Northern Ireland Electricity Networks

SAFETY ADVICE FOR CONTRACTORS:
WORKING IN THE VICINITY OF UNDERGROUND ELECTRICAL CABLES

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Foreward

This advice booklet is issued by Northern Ireland Electricity Networks (NIE Networks) to assist those involved in work or excavation in the vicinity of the underground electricity network.

It is based on NIE Networks' interpretation of the requirements of the Health and Safety Executive document HSG47 Avoiding Danger from Underground Services.

The advice in this document is not intended to be a substitute for the advice given in HSG47. It is intended to provide advice in relation to work in the vicinity of underground electrical cables and improve the communications between the contractor and NIE Networks.

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1.0 Introduction

Northern Ireland Electricity Networks owns and maintains the transmission and distribution grids, connecting your homes, businesses and communities to the energy you use every day.

1.1 Damage to live underground cables during excavation works is the cause of an increasing number of accidents which can result in severe burn injuries to people at work and disruption of consumers' electricity supplies. Occasionally such accidents prove fatal.

Injuries are rarely caused by direct electric shock but usually take the form of projectile impact injury and of burns to hands, face and body due to the explosive arcing current at the point of contact or any fire which may ignite.

The purpose of these recommendations is to promote greater awareness of the dangers present when work is undertaken near underground cables without adequate precautions and to indicate procedures and practices that will minimise the possibility of accidents occurring.

1.2 The guidance given is strongly commended to all organisations and persons involved in connection work, particularly the principle of the closest co-operation with NIE Networks who are generally the owners of underground cables which may be present on a site. This applies both to the planning and carrying out of work. From past records it is clear that the majority of accidents have been caused by failure to establish the presence of underground cables before work commences on a site and subsequently to take all practicable precautions for avoidance of danger. The advice is directed particularly at persons having legal responsibilities under The Construction (Design and Management) Regulations (NI) 2007. It will, also be helpful to those who have responsibilities under the following legislation:

- Health and Safety at Work (NI) Order 1978,
- The Management of Health and Safety at Work Regulations (NI) 2000,
- The Provision and use of Work Equipment Regulations (NI) 1999
- The Electricity at Work Regulations (NI) 1991.
- The Streetworks (NI) Order 1995

1.3 If further advice or information is required reference should be made to HSG 47 or directly to the Health and Safety Executive for Northern Ireland - see under HSENI in the telephone directory. Specific information or advice concerning the location of cables and advice on appropriate measures to be taken can be obtained from tNIE Networks. (For special case of privately owned cables see under section 3.)

When works are being planned information about the position of underground cables should be obtained from NIE Networks or other owners.

1.4 NIE Networks will do everything that is reasonably practicable to ensure information is made available provided reasonable notice (10 working days) is given, preferably by written application with details of the work location and work method.

- ***c850,000 consumers***
- ***2,200km transmission network***
- ***47,000km distribution network***
- ***300 major substations***
- ***8,137GWh electricity distributed***

2.0 Legal Obligations

2.1 The Construction (Design and Management) Regulations (NI) 2007 (CDM) apply to all construction projects and place responsibilities on Clients, Designers and contractors for the design, planning and management of all activities. This includes the identification of risk from underground services. Risks should be properly managed by action during the design, planning and execution phases of the project.

Before any operations or works to which these Regulations apply are commenced, and also during the progress thereof, the identification steps are to be suitable and sufficient and the controls implemented are to prevent so far as is reasonably practicable any risk of injury from an underground service or cable.

2.2 Under the wider application of the Health and Safety at Work (NI) Order 1978 the duties placed on an employer include, amongst other things, the provision and maintenance of systems of work that are, so far as is reasonably practicable, safe and without risks to health, and the provision of such information, instruction, training and supervision as is necessary to ensure, so far as is reasonably practicable, the health and safety at work of his employees and put them into effect in situations additional to those to which the CDM Regulations apply.

The Order also imposes on each employee a duty to take reasonable care for the safety of himself and of other persons who may be affected by his acts or omissions at work. He also has a duty to co-operate, so far as is necessary, to enable his employer to comply with any duty or requirement imposed on the employer.

NIE Networks has a legal obligation under the Streetworks Northern Ireland Order 1995 and the Electricity Safety, Quality and Continuity Regulations (NI) 2012 (ESQCR), to maintain records and plans of underground cables on public property and to make available relevant information at the request of an enquirer.

2.3 Other owners of underground cables should be prepared to make available relevant information, so far as is reasonably practicable, at the request of an enquirer.

3.0 Ownership of cables

Most cables, including service cables to buildings, belong to NIE Networks, even those in the highway. However, cables may be privately owned: street lighting cables, for example, may belong to the lighting authority. Privately owned cables may also be found on commercial, industrial, military or other sites as well as NIE Networks cables and the owners or occupiers of these sites need to be consulted.

4.0 Cable depths and protection

4.1 In most cases there is no visible indication of the location of an underground cable. On the other hand, particularly in streets, private land adjacent to substations, waterway footpaths, railway property, etc the existence of one or more cables should be assumed.

Underground electricity cables are usually buried between 0.45m and 1m below the surface of the ground, in ducts, or may have a layer of tiles, boards or coloured plastic tape placed approximately 150mm above them. However, it must be emphasised that cables are laid directly in the ground without marking or covers particularly on housing developments and this highlights the importance of adopting safe procedures.

4.2 Some cables have a mechanical protective outer layer of steel wire or tape, while others have only an outer serving of hessian or PVC overlaid on aluminium or lead sheaths. Plastic sheathed cables are usually coloured black or red and usually have the legend "electric cable" embossed throughout their length. Plastic sheathed electricity cables look very much like plastic water pipes and can also be easily mistaken for telephone cables. Consequently whenever an object is encountered which looks like a buried cable it should be treated as though it were a 'live' electric cable.

4.3 Occasionally, cables are terminated in the ground by means of a seal, sometimes with additional external mechanical protection. These 'pot-ended' cables, as they are called, may be live and should not be assumed to represent abandoned or disused cables.

If 'pot-ends' are encountered in an excavation, the advice contained in section 10 for exposed cables will equally apply.

Whenever an object is encountered which looks like a buried cable, it should be treated as though it were a live electric cable.

5.0 Cable location devices

One way of detecting the presence of live underground cables is by using cable location devices. It is recommended that such a device is always available on site when excavating in the vicinity of underground services.

With any cable location device the degree of confidence with which the presence of cable can be detected depends upon factors such as the capabilities of the device being used, the type and depth of the cable, the magnitude of the current it is carrying, the effects of other cables and metal pipes in close proximity and last, but not least, the skill and experience of the operator.

It may sometimes not be possible to detect the presence of a cable by means of a cable location device and if presence of a cable is suspected safe digging practices as described in HSG 47 should be observed. It is essential that those required to operate cable location devices are suitably trained and competent to do so.

Hence the absence of a positive indication must not be taken as proof that a cable is not present or that a cable present is not live.

It should be noted that all types of cable locator may be unable to distinguish between cables situated in close proximity and may represent them as a single cable.

It should be noted that in cables where there is little or no current flowing, for example, service connection cables to unoccupied premises or street lighting cables in the daytime, these may not be picked up on the 'power mode'.

6.0 Risks and responsibilities

6.1 Numerous incidents occur each year when live cables are damaged during the course of work on housing estates, construction sites, 6.1in streets and elsewhere. Injuries arising from such incidents are usually due to the effects of arcing when the metallic sheath of a cable and the conductor insulation are penetrated by a sharp object such as the point of a tool.

6.2 Although cable damage is often caused by excavating machines, it is also caused by the use of hand held tools such as pneumatic drills, crowbars, pins, picks, forks etc which bring the user close to a potential source of danger. Accidents can occur after cables have been exposed in spite of the provision of temporary protection and supports (see Section 10).

6.3 From the information already given in this document it will be seen that contractors and employers responsible for excavation work, or other work, where cables may be present, must anticipate the danger involved in striking a cable.

Most of the Regulations listed earlier in this document require a Risk Assessment to be carried out in order to identify risk and detail the control measures necessary to minimise that risk. In particular, reference should be made to HS(G)47 when carrying out Risk Assessments.

Before the work commences, and during the progress of the work, they have a responsibility

to take measures (which should include adequate training of supervisors and operatives) which will overcome the hazard. These measures should include adequate supervision of employees to ensure that the appropriate precautions are stringently applied.

They should embody the principles that:

(i) all cables should be assumed live and

(ii) all persons involved in the work should exercise care for the safety of themselves and others.

All persons involved in the work should exercise care for the safety of themselves and others.

7.0 Classification of works

7.1 In the cases of all works, including works of demolition, development and construction, NIE Networks (or other owner of cables) should be consulted at an early stage. NIE Networks will whenever possible make available information which may include a copy of a cable plan indicating locations of any of their cables buried in the proposed work area to enable the works concerned to proceed, taking into account the safety measures required. This will assist the contractor to plan a safe working procedure after consulting NIE Networks and will save time in the execution of the work and cause minimum inconvenience to the public.

Works may be considered as being in one of the following classes:-

(a) Planned Works – where advance statutory notification is required.

(b) Emergency Works and "excepted works".

7.2 In the case of all planned works, including works of demolition, development and construction, NIE Networks (or other owner of cables) should be consulted at an early stage (10 working days). NIE Networks will wherever possible make available information which may include a copy of a cable plan indicating locations of any of their cables buried in the proposed work area to enable the works concerned to proceed, taking into account the safety measures required. This will assist the contractor to plan a safe working procedure after consulting NIE Networks and will save time in the execution of the work and cause minimum inconvenience to the public. These safety measures could take the form of adopting methods of working as discussed in section 9 below or, diversion of the cable or making the cable dead. If the appropriate information is not available from NIE Networks at the time of the enquiry this will be made known to the enquirer, who will also be told when it can be provided.

7.3 Information on the position and depth of cables in the proposed work area should then be recorded on plans (or if impracticable indicated on site) by those responsible for the works so that it can be readily understood by the contractor or organisation carrying out the work. It is essential that consultants or main contractors who may have initially consulted NIE Networks should pass on the necessary detailed information to sub-contractors engaged on excavation and groundwork. It is essential that colour copies of any plans or drawings are provided for the operatives engaged in the excavation and groundwork.

Any sub-contractor or his appointed representative who needs safety information should preferably participate directly at the work planning stage and any subsequent meeting with NIE Networks. Before digging commences the area to be excavated should be carefully marked out and then, where appropriate, by the use of a cable location device the position of each cable in the vicinity should be determined as far as possible.

The line of any cable found to be within or adjacent to the area to be excavated should be marked with chalk or paint and with wooden pegs in grassed or unsurfaced areas. (Steel pins or spikes, or long pegs which could damage any cables laid at shallow depth, should not be used for this purpose).

7.4 Trial holes should be excavated as necessary to confirm that the proposed line of trench can be followed and also to locate the line and depth of any electric cable believed to lie in the area of excavation. Hand digging methods should be

7.0 Classification of works

used to the maximum extent possible with special care being exercised when digging above or close to the assumed line of the cable. As an additional safeguard repeat checks should be made with a cable location device as the work proceeds in an effort to determine the position of any cable more precisely. Once the trial holes have confirmed that the proposed line of trench can be followed and the position of any cables has been determined, excavation may proceed.

If difficulty is experienced in locating the position of a cable recorded on the layout plan or in the position indicated by those responsible for the works the assistance of NIE Networks should be sought but it should be recognised that some time may elapse before NIE Networks representative can arrive on site. If digging has to proceed in the meantime then extreme care must be exercised.

7.5

Cables embedded in or situated close to an underground structure, such as a manhole or a surface inspection box, constitute a special hazard for operatives demolishing or otherwise carrying out work on the fabric of the structure. Consequently, it is particularly important that before any such work is commenced excavations are made to determine the precise location of any electric cables which could be affected by the work.

All excavation work should be carried out in accordance with safe digging practices described in section 8.

7.6

If the contractor has completed the steps detailed in sections 7.1 to 7.5 NIE Networks may decide to isolate or divert the cable, however it should be appreciated that some time may elapse between the request for the isolation or diversion and the work taking place.

It is essential that colour copies of any plans or drawings are provided for the operatives engaged in the excavation and groundwork.

8.0 Safe digging practices

8.1 When excavating in close proximity to cables, trial holes should be used as necessary to establish the presence or otherwise of cables. In the light of the information obtained work can then proceed with a greater measure of confidence. Hand digging methods should be used wherever practicable in the immediate vicinity of the indicated line of cables. In particular mechanical excavators or power tools other than for breaking paved surfaces should not be used within 0.5m to the individual line of the cable unless the prior agreement of NIE Networks has been obtained. In special cases a greater distance may be specified by NIE Networks. Over penetration by hand-held power tools employed to break up paved surfaces is a common source of accidents. Where such tools are employed care should be taken to guard against over penetration and as much as possible of the excavation should be carried out with hand tools. In the vicinity of cellars, over bridges or other structures which may have caused cables to be laid at unusually shallow depths power tools should only be used if other methods of excavation are impracticable. Spades and shovels should be used in preference to other tools.

If a cable is found to be embedded in concrete or other major obstacles which has to be broken out NIE Networks or other owner of the cable should be asked to make the cable dead before work is begun.

Picks, pins or forks may be used to free lumps of stone etc and break up hard layers of chalk or sandstone but picks should not be used in soft clay or other soft soils where cables are present.

8.2 A banksman should always be in attendance to ensure a continuous watch is kept for signs of cables as the work progresses. When observation can be supplemented by the progressive use of a cable locator as work proceeds, the likelihood of an early warning of the proximity of cables is increased.

8.3 It should be recognised that cable depths for 33 kV and 110 kV cables shown on drawings or other records may be unreliable as the ground level may have changed since the cables were laid and records last updated. The position of cables may be different from those shown on records due to the alteration of reference points such as kerb lines, or as a result of third party interference during excavation and reinstatement subsequent to cable laying.

8.4 Use of a Mole.

Any trenchless installation must be planned with the objective of minimising risks to members of the public, operatives and installations below and above ground. Care should be taken in selecting the route, method and equipment most suited to the task.

A detailed safety plan should be established at the project planning stage.

8.0 Safe digging practices

A detailed safety plan should be established at the project planning stage and should address the following points -

Are underground electricity cables present?

Can their location and depth be accurately established?

Is the minimum safe clearance known? This can vary dependent on voltage and type of cable.

What are the ground conditions?

All sites should be visited and inspected in detail. Evidence of recent redevelopment would be significant as this would affect the accuracy of the original records.

Before progressing further with the plan, the information should be reviewed to confirm the feasibility of horizontal directional drilling and/or impact moling.

With the foregoing confirmed the next stage of planning would be the preparation of a detailed borehole path. The degree to which this could be determined in detail depends upon confirming the location and depth of all electricity cables. This can only be safely carried out by excavating trial holes to confirm line and depth of all cables in the path of the bore.

A minimum clearance of 500mm is required for LV cables.

Further information can be obtained from Trenchless Methods of Construction Technical Note 127 or Horizontal Directional Drilling and Impact Moling IGE/SR/26 .

9.0 Exposed cables

All exposed cables should be given suitable protection against damage. Contractors and employers are urged to take into account any advice that may be given by NIE Networks or other owner. A Suitable and Sufficient Risk Assessment should be formulated in relation to the excavation, support and protection of underground electrical services.

Exposed lengths greater than 1m should be supported with slings or props. Planks should be placed over cables crossing a trench. Any cables lying on the bottom of an excavation should be protected by means of wooden planks, troughing, or other suitable means, but care must be taken not to use materials or equipment which could penetrate the outer sheath of cables.

Cables which are exposed should not be used as hand or foot holds when climbing into or out of the excavation. Cables are sometimes laid on a layer of riddled soil or sand and are covered in a similar manner to prevent damage from sharp stones or other hard fill. A layer of tiles may also be provided in some cases.

When such cables are exposed those responsible for the excavation should be careful to restore conditions around the cable to their former state. In particular, pieces of rock, large stones, hardcore or surplus concrete should not be tipped into open cable trenches.

10.0 Damaged cables

If a cable suffers damage, however slight, NIE Networks should be informed immediately by calling 03457 643643. The contractor should take steps to keep people well clear of the cable until it has been made safe by a representative of NIE Networks.

11.0 New housing sites

Underground cables installed within the confines of partly completed housing developments are especially prone to damage from the numerous operations which are carried out by the various parties working in and around building sites.

It is clearly necessary that close liaison be maintained between the developers, NIE Networks and other utilities so that the position of electric cables is known to all concerned. It is important also that each utility keeps to his allotted position in the footway. The latecomers should be extra careful not to damage plant already installed, particularly service crossings. The use of a common services trench is helpful but this is normally only possible in the case of new town and similar highly co-ordinated schemes.

12.0 Demolition sites

Special problems can arise in the case of NIE Networks cables and service termination equipment in derelict property or on demolition sites. Those parties concerned with demolition works have a statutory duty to give adequate notice (10 working days) of intention to demolish premises, to enable NIE Networks to disconnect cables and equipment before demolition is commenced. Demolition should not commence until NIE Networks has confirmed in writing that disconnection or other appropriate action has been taken.

In the special case of buildings or plant or large industrial or commercial sites, which may be supplied by underground cables which are the property of the site occupier, the contractor, before commencing demolition, should contact the site owner or occupier to confirm that all cables to/or on the site concerned have in fact been made dead.

13.0 Contacting NIE Networks

All contact with NIE Networks should be via the Customer Helpline telephone number:

03457 643643

System Details

NIE Networks' Contact Centre is open 24 hours, 7 days a week. During normal business hours (Monday – Friday 08:30 to 17:00), callers will hear a menu offering 2 options:

1 Report a fault
2 All other calls

Callers selecting option 2 will then be offered a further 5 options:

1 Moving house, bills, keypad queries etc (Supplier related issues)
2 New electricity connections or alteration work
3 Named person
4 All other calls
5 Hear the options again

Which option to choose

To report a possible fault where contact has been made with NIE Networks equipment:

Select Option 1 (Faults) where contact has been made with NIE Networks equipment - overhead or underground. Contact NIE Networks immediately on 03457 643643 and select Option 1 to report the incident.

If all call agents are busy taking other fault calls, your call will be routed to an automated call handling service where you should Press 1, to report "a hazardous or life threatening situation". If a call agent is not available to take your call, you will be asked to key in a telephone number so we can call you back as soon as possible.

To get information or an update about existing services in a new development:

Select Option 2 (All other calls) and then Option 4 (All other calls). Please provide the location and the nature of the proposed work.

To contact an individual where there is ongoing business

Select Option 2 (All other calls) and then Option 3. State the name of the person you have been dealing with and your call will be transferred. Please note that the person may have a direct line and if the number has been quoted on correspondence, it would be preferable to use that number.

NB: If you have received a quotation from NIE Networks for the proposed work, then select Option 2 (All other calls) and then Option 2 (new electricity connections or alteration work).

To report NIE Networks equipment that has been exposed during works

Select Option 1 (Faults). Contact NIE Networks immediately on 03457 643643 and select Option 1 to report the incident.

If all call agents are busy taking other fault calls, your call will be routed to an automated call handling service where you should Press 1, to report "a hazardous or life threatening situation". If a call agent is not available to take your call, you will be asked to key in a telephone number so we can call you back as soon as possible.

Appendix 1

Northern Ireland Electricity Networks Underground Equipment

NIE Networks has several different sizes and types of underground cable, cable joints and underground distribution boxes (UDB).

1. Low Voltage (LV) Cables

400 V	Mains Cables
230V	Service Cables

2. High Voltage (HV) Cables

6.6 Kv	Solid
11 kV	Solid
33 kV	Solid and Oil filled
110 kV	Solid and Oil filled

3. Pilot Cables

Protection system cables
Supervisory control cables

4. LV Joints – Straight through, breeches, tee off and multi joints and pot ends
HV Joints - Straight through, breeches, and pot ends

5. Underground Distribution Boxes (UDB's) – mainly found in the greater Belfast area however, there are some UDB's located in various towns throughout Northern Ireland. They are usually positioned in footpaths and/or pedestrian areas and if your work area is within 2m of a UDB, you need to contact NIE Networks for further advice.

This is NIE Networks equipment which is underground and out of sight. There is also a lot of equipment above ground such as wooden poles, overhead powerlines, stay wires, mini-pillars, transformers, which also require you to take care when working in their vicinity. If in any doubt contact NIE Networks on 03457 643 643.

Appendix 2

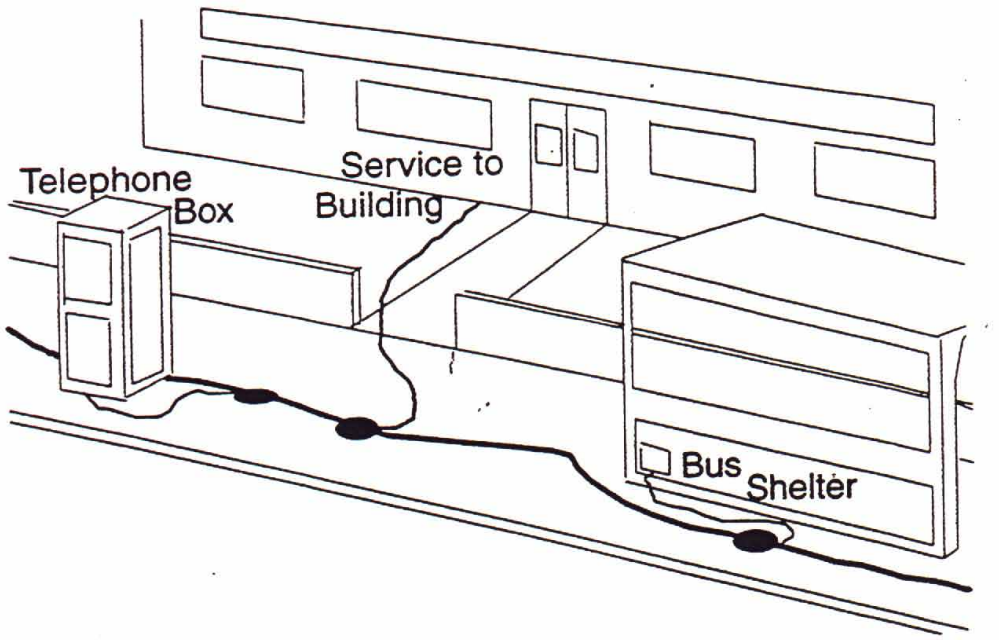


Figure 1.1

Service joints and cables are usually found in the footpath. For a number of reasons, it is not always possible to detail the exact position of service cables on mains drawings. Before starting work, look around to see what apparatus is likely to have an electricity service.

When excavating in the footpath in towns and cities and villages you can be sure of coming across a service cable before too long. In order to help you avoid damaging electricity cables, special attention must be paid to the following points:

1. Always have cable drawings with you on site and check them before starting excavation. Remember that some cables may not belong to NIE, and therefore will not be shown on the drawings.

2. Always have a Cable Avoidance Tool (CAT) on site, using it before starting, to help you survey the site.

3. Always mark out where electricity cables are in accordance with the CAT signals. Remember that the CAT, in the 'power', mode will not always detect the presence of cables especially if they are not carrying any current at the time. However, when used in conjunction with the 'Genny' or in the 'Radio' mode, it is more likely that these cables can be detected.

4. Always look around, see if there is anything nearby that would have an electricity service, such as: lamp columns, phone boxes, bus shelters, traffic lights etc.

5. Always continue using the CAT during the entire excavation process, you may be only inches away from a live cable.

6. Extreme care must be exercised when using mechanical diggers in footpaths.

Appendix 2

How to avoid damaging electricity service cables

Damage to service cables form the largest proportion of cable damage incidents. Do not underestimate the danger of LV service cables, they have the potential to kill!

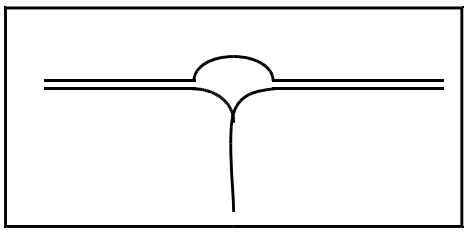
Service cables are, by nature, difficult to locate due to their unpredictable route and depth. This unpredictability results from a number of circumstances:

(a) The service cable may be moved by other parties who have excavated in the area.

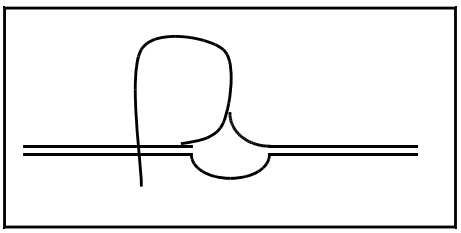
(b) Service cables vary in size, the smaller of them may weave around obstacles when they are installed.

(c) When a service cable is jointed onto a main cable it can approach the main cable in many different ways. Some examples are shown below:

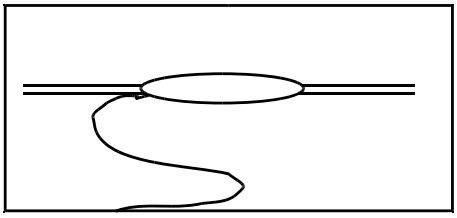
1. At right angles from the same side



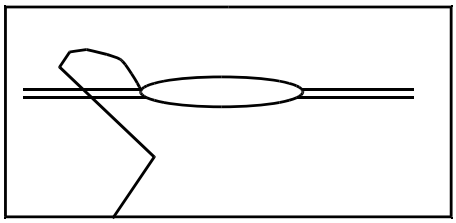
2. At right angles from the opposite side



3. From the left on the same side

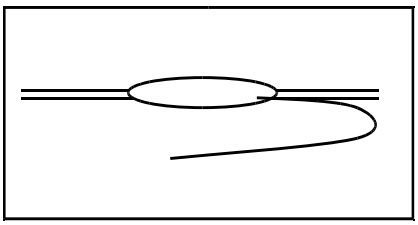


4. From the left on the opposite side

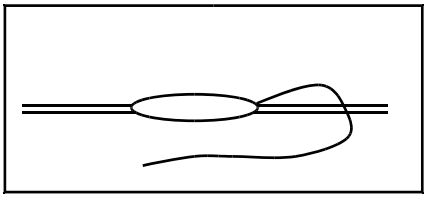


Appendix 2

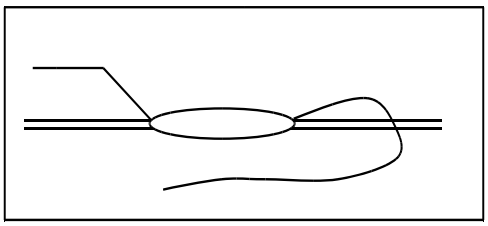
5. From the right on the same side



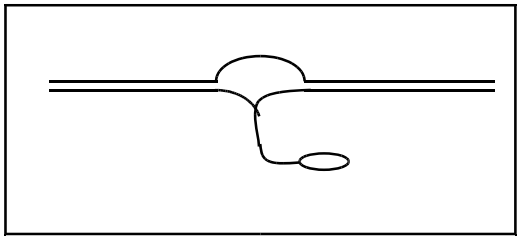
6. From the right on the opposite side

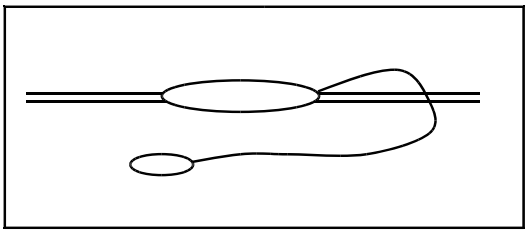


(d) There may be more than one cable connected to one joint.



(e) Some service cables may have been pot ended, but they are still live and dangerous if interfered with.





(f) Most plan drawings show service cables running in a straight line, but this is only intended to give a guide to the estimated position of the service joint and the point of cable entry into the building. The service cable will not necessarily be running in a straight line as shown in Figure 1.1.

Appendix 2

7. Spades and shovels should be used in preference to other tools and must not be thrown or spiked into the ground.

8. Picks and forks should only be used for breaking up top materials and when the ground is very hard. NB: forks should have short chisel ended tines.

9. Never assume that service cables follow a straight line or that they run at a constant depth.

10. Never handle or attempt to move service cables.

11. Never use exposed electricity cables as a convenient step or handhold.

You should obtain a copy of the Health and safety Executive Guidance Note HS(G)47 "Avoiding Danger from Underground Services". This outlines the dangers which can arise from work near underground services and gives advice on how to reduce the risk.

For more information contact
NIE Networks Customer Helpline 03457 643 643
or visit nienetworks.co.uk