used, plans showing the source substation HV cable routes must be available on site. Relevant plans of EHV cables and of any other power cables including, where known, those not belonging to UK Power Networks must also be made available to the operative.

If any other cables not on the plans are exposed, or the plans show an abandoned cable, one of the other methods of identification must be adopted.

8.5 Escalation Process

If any person is unable to positively identify an LV cable, for whatever reason, they must stop work immediately and contact a suitably qualified, competent and experienced person to confirm positive identification.

8.6 Elimination of HV cables

If none of the approved methods above can be used to positively identify the LV cable, all adjacent HV cables must be identified by following the methodology within DSR 01 007 or as described in 8.8 to eliminate them. Because of the risk of unrecorded cables, or cables
not owned by UK Power Networks, this does not positively identify any remaining cables as being LV. However in some circumstances it may be considered an appropriate method of reducing the risk of opening an HV cable.

8.7 Spiking LV Cables

If none of the above options are able to be applied, and a cable cannot be positively identified as LV, the only option left is for all of the cables to be de-energised and to spike the cable to be worked on. Control must be informed immediately before and after the cable is spiked.

8.8 Other indicators of cable operating voltage

(1) The following shall **NOT** be relied on as indicators of cable voltage:

- Presence of cable slabs or other external markers
- Depth of cable
- Position of cable relative to other cables
- Whether cable is armoured
- Type of armour
- Black plastic sheath without clear marking of LV voltage
- Colour of belt or core paper.

(3) Indicators when stripping cables

Having positively identified an LV cable there are other indications that may give a degree of confidence or alarm. It is recommended that even though the cable will have been positively identified a jointer should always look for the following indicators during the cable stripping process:

- Underneath the outer Hessian or lead sheath there is sometimes a marker ribbon that states whether the cable is LV or HV. This is not present on all cables.

- Having removed the lead sheath, the jointer should always check the amount of layers of belt papers that are removed. LV cables normally have between 7 and 10 layers, HV have 20 to 30 layers.

- Having removed the belt papers, count the number of cores. Are you expecting 3 cores? Are there 3 core LV cables or 4 or 5 core HV cables in the area? The above are only indications and are not to be used as positive identification. If you find that a cable has an indicator that you are not expecting, stop work immediately and seek advice/further clarification.
STOP work and seek advice

Do you have 1/500 plans, with relevant sections, HV & EHV Plans, LV Schematic Diagrams and a Task Instruction which specifies which method of identification is to be used?

Yes

Are you familiar with the cable types and understand what you are to do?

Yes

Are plans unequivocal about cable locations and all other cables identified or eliminated?

No

Could a plan error or the presence of other cables be a factor?

Yes

Does a CAT sweep indicate other cables?

Yes

STOP work and seek advice

No

Can a signal device be connected to the network in an approved manner?

Yes

Are all the cables shown on the plans at the point of work been exposed in the joint hole?

No

STOP work and seek advice

Yes

STOP work and seek advice

Is it a black plastic cable CLEARLY embossed 600/1000V?

Yes

Has the service been traced back to a house boundary or to street furniture?

No

You MUST use another method to identify the LV cable or seek advice

No

Does Field Engineer agree I.D.?

Yes

You MUST use another method to identify the LV cable or seek advice

No

You MUST use another method to identify the LV cable or seek advice

Yes

This is positive identification of an LV cable