

Avoiding danger from overhead power lines

Guidance Note GS6 (Fourth edition)



This general series guidance note is for people who may be planning to work near overhead lines where there is a risk of contact with the wires, and describes the steps you should take to prevent contact with them. The fourth edition makes the advice easier to follow and has brought the supporting visuals up to date. The guidance has not fundamentally changed from the previous version.

It is primarily aimed at employers and employees who are supervising or in control of work near live overhead lines, but it will also be useful for those who are carrying out the work.

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Introduction

1 Every year people at work are killed or seriously injured when they come into contact with live overhead electricity power lines. These incidents often involve:

- machinery, eg cranes, lorry-loader cranes, combine harvesters, and tipping trailers;
- equipment, eg scaffold tubes and ladders;
- work activities, eg loading, unloading, lifting, spraying, and stacking.

2 If a machine, scaffold tube, ladder, or even a jet of water touches or gets too close to an overhead wire, then electricity will be conducted to earth. This can cause a fire or explosion and electric shock and burn injuries to anyone touching the machine or equipment. An overhead wire does not need to be touched to cause serious injury or death as electricity can jump, or arc, across small gaps.

3 One of the biggest problems is that people simply do not notice overhead lines when they are tired, rushing or cutting corners. They can be difficult to spot, eg in foggy or dull conditions, when they blend into the surroundings at the edge of woodland, or when they are running parallel to, or under, other lines.

4 Always assume that a power line is live unless and until the owner of the line has confirmed that it is dead.

5 This guidance is for people who may be planning to work near overhead lines where there is a risk of contact with the wires, and describes the steps you should take to prevent contact with them. It is primarily aimed at employers and employees who are supervising or in control of work near live overhead lines, but it will also be useful for those who are carrying out the work.

Types of overhead power lines and their heights

6 Most overhead lines have wires supported on metal towers/pylons or wooden poles – they are often called ‘transmission lines’ or ‘distribution lines’. Some examples are shown in Figures 1–3.



Figure 1 275 kV transmission line



Figure 2 11 kV distribution line



Figure 3 400 V distribution line

7 Most high-voltage overhead lines, ie greater than 1000 V (1000 V = 1 kV) have wires that are bare and uninsulated but some have wires with a light plastic covering or coating. All high-voltage lines should be treated as though they are uninsulated. While many low-voltage overhead lines (ie less than 1 kV) have bare uninsulated wires, some have wires covered with insulating material. However, this insulation can sometimes be in poor condition or, with some older lines, it may not act as effective insulation; in these cases you should treat the line in the same way as an uninsulated line. If in any doubt, you should take a precautionary approach and consult the owner of the line.

8 There is a legal minimum height for overhead lines which varies according to the voltage carried. Generally, the higher the voltage, the higher the wires will need to be above ground (see Figure 4). Equipment such as transformers and fuses attached to wooden poles and other types of supports will often be below these heights. There are also recommended minimum clearances published by the Energy Networks Association (ENA Technical Specification 43–8 *Overhead Line Clearances*)¹ between the wires and structures such as buildings and lamp posts.

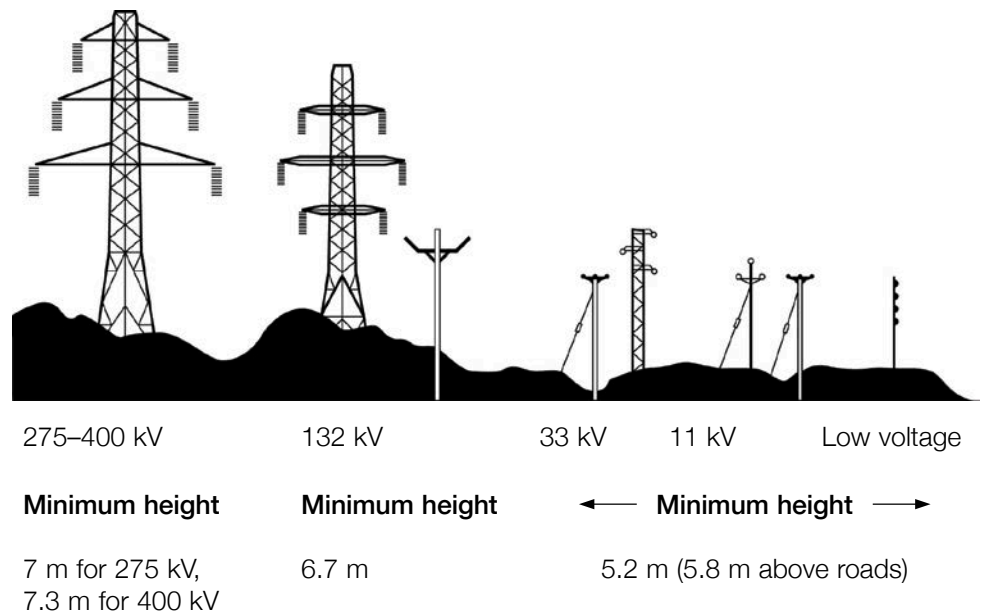


Figure 4 Minimum heights above ground level for overhead power lines

What does the law require?

9 The law requires that work may be carried out in close proximity to live overhead lines only when there is no alternative and only when the risks are acceptable and can be properly controlled. You should use this guidance to prepare a risk assessment that is specific to the site. Guidance on how to carry out a risk assessment is available at www.hse.gov.uk/toolbox/managing/managingtherisks.htm.

10 Businesses and employees who work near to an overhead line must manage the risks. Overhead line owners have a duty to minimise the risks from their lines and, when consulted, advise others on how to control the risks. The line owner will usually be an electricity company, known as a transmission or distribution network operator, but could also be another type of organisation, eg Network Rail, or a local owner, eg the operator of a caravan park. More details about legal responsibilities can be found in Annex 1.

Preventing overhead line contact accidents

11 Good management, planning and consultation with interested parties before and during any work close to overhead lines will reduce the risk of accidents. This applies whatever type of work is being planned or undertaken, even if the work is temporary or of short duration. You should manage the risks if you intend to work within a distance of 10 m, measured at ground level horizontally from below the nearest wire.

Remove the risk

12 The most effective way to prevent contact with overhead lines is by not carrying out work where there is a risk of contact with, or close approach to, the wires.

13 If you cannot avoid working near an overhead line and there is a risk of contact or close approach to the wires, you should consult its owner to find out if the line can be permanently diverted away from the work area or replaced with underground cables. This will often be inappropriate for infrequent, short-duration or transitory work.

14 If this cannot be done and there remains a risk of contact or close approach to the wires, find out if the overhead line can be temporarily switched off while the work is being done. The owner of the line will need time to consider and act upon these types of requests and may levy a charge for any work done.

Risk control

15 If the overhead line cannot be diverted or switched off, and there is no alternative to carrying out the work near it, you will need to think about how the work can be done safely. If it cannot be done safely, it should not be done at all. Your site-specific risk assessment will inform the decision. Things to consider as part of your risk assessment include:

- the voltage and height above ground of the wires. Their height should be measured by a suitably trained person using non-contact measuring devices;
- the nature of the work and whether it will be carried out close to or underneath the overhead line, including whether access is needed underneath the wires;
- the size and reach of any machinery or equipment to be used near the overhead line;
- the safe clearance distance needed between the wires and the machinery or equipment and any structures being erected. If in any doubt, the overhead line's owner will be able to advise you on safe clearance distances;
- the site conditions, eg undulating terrain may affect stability of plant etc;
- the competence, supervision and training of people working at the site.

16 If the line can only be switched off for short periods, schedule the passage of tall plant and, as far as is possible, other work around the line for those times.

17 Do not store or stack items so close to overhead lines that the safety clearances can be infringed by people standing on them.

Working near but not underneath overhead lines – the use of barriers

18 Where there will be no work or passage of machinery or equipment under the line, you can reduce the risk of accidental contact by erecting ground-level barriers to establish a safety zone to keep people and machinery away from the wires. This area should not be used to store materials or machinery. Suitable barriers can be constructed out of large steel drums filled with rubble, concrete blocks, wire fence earthed at both ends, or earth banks marked with posts.

- If steel drums are used, highlight them by painting them with, for example, red and white horizontal stripes.
- If a wire fence is used, put red and white flags on the fence wire.
- Make sure the barriers can be seen at night, perhaps by using white or fluorescent paint or attaching reflective strips.

19 The safety zone should extend 6 m horizontally from the nearest wire on either side of the overhead line. You may need to increase this width on the advice of the line owner or to allow for the possibility of a jib or other moving part encroaching into the safety zone. It may be possible to reduce the width of the safety zone but you will need to make sure that there is no possibility of encroachment into the safe clearance distances in your risk assessment.

20 Where plant such as a crane is operating in the area, additional high-level indication should be erected to warn the operators. A line of coloured plastic flags or 'bunting' mounted 3–6 m above ground level over the barriers is suitable. Take care when erecting bunting and flags to avoid contact or approach near the wires.

Passing underneath overhead lines

21 If equipment or machinery capable of breaching the safety clearance distance has to pass underneath the overhead line, you will need to create a passageway through the barriers, as illustrated in Figure 5. In this situation:

- keep the number of passageways to a minimum;
- define the route of the passageway using fences and erect goalposts at each end to act as gateways using a rigid, non-conducting material, eg timber or plastic pipe, for the goalposts, highlighted with, for example, red and white stripes;
- if the passageway is too wide to be spanned by a rigid non-conducting goalpost, you may have to use tensioned steel wire, earthed at each end, or plastic ropes with bunting attached. These should be positioned further away from the overhead line to prevent them being stretched and the safety clearances being reduced by plant moving towards the line;
- ensure the surface of the passageway is levelled, formed-up and well maintained to prevent undue tilting or bouncing of the equipment;
- put warning notices at either side of the passageway, on or near the goalposts and on approaches to the crossing giving the crossbar clearance height and instructing drivers to lower jibs, booms, tipper bodies etc and to keep below this height while crossing;
- you may need to illuminate the notices and crossbar at night, or in poor weather conditions, to make sure they are visible;
- make sure that the barriers and goalposts are maintained.



Figure 5 Typical passageway through barriers

22 On a construction site, the use of goalpost-controlled crossing points will generally apply to all plant movements under the overhead line.

Working underneath overhead lines

23 Where work has to be carried out close to or underneath overhead lines, eg road works, pipe laying, grass cutting, farming, and erection of structures, and there is no risk of accidental contact or safe clearance distances being breached, no further precautionary measures are required.

24 However, your risk assessment must take into account any situations that could lead to danger from the overhead wires. For example, consider whether someone may need to stand on top of a machine or scaffold platform and lift a long item above their head, or if the combined height of a load on a low lorry breaches the safe clearance distance. If this type of situation could exist, you will need to take precautionary measures.

25 If you cannot avoid transitory or short-duration, ground-level work where there is a risk of contact from, for example, the upward movement of cranes or tipper trailers or people carrying tools and equipment, you should carefully assess the risks and precautionary measures. Find out if the overhead line can be switched off for the duration of the work. If this cannot be done:

- refer to the Energy Networks Association (ENA) publication *Look Out Look Up! A Guide to the Safe Use of Mechanical Plant in the Vicinity of Electricity Overhead Lines.*² This advises establishing exclusion zones around the line and any other equipment that may be fitted to the pole or pylon. The minimum extent of these zones varies according to the voltage of the line, as follows:
 - low-voltage line – 1 m;
 - 11 kV and 33 kV lines – 3 m;
 - 132 kV line – 6 m;
 - 275 kV and 400 kV lines – 7 m;
- under no circumstances must any part of plant or equipment such as ladders, poles and hand tools be able to encroach within these zones. Allow for uncertainty in measuring the distances and for the possibility of unexpected movement of the equipment due, for example, to wind conditions;
- carry long objects horizontally and close to the ground and position vehicles so that no part can reach into the exclusion zone, even when fully extended. Machinery such as cranes and excavators should be modified by adding physical restraints to prevent them reaching into the exclusion zone. Note that insulating guards and/or proximity warning devices fitted to the plant without other safety precautions are not adequate protection on their own;
- make sure that workers, including any contractors, understand the risks and are provided with instructions about the risk prevention measures;
- arrange for the work to be directly supervised by someone who is familiar with the risks and can make sure that the required safety precautions are observed;
- if you are in any doubt about the use of exclusion zones or how to interpret the ENA document, you should consult the owner of the overhead line.

26 Where buildings or structures are to be erected close to or underneath an overhead line, the risk of contact is increased because of the higher likelihood of safety clearances being breached. This applies to the erection of permanent structures and temporary ones such as polytunnels, tents, marquees, flagpoles, rugby posts, telescopic aerials etc. In many respects these temporary structures pose a higher risk because the work frequently involves manipulating long conducting objects by hand.

27 The overhead line owner will be able to advise on the separation between the line and structures, for example buildings using published standards such as ENA Technical Specification 43–8 *Overhead Line Clearances*.¹ However, you will need to take precautions during the erection of the structure. If the overhead line cannot be diverted or switched off then you should take account of the guidance in paragraphs 23 to 26 relating to working underneath such lines.

28 Consider erecting a horizontal barrier of timber or other insulating material beneath the overhead line to form a roof over the construction area – in some cases an earthed, steel net could be used. This should be carried out only with the agreement of the overhead line owner, who may need to switch off the line temporarily for the barrier to be erected and dismantled safely.

29 Ideally, work should not take place close to or under an overhead line during darkness or poor visibility conditions. Dazzle from portable or vehicle lighting can obscure rather than show up power lines.

Working near overhead lines connected to buildings

30 Sometimes, work needs to be carried out near uninsulated low-voltage overhead wires, or near wires covered with a material that does not provide effective insulation, connected to a building. Examples of such work are window cleaning, external painting or short-term construction work. If it is not possible to re-route or have the supply turned off, the line's owner, eg the distribution network operator, may be able to fit temporary insulating shrouds to the wires, for which a charge may be levied. People, plant and materials still need to be kept away from the lines.

Emergency procedures

31 If someone or something comes into contact with an overhead line, it is important that everyone involved knows what action to take to reduce the risk of anyone sustaining an electric shock or burn injuries. Key points are:

- never touch the overhead line's wires;
- assume that the wires are live, even if they are not arcing or sparking, or if they otherwise appear to be dead;
- remember that, even if lines are dead, they may be switched back on either automatically after a few seconds or remotely after a few minutes or even hours if the line's owner is not aware that their line has been damaged;
- if you can, call the emergency services. Give them your location, tell them what has happened and that electricity wires are involved, and ask them to contact the line's owner;
- if you are in contact with, or close to, a damaged wire, move away as quickly as possible and stay away until the line's owner advises that the situation has been made safe;
- if you are in a vehicle that has touched a wire, either stay in the vehicle or, if you need to get out, jump out of it as far as you can. Do not touch the vehicle while standing on the ground. Do not return to the vehicle until it has been confirmed that it is safe to do so;

- be aware that if a live wire is touching the ground the area around it may be live. Keep a safe distance away from the wire or anything else it may be touching and keep others away.

Industry-specific guidance

32 HSE and other organisations publish industry and sector-specific guidance based on this guidance. The main industries and sectors covered by this are construction, agriculture, horticulture, forestry and arboriculture. The Energy Networks Association (ENA), the body representing transmission and distribution network operating companies, also publishes guidance leaflets (see the References section).

Annex 1 The law

1 The Health and Safety at Work etc Act 1974 (HSW Act) places responsibilities on everyone concerned with work activities, including employers, the self-employed and employees.

Regulations:

www.legislation.gov.uk/ukpga/1974/37/contents

2 The Management of Health and Safety at Work Regulations 1999 require that:

- risks are properly assessed and controlled;
- employees are provided with adequate health and safety training;
- employers who share a workplace consult and co-ordinate with each other.

Regulations:

www.legislation.gov.uk/uksi/1999/3242/contents/made

3 Regulation 9 of The Provision and Use of Work Equipment Regulations 1998 requires all people who use work equipment to have received adequate training in the use of that equipment.

Regulations:

www.legislation.gov.uk/uksi/1998/2306/contents/made

Approved Code of Practice:

Safe use of work equipment. Provision and Use of Work Equipment Regulations 1998. Approved Code of Practice and guidance L22 (Third edition) HSE Books 2008 ISBN 978 0 7176 6295 1 www.hse.gov.uk/pubns/books/l22.htm

4 The Electricity at Work Regulations 1989 require precautions to be taken against the risk of death or personal injury from electricity in work activities. Regulation 14 addresses live work activities, which include working on, or so near, live overhead lines that there is a risk of injury.

Regulations:

www.legislation.gov.uk/ukxi/1989/635/contents/made

Guidance:

Memorandum of guidance on the Electricity at Work Regulations 1989. Guidance on Regulations HSR25 (Second edition) HSE Books 2007 ISBN 978 0 7176 6228 9 www.hse.gov.uk/pubns/books/hsr25.htm

5 The Electricity Safety Quality and Continuity Regulations 2002 require, among other things, owners of overhead lines to ensure that they are at the appropriate height and meet certain standards.

Regulations:

www.legislation.gov.uk/ukxi/2002/2665/contents/made

Guidance:

www.berr.gov.uk/files/file26709.pdf

6 The Construction (Design and Management) Regulations 2007 place duties on construction clients, designers and contractors to plan and organise work so as to avoid danger from energy distribution networks.

Regulations:

www.legislation.gov.uk/ukxi/2007/320/contents/made

Approved Code of Practice:

Managing health and safety in construction. Construction (Design and Management) Regulations 2007. Approved Code of Practice L144 HSE Books 2007 ISBN 978 0 7176 6223 4 www.hse.gov.uk/pubns/books/l144.htm

References

1 ENA Technical Specification 43–8 *Overhead Line Clearances*
www.energynetworks.org/electricity/

2 *Look Out Look Up! A Guide to the Safe Use of Mechanical Plant in the Vicinity of Electricity Overhead Lines* Energy Networks Association (ENA)
www.energynetworks.org/electricity/

Further reading

Agriculture

Working safely near overhead electricity power lines Agriculture Information Sheet AIS8(rev3) HSE Books 2012 www.hse.gov.uk/pubns/ais8.htm

Safety information for farmers and agricultural contractors ENA 2007
<http://energynetworks.squarespace.com/agriculture/>

Safety information for farmers utilising polytunnels ENA 2008
<http://energynetworks.squarespace.com/polytunnels/>

Construction

Guidance is published by HSE under the heading *Electricity – Overhead power lines* at www.hse.gov.uk/construction/safetytopics/overhead.htm

Safe use of Lorry Loaders – Best practice guide the Association of Lorry Loader Manufacturers and Importers (ALLMI) and the Construction Plant-hire Association (CPA) www.allmi.com

Safety information for demolition companies ENA 2008
<http://energynetworks.squarespace.com/demolition/>

Safety information for scaffolders ENA 2007
<http://energynetworks.squarespace.com/scaffolders/>

Quarries

Guidance is published by HSE at www.hse.gov.uk/quarries/hardtargt/electricity.htm

Arboriculture and forestry

Treework web pages: www.hse.gov.uk/treework/safety-topics/power-lines.htm

Safety information for tree trimming near overhead power lines ENA 2008
<http://energynetworks.squarespace.com/tree-trimming/>

Landscaping and ground maintenance

Safety information for landscaping and ground maintenance workers ENA 2011
<http://energynetworks.squarespace.com/tree-trimming/>

Railways

Advice in relation to railways is available at www.rail-reg.gov.uk/upload/pdf/rgd-2011-05-web.pdf

Emergency services

Safety advice for the fire service ENA 2007
<http://energynetworks.squarespace.com/fire-service/>

Safety advice for the police service ENA 2007
<http://energynetworks.squarespace.com/police/>

Further information

For information about health and safety, or to report inconsistencies or inaccuracies in this guidance, visit www.hse.gov.uk/. You can view HSE guidance online and order priced publications from the website. HSE priced publications are also available from bookshops.

This guidance is issued by the Health and Safety Executive. Following the guidance is not compulsory, unless specifically stated, and you are free to take other action. But if you do follow the guidance you will normally be doing enough to comply with the law. Health and safety inspectors seek to secure compliance with the law and may refer to this guidance.

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