

Engineering Recommendation G55

Issue 4 2019

Safe tree working in proximity to overhead
electric lines

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Last published, 2013

Revised, 2019

Amendments since publication

Issue	Date	Amendment
Issue 2	September 2008	Revision to take in to account developments in a maturing vegetation management industry and to avoid any confusion relating to the referenced documents.
Issue 3	November, 2013	Minor revision of Issue 2 to reflect changes in the British Standards referenced and amendment of affected clauses. This issue does not contain any principal technical changes.
Issue 4	March, 2019	Minor revision of Issue 3 to reflect changes in the documents referenced, to enhance the guidance and to incorporate SHE Standard 04 'G55/3 Live Zone LV & HV Distance'. This issue includes the following principal technical changes. Clause 2: BS EN 50110-2, Work at Height Regulations, Wildlife & Countryside Act, EREC G56 and EREC G96 added to list of references. Clause 3: Term and definition for "lightly insulated conductor" and "non-insulated conductor" added. Clause 7.2: Requirements to meet the Electricity at Work Regulations and the need to categorise and re-asses trees in relation to the overhead line made mandatory. Clause 7.3: Requirement that network operator to have an approved method of carrying out the work safely made mandatory. Clause 7.4: (i) Method for the categorisation of trees amended to emphasise the position of the crown of the tree as well as the branches. (ii) Requirement that "No person shall work above any live conductor." amended to "No person shall work in a position vertically above the vicinity zone of any live conductor. Caution note added that this does not preclude working above the height of a live conductor outside the Vicinity

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		<p>Zone but such work shall ensure that there is no possibility of any part of the equipment and/or the operative could breach the Vicinity Zone.</p> <p>Clause 7.5: CAUTION note added to emphasise the importance of ensuring that the conductors are 'effectively insulated' before adopting this work procedure.</p> <p>Clause 7.9: Requirement that network operators have monitoring systems to ensure the requirements of EREC G55 are achieved, made mandatory.</p> <p>Annex B: The content of SHE Standard 04 incorporated into EREC G55.</p>
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Contents

Foreword	7
Introduction.....	9
1 Scope.....	9
2 Normative references.....	9
3 Terms and definitions.....	10
4 Advice to third parties	13
5 Management action for network operator work.....	14
5.1 Competence and authorisation of persons.....	14
5.2 Standards of arboricultural work.....	15
5.2.1 Planning stage.....	15
5.2.2 Execution stage	16
5.2.3 Measure and correct stages	16
6 Risk assessment requirements for network operator work.....	16
6.1 Generic risk assessment principles	17
6.2 Risk assessment requirements for network operator work.....	17
7 Safe execution of network operator work.....	18
7.1 Working within the proximity zone	18
7.2 Work planning principles	18
7.3 Conditions required for working with the line live	19
7.4 Categories of tree work and procedures to control risk.....	20
7.5 Effectively insulated conductors	22
7.6 Use of machinery.....	23
7.7 Tidy-up operations.....	23
7.8 Emergency procedures	24
7.9 Performance monitoring	24
7.10 Review of procedures.....	24
Annex A (normative) Vicinity and live zone categories	25
A.1 Category A trees.....	25
A.2 Category B trees.....	27
A.3 Category C trees	28
A.4 Category D trees	29
Annex B (informative) Rationale for adopting the distances for LV live zone quoted in Table 1 of EREC G55	30
Foreword	30
B.1 Scope	30
B.2 General.....	30
B.3 Rationale for adopting 300 mm for the LV Live Zone Distance	30
B.3.1 Background	30
B.3.2 Rationale	31
B.3.3 BS EN 50110-1:1997.....	31
B.3.4 Comparison of EREC G55 with BS EN 50110-1 2013 Standard	32

Bibliography..... 34

Figures

Figure 1 — Work planning process 19
Figure 2 — Tree category decision flowchart..... 22
Figure A1 — Category A trees 25
Figure A2 — Category B trees 27
Figure A3 — Category C trees 28
Figure A4 — Category D trees 29

Tables

Table 1 — Live zone and vicinity zone distances..... 13
Table B.1 — Comparison of LV distances in EREC G55 with BS EN 50110-1:2013 33

Foreword

This Engineering Recommendation (EREC) is published by the Energy Networks Association (ENA) and comes into effect from date of publication. It has been prepared under the authority of the ENA Engineering Policy and Standards Manager and has been approved for publication by the ENA Electricity Networks and Futures Group (ENFG). The approved abbreviated title of this engineering document is “EREC G55”, which replaces the previously used abbreviation “ER G55”.

This document replaces and supersedes Engineering Recommendation G55 Issue 3 2013.

This EREC provides a common basis for safe working practices for tree work in proximity to any network operator’s equipment covering both works carried out by or on behalf of network operators and works carried out by third parties not in their employ.

Where the term “shall” or “must” is used in this document it means the provision is mandatory. Where the term “should” is used in this document it means the provision is a recommendation. The term “may” is used to express permission.

NOTE: Commentary, explanation and general informative material is presented in smaller type, and does not constitute a normative element.

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Introduction

The purpose of this EREC is to provide a common basis for safe working practices for tree work in proximity to any network operator's equipment. It sets out to differentiate between works carried out by or on behalf of network operators and works carried out by third parties not in their employ. The primary focus of this document is to provide detailed advice to ENA Member Companies. Third parties will be steered towards existing publications for guidance.

This EREC also provides guidance in the establishment and use of management procedures to achieve the safest possible working practices. It takes into account developments in a maturing vegetation management industry and seeks to avoid any confusion in relating to the referenced documents.

Working in proximity to live overhead electric lines and underground electric cables results in many incidents every year. These incidents frequently result in serious injury of people, damage to equipment and disruption of electricity supplies. Some of these incidents are related to tree work in proximity to live electrical equipment.

The risk of injury associated with any task may be minimised with the development of a suitable work plan based on risk assessment, the use of competent staff, the provision of suitable equipment and the application of safe work procedures. These are the actions that should be taken when preparing to work on trees in proximity to all types of electrical equipment to ensure that the risk of an incident is minimised.

Tree work in proximity to live overhead electric lines and other equipment is subject to the provisions of the Electricity at Work Regulations (EAWR) [N1]. This EREC sets out to comply with these provisions.

This EREC is principally concerned with the management of work on trees. It is recognised that a comparable activity is concerned with coppices and taller shrubs e.g. rhododendron, climbers etc, especially around LV lines. Whilst much of the guidance given in this EREC is relevant to such work, further guidance is available in Forest Industry Safety accord (FISA) 804 [1] and ENA EREC G96 [N11].

1 Scope

The approach set out in this EREC is recommended for all tree work carried out in proximity to any network operator's live electrical equipment.

The management procedures established by this EREC should be applied to work initiated by the network operator. Any work initiated by third parties should refer to Clause 4.

Where the staff of any other employers are working in proximity to live electrical equipment then the network operator will provide guidance to assist those employers to meet their responsibilities to provide a safe place of work. For tree work and related activities, the principles on which that guidance is to be founded are set down in this EREC.

This EREC gives recommendations for tree work with specific regard to the electrical hazard and does not seek to give guidance on managing the non-electrical hazards.

2 Normative references

The following referenced documents, in whole or part, are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

Standards publications

BS EN 50110-1, Operation of electrical installations

BS EN 50110-2:2010, *Operation of electrical installations. National annexes*

Other publications

[N1] The Electricity at Work Regulations, 1989

[N2] *Work at Height Regulations 2005*

[N3] The Electricity Safety, Quality and Continuity Regulations, 2002 (as amended) (ESQCR)¹

[N4] New Roads and Street Works Act, 1991 (NRSWA)

[N5] Wildlife & Countryside Act, 1981 (as amended)

[N6] *HSE Guidance Booklet GS6 (Fourth Edition), Avoidance of Danger from Overhead Power Lines*

[N7] HSE Guidance Booklet HSG 85 (Third Edition *Electricity at Work. Safe working practices*)

[N8] ENA SHE Public Safety Leaflet, *Safety Advice for Tree Work Near Overhead Power Lines*

[N9] ENA TS 43-8, *Overhead Line Clearances*

[N10] ENA EREC G56, *Arrangements for Access by ENA Member Company Staff to Network Rail Infrastructure*

[N11] ENA EREC G96, *Use of Mechanical Harvesters in Vegetation Management*

[N12] ENA ETR 132, *Improving resilience of overhead networks under abnormal weather conditions using a risk-based methodology*

[N13] ENA ETR 136, *Vegetation Management Near Electricity Equipment – Principles of Good Practice*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1

approved insulated tool

tool including attachments approved by the network operator as being insulated and fit for purpose to the extent that it may be used in close proximity to live electrical equipment without presenting a danger to the operator or network

NOTE: Insulated tools shall be suitable for the voltage that they are being used for.

¹ In Northern Ireland, the Electricity Safety, Quality and Continuity Regulations (Northern Ireland) 2012 apply.

3.2 circuit conductor

electrical conductor arranged to be electrically connected to a network

3.3 competent

suitably trained person, who is recognised as having sufficient technical knowledge, experience and ability to enable them to avoid danger in respect of the electrical overhead line network and who is authorised by the network operator and engaged to work on its behalf

NOTE: Suitable accreditation schemes are available; for example, arboriculture industry recognised competency certification schemes such as those endorsed by the Health and Safety Executive's AFAG committee, Arboricultural Association Utility Arboriculture Group (UAG), e.g. Lantra Awards qualifications, the Forest Industry Safety Accord (FISA), and the City & Guilds Land Based Services (formerly NPTC) Utility Arboriculture qualifications.

3.4 effectively insulated conductor

line conductor which is insulated for continuous phase-to-phase or phase-to-earth contact and is protected, so far as is reasonably practicable, against mechanical damage or interference having regard to its accessibility

NOTE 1: The implication here is that effectively insulated conductors may be placed such that they are ordinarily accessible.

[ENA TS 43-8, Clause 3.9]

NOTE 2: Refer to ENA TS 43-8 [N9] for an explanation of 'ordinarily accessible'.

NOTE 3: The implication here is that conductors which are not effectively insulated are treated as non-insulated.

3.5 lightly insulated conductor

line conductor which is insulated against momentary phase-to-phase or phase-to-earth contact and is considered as a non-insulated conductor for clearance purposes

[ENA TS 43-8, Clause 3.12]

NOTE: Lightly insulated covered conductors will provide some protection in the event of accidental contact with other plant but are not deemed to be safe to touch and so are treated in the same way as non-insulated conductors for the purposes of establishing required electrical clearances.

3.6 live zone

zone around an exposed live circuit conductor or supporting insulators where there is a danger of burn or electric shock if any part of a person's body or non-insulated tool they are using enters the zone

NOTE: For HV and EHV circuit conductors this is related to the 'safety distance' as described by the network operator. The distances, which depend on voltage, are shown in Table 1.

3.7 network operator

organisation that owns and/or operates a distribution network and is responsible for keeping vegetation clear of overhead lines

NOTE: A network operator might also be referred to as a Distribution Network Operator (DNO) or Transmission System Operator (TSO).

3.8

Non-insulated conductor

conductor which is insufficiently insulated for continuous phase-to-phase or phase-to-earth contact

NOTE: A conductor which is either bare wire or lightly insulated wire is treated as non-insulated.

3.9

proximity

close enough to electrical equipment to present a danger

NOTE: Depending on the type of operation, the definition of proximity is split in to 'proximity zone 1' and 'proximity zone 2'.

3.10

proximity zone 1

within two tree lengths of any live equipment

NOTE: This will be measured horizontally from a point directly beneath the nearest conductor to the base of the tree.

3.11

proximity zone 2

within 9 m of any live equipment up to and including 66 kV and/or 15 m of any live equipment greater than 66 kV

NOTE 1: If there is any doubt about the voltage then the advice of the network operator should be sought.

NOTE 2: This distance will be measured horizontally from a point directly beneath the nearest conductor to a point directly under the nearest point of the canopy of the tree.

NOTE 3: Where mechanical plant is being used, e.g. harvesters or forwarders, then the stated distances will be measured to the nearest point to the line that any part of the machine or load can reach.

3.12

third party

person or organisation that needs to carry out tree works in proximity to a network operator's electrical equipment for their own purposes

3.13 vicinity zone

zone around an exposed live circuit conductor, which if maintained will ensure that the danger of burn or electric shock is prevented because the live zone is not breached

NOTE 1: The live zone is included within the measurement of the vicinity zone.

NOTE 2: The distances, which depend on voltage, are shown in Table 1. 'Working and access clearances', as described by some network operators, for the vicinity zone should not be used as they have different values.

Table 1 — Live zone and vicinity zone distances

System voltage	Live zone	Vicinity zone
Up to and including 1 kV	0.3 m	1.0 m
Up to and including 11 kV	0.8 m	2.0 m
Up to and including 33 kV	0.8 m	2.5 m
Up to and including 66 kV	1.0 m	3.0 m
Up to and including 132 kV	1.4 m	3.5 m
Up to and including 275 kV	2.4 m	4.0 m
Up to and including 400 kV	3.1 m	5.0 m
NOTE 1: The rationale for adopting the value of 300 mm as the live zone distance for system voltages 'up to and including 1 kV' is explained in Annex B.		
NOTE 2: For the avoidance of doubt, systems operating between voltage limits should adopt the higher values of live zone and vicinity zone distances. For example, systems operating at 20 kV should adopt the 'up to and including 33 kV' live zone and vicinity zone distances.		

4 Advice to third parties

Any third party, not in the employ of the network operator, wishing to carry out tree work in proximity to the network operator's live electrical equipment should consult the following documents.

- a) HSE Guidance Booklet GS6 [N6] is applicable to people who may be planning to work near overhead lines, where there is a risk of contact with the wires, and describes the steps that should be taken 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.
- b) HSE Guidance Booklet HSG 85 [N7], which gives guidance on devising safe working practices for people who carry out work on or near electrical equipment. It includes advice that is relevant to managers and supervisors who control or influence the design, specification, selection, installation, commissioning, maintenance or operation of electrical equipment.
- c) ENA SHE Public Safety Leaflet:2012, *Safety Advice for Tree Work Near Overhead Power Lines* [N8], which provides general advice on tree felling, tree trimming and clearing vegetation near overhead electric lines.
- d) ENA SHE Public Safety Leaflet:2012, *Working in the Vicinity of Overhead Lines* [2], which contains general safety advice covering staying safe, planning ahead and what to do if a vehicle or machinery comes into contact with an overhead electric line.

- e) BS EN 50110-2:2010, *Operation of electrical installations. National annexes*, which contains a comprehensive list of the Laws and Regulations applicable when working on or adjacent to electrical installations.
- f) ENA EREC G96 [N11], which provides guidance on when mechanised felling operations are carried out within close proximity to live overhead lines, also referred to as operations in the RED zone. A detailed methodology is provided in Clause 4 of EREC G96 of justification for any live working that is proposed.
- g) *Trees species selection for green infrastructure. A guide for specifiers* [3], which provides extensive guidance on selecting appropriate species for a range of contrasting planting scenarios, as well as providing advice on the general approach to species selection.

These documents will direct the third party to consult with the network operator before proceeding. Advice can be obtained from the network operator responsible for the local area; the contact telephone number is listed in telephone directories under 'Electricity'. Further guidance on public safety can be found on the Energy Networks Association Website at <http://www.energynetworks.org>.

5 Management action for network operator work

Network operators should ensure that their procedures meet the requirements of this EREC. Although outside the scope of this document, non-electrical hazards in connection with surveying, gaining consents and clearing vegetation must be adequately addressed in line with ENA ETR 136 [N13].

5.1 Competence and authorisation of persons

The network operator should ensure that all staff involved in tree work in proximity to their overhead lines are competent for both tree work and for working in proximity to their electrical network.

Competence in tree work should be demonstrated through training, assessment and qualification under a nationally recognised utility arboricultural training scheme, or the network operator's own tree working training scheme.

NOTE: The Arboricultural Association's Utility Arboriculture Approved Contractor Scheme is recommended as an appropriate contractor approval scheme for operators in this sector. The scheme has ISO 9001 accreditation in recognition of its quality management systems and is a registered member of The Safety Schemes in Procurement forum, which is an umbrella organisation for recognised health & safety schemes in the UK.

For network electrical competence, the network operator will ensure that training, assessment and authorisation awarded to staff engaged in tree work meets the individual network operator's requirements.

Certificates of competence should reflect best practice. If this is not the case, then personnel should be retrained and reassessed.

Trainees may undertake site work only when they are subject to appropriate supervision, limitations and control, as determined by the network operator. Where trainees are engaged in works adjacent to overhead electric lines then adequate arrangements for their supervision must be agreed with the network operator. It is recommended that these arrangements be recorded on the site risk assessment with specific reference to:

- a) the operative(s) being supervised;
- b) the nominated supervisor(s); and
- c) the level of supervision required.

5.2 Standards of arboricultural work

The standards referenced in this clause address 'good practice' principles of work associated with safe tree work in proximity to overhead electric lines.

The key safety management factors that should be applied by the network operator may be grouped within the recognised and accepted management process stages represented as:

- PLAN;
- EXECUTE;
- MEASURE;
- CORRECT.

These stages are described below in the Clauses 5.2.1, 5.2.2 and 5.2.3.

5.2.1 Planning stage

The following should be considered in the planning stage.

- a) Training and qualification in utility arboriculture practice as referenced in Clause 5.1.
- b) The network operator will ensure that, where relevant, project planning adopts the principles ENA ETR 132 [N12]² and ENA ETR 136 [N13]³ to ensure a safe and effective procedural framework for the delivery of site-specific requirements.
- c) Surveys of the assets and associated vegetation to capture the data that will provide the information for the risk assessment.
- d) Vehicle and plant access with regard to the electrical hazard.
- e) Reference should be made to the geographical and electrical location of the work site.
- f) Defined asset to vegetation clearance objectives should be designed to maintain the statutory clearance requirements.
- g) Specific methods of delivery such as a system outage or working in proximity to the live equipment.
- h) Site-specific public safety risk control procedures and the delivery and maintenance of survey data to enable compliance with the relevant ESQCR [N3] requirements. Record of the vegetation condition identified as non-compliant will require prioritisation, e.g. accessible assets via vegetation in a publicly utilised area.
- i) The asset condition risk and the site environment condition risk assessment are specific to the project location. The information/data recorded will be essential to facilitate safe delivery activities. Example of the items referenced may be asset conductor and fitting condition, New Roads and Street Works Act [N4] requirements (e.g. traffic management), ENA EREC G56 [N10] for proximity to Network Rail sites, other environmental impact and risk such as water courses.
- j) The vegetative material risk should be assessed specific to the project location. The information/data recorded will be essential to facilitate safe delivery activities. Examples of the items referenced may be species-specific regarding projected growth, individual

² ENA ETR 132 [N12] takes as its starting point the safety clearances for overhead lines as specified in ENA TS 43-8 [N9] and as required under the Electricity Safety, Quality and Continuity Regulations [N3].

³ The aim of ENA ETR 136 [N13] is to present generic principles of good practice for vegetation management in the vicinity of electricity networks and network equipment when in pursuit of compliance with the statutory obligations that are placed on network operators. It explains why vegetation management is necessary and how good co-operation can benefit all stakeholders.

tree structure condition, climbing vegetation that has or may encroach the overhead line, and the consequential risk of the works, such as 'wind blow effect' on the remaining trees due to the likelihood of increase in swaying, uprooting, permanent set and/or snapping.

- k) Assessments, particularly during the nesting season, in order to determine whether the work will affect nesting birds and/or protected species, and plan accordingly. The Wildlife & Countryside Act [N5] defines the relevant legislative requirements.
- l) Selection of appropriate plant, equipment and vehicles for the work to be carried out.

5.2.2 Execution stage

During the execution stage, the following must be ensured.

- a) Critical customer/landowner details will enable safe delivery of the planned works, e.g. safe access and egress routes.
- b) Robust site-specific planning processes will be demonstrated. All the required information will be collated into a site-specific document/file. Sound process will ensure the information is clear, concise and relevant. The information will be communicated to those staff associated with the physical delivery of the work. Site-specific planning will ensure sufficient resource for the works. The relevant safety and environmental control information will be shared with all customers and stakeholders as necessary to ensure safe working and acceptable conduct.
- c) Equipment utilised for the delivery and execution of the work will be fit for purpose. Items must conform to the basic requirements of being tested, certified, registered and maintained to the approved network operator procedures.
- d) Guidance on suitable Personal Protective Equipment (PPE) to be worn is given in the Health and Safety Executive (HSE) guides relevant to each tree related task. In addition, the requirements of individual network operator procedures must be adhered to.

5.2.3 Measure and correct stages

During the 'measure and correct stages' the following must be ensured.

- a) Safety event reporting and recording will be sufficiently robust to enable the network operator to identify all tree related incidents and will ensure that they are reported both locally and nationally via recognised electricity industry channels.
- b) Compliance measurement will be ensured via audit activity. Checks and assessments are recommended regarding:
 - i. quality of tree work;
 - ii. safety practice compliance;
 - iii. clearance from vegetation to assets achieved;
 - iv. clearance sustainability;
 - v. compliance with environmental constraints and the Wildlife & Countryside Act [N5]; and
 - vi. customer communication, understanding and satisfaction.
- c) Processes will be sufficiently flexible to accommodate modification required as a result of non-compliances identified within the audit check cycle.

6 Risk assessment requirements for network operator work

The network operator should ensure the principles of risk assessment are embedded in the process from project conception through to the delivery and execution phase of the work.

The risk assessments will be available to all staff and associated stakeholders (as appropriate) involved in the works.

Network operators should ensure that a suite of generic risk assessments covering all activities involved in this type of work is available to all.

6.1 Generic risk assessment principles

The generic risk assessment should include the following aspects.

NOTE: The list is indicative and not exhaustive.

- a) Procedures for live working (and its avoidance).
- b) Working at height (and its avoidance); the provision and use of Mobile Elevating Work Platforms (MEWPs), ladders and fall protection equipment. Guidance on the positioning of MEWPs and ladders near to electrical equipment can found in ENA SHE Public Safety Leaflet, *Working in the Vicinity of Overhead Lines* [2] and ENA EREC G96 [N11]. The working practices shall ensure the provisions of The Work at Height Regulations [N2] are satisfied.
- c) Plant and machinery, e.g. wood chippers, stump grinders, MEWPs etc.
 - i. All tools and equipment to be used should be agreed with the network operator.
 - ii. All tools and equipment must be serviceable, fit for purpose and properly used, maintained and inspected.
 - iii. All tools and equipment must be used in accordance with any specific instructions within network operator procedures.
- d) Arboricultural cutting equipment, e.g. chain saws, pruning shears, chainsaw pole pruners.
- e) Mechanical plant, e.g. harvesters.

6.2 Risk assessment requirements for network operator work

The generic risk assessment will then be subject to and complemented by site specific risk assessment.

It is essential that the risk assessment process deals separately and adequately with both the electrical and non-electrical tree related hazards.

The site-specific risk assessment will be available to all staff and associated stakeholders involved in the works.

The site-specific risk assessment should contain the following.

NOTE: The list is indicative and not exhaustive.

- a) Justification for any live working proposed.
- b) Evaluation of the risks regarding the planned work environment should be detailed. Consideration will be made regarding the location of network operator equipment in relation to highways and roads, weather and ground conditions.
- c) The planned work methodology should be referenced regarding the electrical hazards, namely the category of the works as defined in Clause 7.4. Access methods should be detailed, e.g. MEWPs, tree climbing, rope ascent, ladders etc. Consideration should also be made and referenced to the management of materials produced as a result of the works, e.g. moving and stacking of timber and waste.
- d) The physical condition of the vegetation involved in the works should be assessed from a risk control perspective. Previous survey and condition data may be used to support the pre-work on-site assessment.

- e) Public safety should be assessed regarding provision for overall site management and specifically public exclusion (as appropriate), safe passage through the site if 'rights of way' exist, prevention of damage to property leading to compromising safety, e.g. damaging fences containing animals.
- f) Emergency procedures specific to the site should include the geographical and electrical location, phone signal coverage, hospital locations, provision of communication with the network operator control centre, site 'safe area' for staff welfare and maintenance. Clause 7.8 gives more guidance.

All staff allocated to undertake the works should be informed sufficiently to recognise and understand the risks and the control measures to be applied. It is recommended that a formal sign-off should be obtained.

It is expected that all staff involved should record their acceptance of the risk assessment and the control measures detailed, e.g. tailboard conference.

In the event that any member of the working party identifies safety concerns that are not adequately addressed then work should not continue unless suitable control measures can be agreed and implemented.

It is a fundamental requirement that the on-site risk assessment is updated and amended to take account of any changes in conditions that take place during the execution of the works, e.g. a designated access/egress route may be altered. The change of risk state should always prompt a review and, as appropriate, action to control the situation, e.g. a change in the weather.

Anyone visiting the site of work or joining the work team should be briefed on the risk assessment process and the control measures in place.

7 Safe execution of network operator work

7.1 Working within the proximity zone

All felling works carried out within proximity zone 1, or pruning and dismantling work in proximity zone 2, should be carried out in accordance with the approved procedures of the network operator. Particular care should be taken to ensure that vehicles and plant on site are considered and that their use complies with these procedures.

7.2 Work planning principles

All tree works must be planned in advance to ensure that the most appropriate method of work is adopted.

If branches breach the vicinity zone or there is any potential to breach the vicinity zone then, in line with Regulation 14 of the Electricity at Work Regulations [N1] (see Clause 7.3), consideration shall first be given to whether or not an interruption to supply is already planned for the section of overhead line concerned.

Once the justification process has confirmed the need to work with the line live, then the trees shall be assessed and categorised in terms of their position in relation to the overhead line (see Clause 7.4).

The guidance given in Clause 7.4 will then allow the correct methods to be chosen. As works continue on more complex sites then the remaining trees shall be continually assessed, and work methods revised accordingly.

In summary, the process will be as shown in Figure 1.

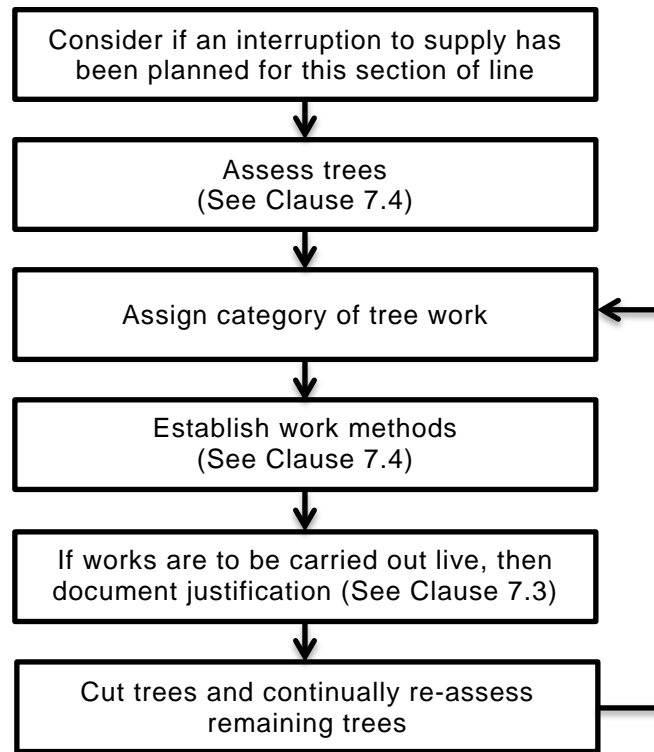


Figure 1 — Work planning process

7.3 Conditions required for working with the line live

All tree cutting must be carried out where reasonably practicable with the line dead.

However, the Electricity at Work Regulations (EAWR) [N1] allow for situations where isolating an electrical supply raises the risks to the customer or staff to a high level. Regulation 14 'Work on or near live conductors' states:

"No person shall be engaged in any work activity on or so near any live conductor (other than one suitably covered with insulating material so as to prevent danger) that danger may arise unless—

- a) it is unreasonable in all the circumstances for it to be dead; and*
- b) it is reasonable in all the circumstances for him to be at work on or near it while it is live; and*
- c) suitable precautions (including where necessary the provision of suitable protective equipment) are taken to prevent injury."*

EREC G96 Clause 4 [N10] provides guidance on how the above conditions a), b) and c) of EAWR Regulation 14 can be satisfied. A written justification must be produced in every case when deciding whether it is unreasonable for an overhead power line to be made dead. A flowchart that assists in making this decision is provided in Figure 4 of EREC G96 [N11].

In addition to these conditions, each network operator shall have in place an approved method of carrying out the work safely that is fully understood by the staff and includes details of the authorisation levels, supervision, assessment and appropriate equipment to be used.

Provided that the network operator has an approved method of work which includes a justification process then trees can be cut with the line live providing this is only done by trained, competent and authorised staff. This justification must be recorded as part of the risk assessment process (see Clause 6.2).

7.4 Categories of tree work and procedures to control risk

The risks associated with each work site with respect to the electrical hazard must be assessed to determine the correct methods to be used to remove or prune the trees. The findings must be recorded as part of the risk assessment process detailed in Clause 6.

A tree will be categorised in terms of the position of its crown relative to any conductors or electrical equipment. Attention to the position of its branches will need to be considered in the categorisation. The assessment will not take into account any work methods that may be intended to be used. The assessment must be made immediately prior to works taking place. The control methods to be used will then be determined as directed later in this clause.

During the assessment process it is necessary to investigate whether any LV service are present at the site, in addition to the LV main, but may be hidden by vegetation. A suitable method is to clear a horizontal band around a pole by hand (insulated rubber gloves) to reveal any services.

There are four categories 'A', 'B', 'C' and 'D' with 'A' generally being the most hazardous and 'D' the least. Where there is any doubt as to the category, staff should default to the safer option.

In general, a work site should be categorised as a whole and the most hazardous tree(s) will determine the category. If a work site is complex, requiring various work methods, then consideration should be given to breaking it down into more manageable sections.

Particular care should be taken when assessing climbing plants such as ivy on poles. It can be difficult to determine exactly where the vegetation stops and, in these cases, again staff should default to the safer option.

Having determined the category of the work site then the appropriate method(s) should be decided and recorded. Work can then progress until the work site is completed or the category of the work site has reduced and different control methods can be adopted following a re-assessment. In this way a logical sequence of work can be developed where the most hazardous trees are removed first with higher levels of control. The removal of the most hazardous categories of trees first will lessen the likelihood of reduced levels of control being used inappropriately.

There will be occasions when this sequence cannot be strictly adhered to if, for example, less hazardous trees (category D) need to be cleared to allow access to others (category A). Such works need to be carefully planned with all staff on site fully briefed on the hazards. Consideration should be made on work sites like this to indicate clearly those trees that must not be worked on with the reduced control measures.

It must be noted that although a work site may have been categorised in advance it must always be re-assessed on the day of the works to take into account any site changes, recent growth or temperature variations causing changes in line sag. This process must be repeated if works continue on subsequent days.

The preferred method to control the electrical hazard is to carry out the work with the network isolated and earthed in accordance with the network operator's safety rules.

Where a decision-making process has taken place in line with Clause 7.3 and the works are to be carried out with the line live, then the following measures should be taken.

- a) For non-insulated conductors, the control measures to be used should be determined by choosing the most appropriate from those available under the diagrams for each category (see Figure 2 and Annex A). However, the following will always apply for all categories of tree.
 - i. No part of any person's body shall, in any circumstance, breach the vicinity zone.
 - ii. No tools or equipment (except approved insulated tools) shall breach the vicinity zone.
 - iii. No person shall work in a position vertically above the vicinity zone of any live conductor.

Caution: This does not preclude working above the height of a live conductor at a position to the side of the live conductor, outside the vicinity zone, if this is required to carry out the work then the horizontal distance from the live conductor of the working position shall be such to ensure that there is no possibility of any part of the equipment used to reach the position and/or the operative could breach the Vicinity Zone.

- b) For effectively insulated conductors, see Clause 7.5.

In the event that works are not carried out in accordance with the recommended controls then works should be carried out with further supervision, and a method statement approved by the network operator must be in place.

The 'Tree category decision flowchart' is shown in Figure 2.

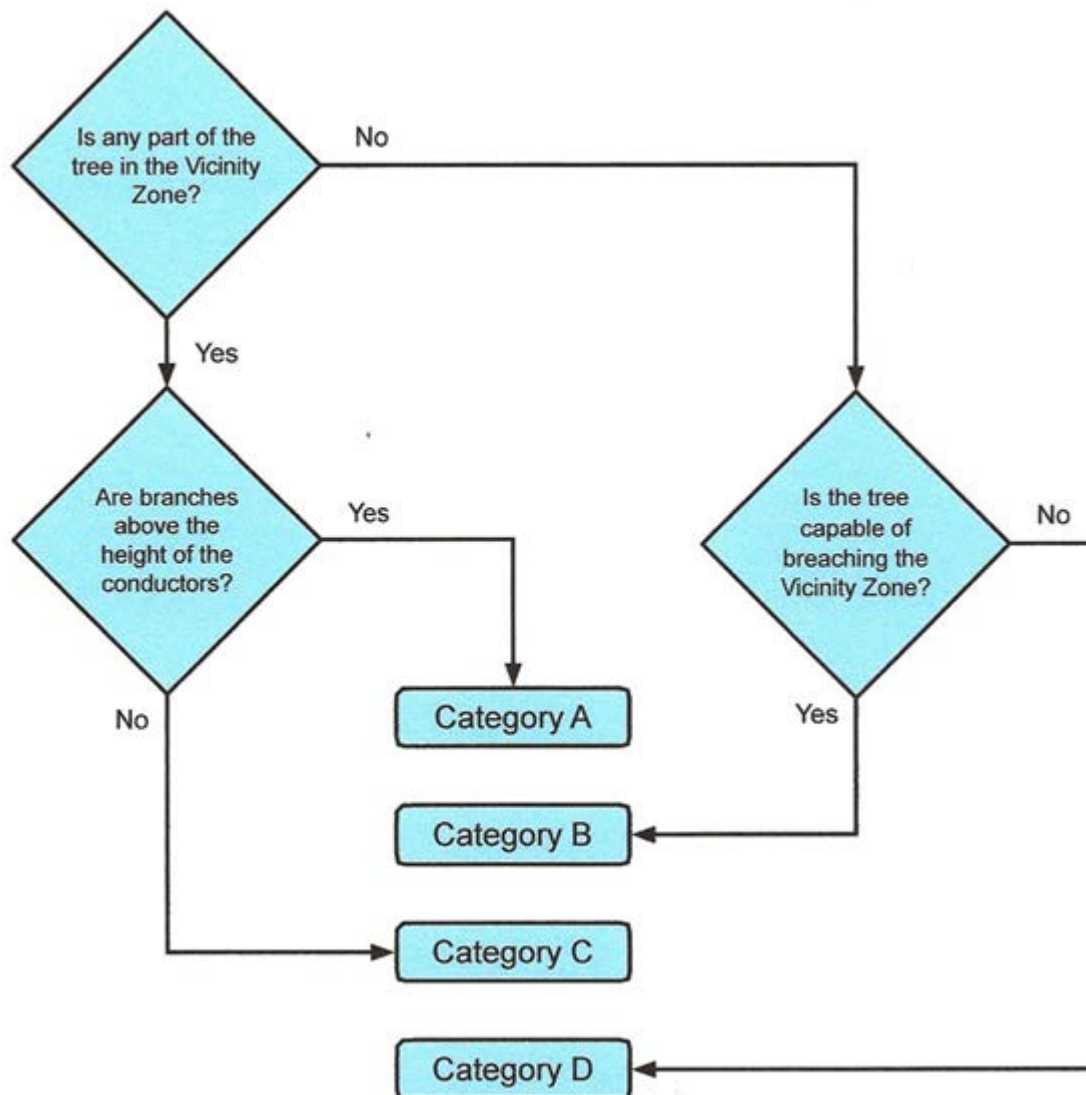


Figure 2 — Tree category decision flowchart

A detailed description of the four categories and recommended control measures can be found in Annex A.

7.5 Effectively insulated conductors

Provided that the conductors are deemed to be effectively insulated conductors by the network operator, the insulation is intact, and the network operator's procedures allow, then it is acceptable to clear vegetation with the line live using conventional non-insulated tools, ensuring that there is no breach of the live zone by persons, tools or equipment.

CAUTION: Conductors covered with insulating material can be classified as lightly insulated or effectively insulated (refer to the definitions in Clauses 3.4 and 3.5). It is essential to confirm with the network operator the level of insulation and not to make an assumption that all conductors covered with insulating material are 'effectively insulated conductors' before using this method of working. Lightly insulated covered conductors will provide some protection in the event of accidental contact with other plant but are not deemed to be safe to touch, and so are treated in the same way as bare wire conductors for the purposes of determining the working practices.

However, it must be borne in mind that where trees are present and have been touching conductors then there will be a strong possibility that abrasion has caused damage to the insulation. Older insulation may be subject to degradation and may not offer full insulation. Thorough inspection and constant vigilance is required to ensure safe conditions. Where there is any doubt then the conductors must be treated as non-insulated.

To ensure that works are carried out safely the following controls should be adhered to.

- a) The network operator must deem the conductor type to be effectively insulated conductors.
- b) Inspect the insulation to ensure that it is intact. If there is any doubt regarding the insulation, then assume that it is not effective.
- c) Inspect the network for non-insulated joints or jumper connections. If any non-insulated joints or jumper connections are found, then the control measures for non-insulated conductors apply (see Clause 7.4).
- d) Ensure that there is no breach of the live zone by persons, tools or equipment.

It must be noted that, even where cable guards are fitted around cables on poles, that extreme caution must be used when using any cutting equipment, particularly with chainsaws and brush cutters.

7.6 Use of machinery

The use of mechanical equipment such as harvesters, front, side, and rear flails and timber forwarders are increasingly being used during clearance operations in proximity to overhead lines. Guidance on the use of such equipment in close proximity to overhead lines is given ENA EREC G96 [N11].

All timber harvesting equipment should only be used in accordance with a risk assessment and method statement approved by the network operator and in accordance with the control measures outlined in Clause 7.4. This must incorporate measures for the safe access of machinery with respect to overhead equipment.

7.7 Tidy-up operations

On completion of works in proximity to overhead electric lines then consideration must be given to any subsequent tidy-up operations and to the safety of the general public. In particular, the following should be considered.

- a) Stacking branches or timber directly underneath the conductors should be avoided where there is any potential fire hazard or possibility of reducing ground clearances to below minimum levels.
- b) Any long branches must be reduced in length where there is any possibility of them being lifted to give access to conductors or electrical equipment.
- c) Timber and branches must not be stacked where it could give access to substations or electrical equipment or where it is known that mechanical plant would be required to be used within minimum safety distances of overhead lines, as defined in HSE Guidance Note GS6 [N6].

7.8 Emergency procedures

All staff must be trained in dealing with emergency situations. In the event of an incident then the emergency procedures detailed below should be followed.

On no account should an attempt be made to remove a tree or a branch that has landed on and remains in contact with the conductors.

The sequence of actions will depend on the type and severity of incident and the number of people on site.

- a) If a vehicle comes in contact with an overhead line, then stay in the vehicle if it is safe to do so or follow the procedure for safe exit.
- b) Stop all work and make the site safe.
- c) Contact the appropriate network control centre as specified by the network operator.
- d) Keep everyone away from live conductors, fences or equipment and vegetation in contact with conductors.
- e) Call emergency services, if necessary, giving the exact location and access details.
- f) Carry out an aerial rescue only if it is safe to do so.
- g) Carry out first aid, if necessary, or take the casualty to the nearest 'Accident and Emergency' department.
- h) Contact a supervisor to report the incident.
- i) Do nothing else until instructed by a suitably authorised person representing the network operator.

7.9 Performance monitoring

Network operators must have suitable monitoring systems that ensure that the standards set out in this EREC are achieved.

To achieve this, competent assessors must carry out regular assessments of a representative sample of tree work.

- a) These assessments should cover working practices and equipment.
- b) It is the responsibility of the network operator to adjust the frequency of the safety checks in line with the findings.
- c) Take prompt and appropriate corrective action if performance standards are not being met.

It is recommended that every manager/supervisor maintains a record showing how this monitoring is carried out in respect of the staff under his control.

7.10 Review of procedures

It is recommended that the operation of all procedures established to meet the requirements of this EREC should be regularly reviewed in respect of their effectiveness in ensuring that all those carrying out tree work on behalf of the network operator enjoy a safe, healthy working environment and incident-free operations. These reviews should lead to appropriate timely action.

Annex A (normative)

Vicinity and live zone categories

A.1 Category A trees

Category A trees are within the vicinity zone (including the live zone), at or above the level of conductors or equipment.

All of the trees illustrated in Figure A1 are category A trees.

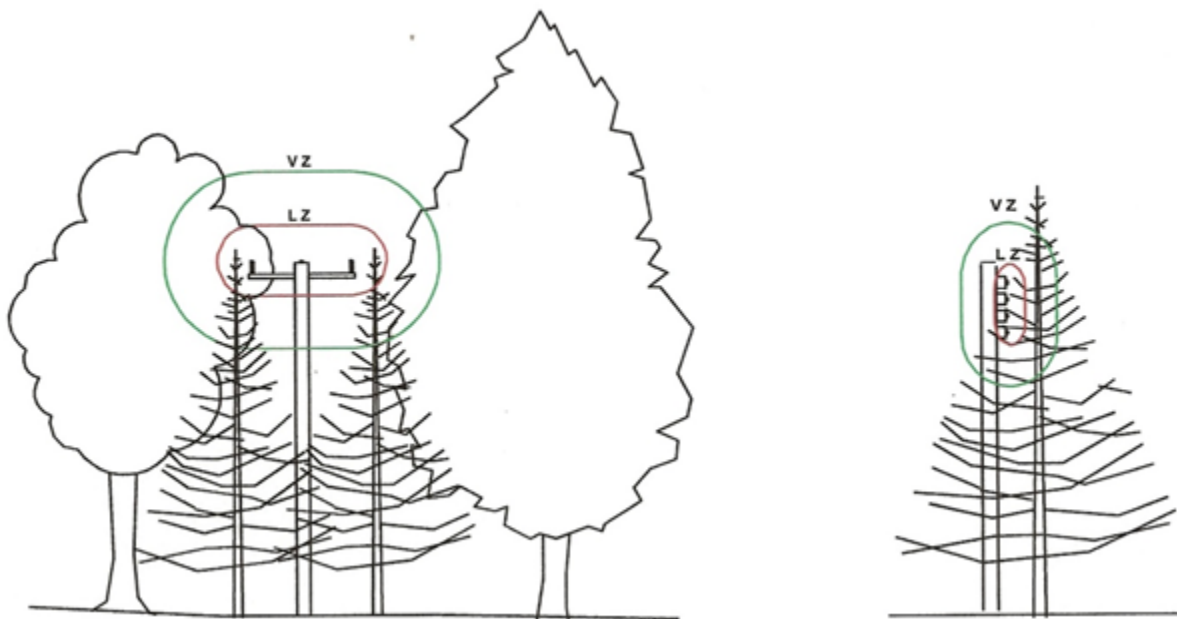


Figure A1 — Category A trees

With the line live the method of work should be established by incorporating the following control measures.

- Where the voltage is greater than 33 kV then the works must be carried out dead. The only exception to this will be where no branches breach the live zone and there is additional supervision as well as a method statement approved by the network operator that ensures there is no breach of the live zone.
- Branches can be reduced by using approved insulated tools.
- Approved insulated tools may only be allowed to be used in the live zone where a procedure approved by the network operator is in place.
- Trees with branches in the live zone must not be climbed.
- Trees with branches in the vicinity zone, but not in the live zone, should only be climbed where a procedure approved by the network operator is in place.
- If branches protrude through the vicinity zone and up above the height of the vicinity zone and overhang the extent of the live zone, then the works must be carried out dead.
- Where approved insulated tools or any cut materials have the potential to cause a phase to phase, or phase to earth, flashover, then this work must be carried out dead.
- The length of cut section must be determined by risk assessment and recorded, particularly taking into account distances between phases.

- i) A dedicated lookout groundsmen capable of stopping work will be required to ensure that the required control measures are being adhered to.
- j) Works must be planned such that contact with electrical equipment is avoided.
- k) The saw head should not be used in the live zone, or on branches less than 25 mm diameter, that protrude into the live zone. This prevents excessive movement and unintentional contact of branches with conductors.

A.2 Category B trees

Category B trees are outside, but capable of breaching, the vicinity zone including the live zone, adjacent to conductors or equipment.

All of the trees illustrated in Figure A2 are category B trees.

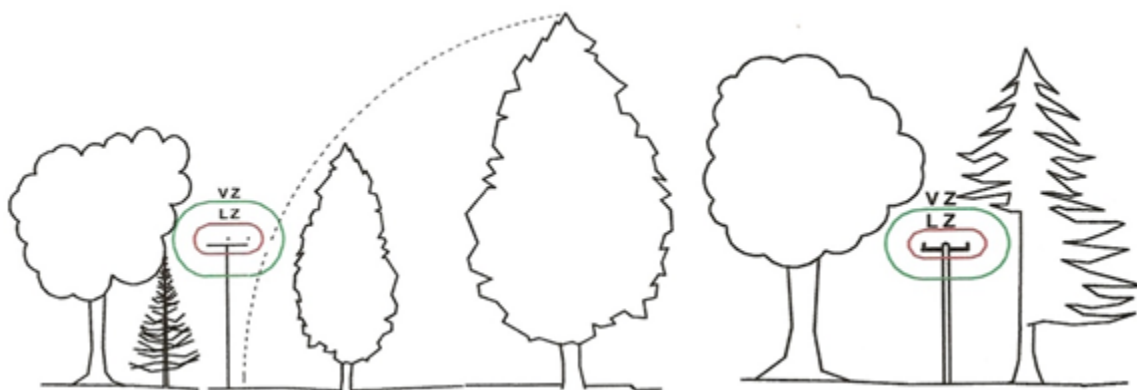


Figure A2 — Category B trees

With the line live the method of work should be established by incorporating the following control measures.

- In the particular circumstance where branches are overhanging the live zone on HV as shown in the right-hand example then the works must be carried out dead. The only exception to this will be where there is further supervision and a method statement approved by the network operator. This must incorporate further controls that ensure no breach of the live zone and may incorporate the use of hand held sections, lowering equipment or rope assisted felling. Full account of the weather conditions must be taken.
- Control measures should, where necessary, include preparatory work to remove branches in a logical manner to avoid the risk of small branches cut higher up in the crown outside the vicinity zone bouncing or cart-wheeling on to the line.
- If branches have the potential to breach the vicinity zone then approved insulated tools must be used.
- If branches have the potential to breach the live zone then only small sections should be removed to avoid a phase to phase contact or damage to the network. The maximum length of cut section should be recorded on the risk assessment.
- These trees can be climbed and dismantled with suitable control measures. However, it must be ensured that in the event of a fall or swing there is no possibility of a climber breaching the vicinity zone.
- A dedicated groundman capable of stopping work must be used to maintain clearances if a climber or MEWP is above the level of conductors.
- Straight fell trees away with appropriate control measures, such as the use of two ropes, to ensure no breach of the vicinity zone. Suitable procedures must be approved by the network operator.

A.3 Category C trees

Category C trees are within the vicinity zone (including the live zone), beneath the level of conductors or equipment.

All of the trees illustrated in Figure A3 are category C trees.

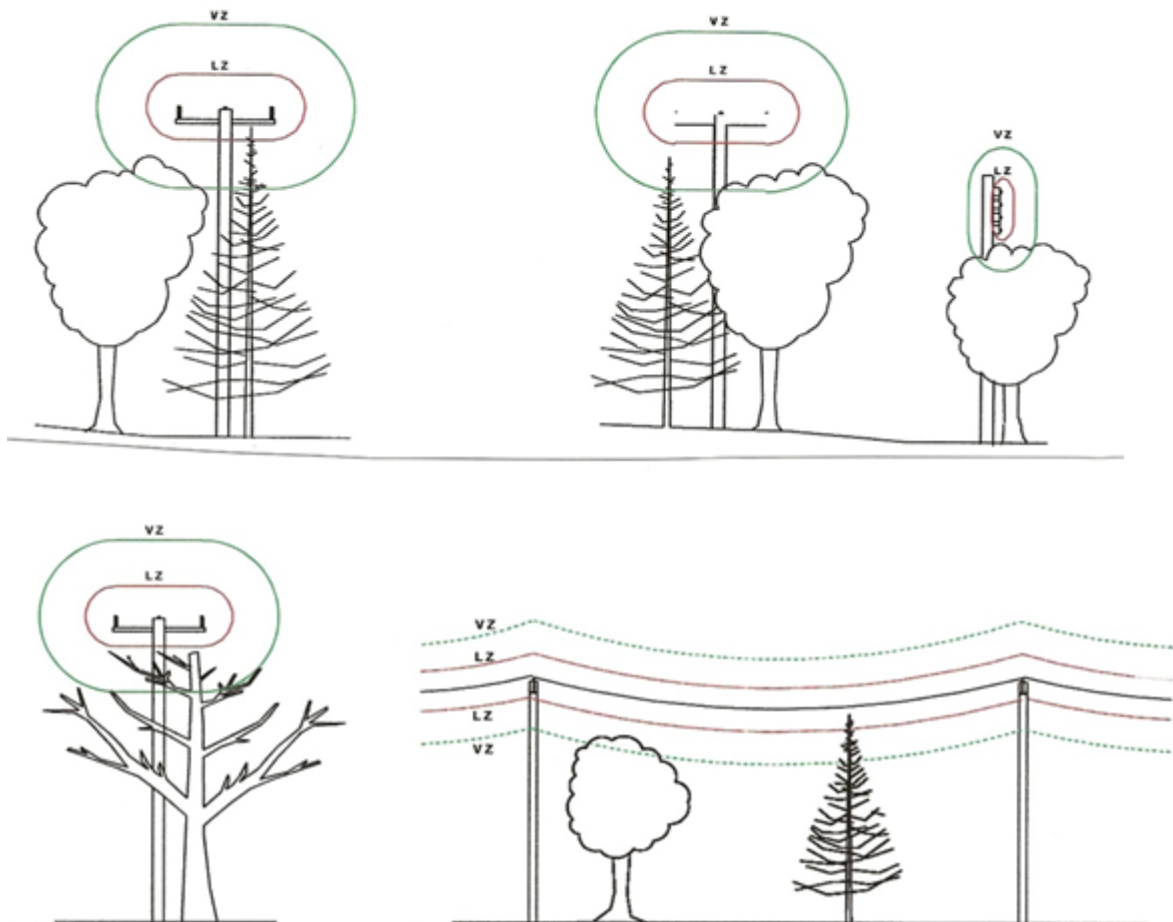


Figure A3 — Category C trees

With the line live the method of work should be established by incorporating the following control measures.

- Remove branches in the live zone with approved insulated tools.
- If the trees are below the level of the live zone, with no possibility of breaching the live zone, such as the trees shown in the top right example, then they may be felled or pruned with non-insulated tools such as a chainsaw.
- If the tree to be felled is below the level of the live zone with a possibility of breaching the live zone, such as the tree shown the bottom left example, then the branches should be removed with approved insulated tools prior to felling.
- If the trees are below the level of the live zone then they may be climbed ensuring that no part of the climber's body, tools or equipment can breach the vicinity zone and that branches are not caused to breach the live zone. A dedicated lookout groundswoman capable of stopping work should be used in this instance.

A.4 Category D trees

Category D trees are within proximity of the overhead electric line but not capable of breaching the vicinity zone.

All of the trees illustrated below in Figure A.4 are category D trees.

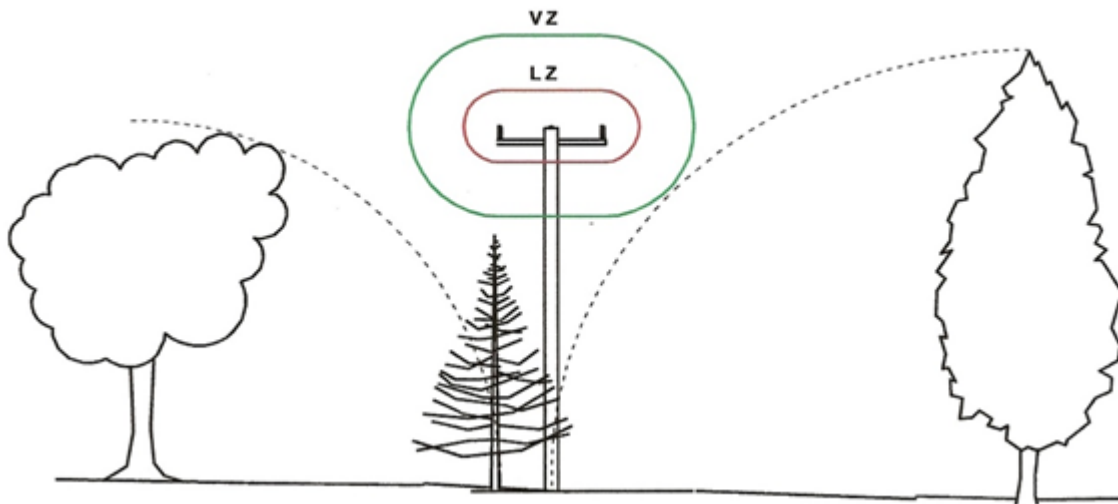


Figure A4 — Category D trees

With the line live the method of work should be established by incorporating the following control measures.

- a) Use of non-insulated tools is permitted and any breach of the vicinity zone by operatives, tools or equipment should be avoided.
- b) Wherever possible trees should be felled away from conductors.
- c) Trees must be felled into a cleared area to avoid the risk of a 'domino' effect with other trees.

Annex B (informative)

Rationale for adopting the distances for LV live zone quoted in Table 1 of EREC G55

Foreword

Energy Networks Association (ENA) Member Companies are committed to sharing best practice and working with the Regulators to successfully manage the risks to health and safety within the Electricity Industry. Where all ENA Member Companies agree to follow a similar approach to manage a specific risk the intention will be to formalise a common standard. This will be communicated to HSE for their information and will provide operational inspectors with an understanding of the minimum standards they should expect when visiting an ENA Member Company.

B.1 Scope

This Annex has been prepared by the ENA Safety, Health and Environment (SHE) Work Group for use by all ENA Member Companies. EREC G55 defines Live Zone and Vicinity Zone distances for tree working in proximity to the overhead LV network. This Annex highlights the rationale for adopting the distances quoted for LV live zone and provides reference to other relevant documentation.

B.2 General

In Clause 3 of EREC G55 two zones are defined:

Live Zone

The zone around an exposed live circuit conductor or supporting insulators where there is a danger of burn or electric shock if any part of a person's body or non-insulated tool they are using enters the zone.

NOTE: For voltages above 1kv (HV) circuit conductors this is related to the 'safety distance' as described by the network operator. The distances, which depend on voltage, are shown in Table 1.

Vicinity Zone

The zone around an exposed live circuit conductor, which if maintained will ensure that the danger of burn or electric shock is prevented because the live zone is not breached.

NOTE 1: The live zone is included within the measurement of the vicinity zone.

NOTE 2: The distances, which depend on voltage, are shown in Table 1. 'Working and access clearances', as described by some network operators, for the vicinity zone should not be used as they have different values.

B.3 Rationale for adopting 300 mm for the LV Live Zone Distance

B.3.1 Background

When EREC G55 was revised in 2008 it was highlighted there was a lack of a clearly specified Live Zone dimension for Low Voltage overhead lines. The previous version of EREC G55 defined the *Live Zone* as:

"The zone around an exposed live Circuit Conductor or supporting insulators where there is Danger of burn or electric shock if any part of a person's body or non-insulated tool they are using enters the zone."

The dimensions for the Live Zone were not stated explicitly in the previous version of EREC G55, but the term Safety Distance was defined (even though the term Safety Distance was not used in EREC G55) as:

“As defined in the Electricity Industry Model Distribution Safety Rules [MDSR]. The Live Zone is equivalent to the Safety Distance.”

It is important to recognise that to ensure that there is no breach of the Live Zone by any part of a person's body or non-insulated tool then a Vicinity Zone is established by adding a factor of safety and that control measures are established to ensure that there is no intentional breach of the Vicinity Zone.

The term Live Zone is used in EREC G55 to establish adequate control measures depending on whether or not branches breach or are overhanging the Live Zone. The Live Zone concept is fundamental to the document and so it is essential that there is no doubt about the definition of the Live Zone or its actual dimension across all voltages.

B.3.2 Rationale

There is no reason to deviate from the statement that the Live Zone is equivalent to the Safety Distance. However, the term Safety Distance is defined in the MDSR only in terms of the distance around live High Voltage conductors to avoid danger. This term is only used in the MDSR in relation to live High Voltage conductors.

The Safety Distances are detailed in section 4.4.1 of the MDSR and are adopted in EREC G55 as the Live Zone dimensions for High Voltage conductors.

As no guidance is given in the MDSR for a suitable Safety Distance for live Low Voltage conductors then the SHE Work Group looked to BS EN 50110-1:1997, *Operation of electrical installations* as this was used to establish the Safety Distances for High Voltage in the MDSR. (Note: although a later version of this standard BS EN 50110-1:2004, *Operation of electrical installations* existed at the time of writing, the principles of the 1997 version were used since the distances in the MDSR were based upon that version. A comparison was done against the guidance in the 2004 version in section 16 and from this it can be seen that the distance adopted also satisfies the 2004 version.)

B.3.3 BS EN 50110-1:1997

In BS EN 50110-1:1997 the following definitions are relevant.

Live working zone: a space around live parts in which the insulation level to prevent electrical danger is not assured when encroaching it without protective measures.

Vicinity zone: a limited space around the live working zone.

Working in the vicinity of live parts: all work in which a worker or any part of their body, with a tool or any other object enters into the vicinity zone without encroaching into the live working zone.

Live working: all work in which a worker makes contact with live parts or reaches into the live working zone with either parts of their body or with tools or devices being handled.

Electrical distance: the distance in air that protects against electrical breakdown during live working. In general terms, the electrical component is the minimum distance between two electrodes, which represent live and/or earthed parts, required to ensure that the probability of electrical breakdown is negligible when subjected to the most severe electrical stress likely to arise under the conditions prescribed.

Ergonomic component: the distance in air which allows for limited errors of movement and judgement of distance during the work required to be carried out at the minimum working distance. This needs to take into consideration the actions of the person as well as the tools that are to be used and manipulated.

BS EN 50110-1:1997 Table A.1 specifies a distance in air defining the outer limit of the vicinity zone as 500 mm for 'working in the vicinity of live parts' with a nominal system voltage of <1,000 volts. Clause A.1 specifies that the distance to the outer boundary of the 'live working zone' should be equal or greater than the 'minimum working distance' which Table A.2 specifies as 200 mm for parts with a nominal system voltage of <1,000 volts.

BS EN 50110-1:1997 Clause A.3 recommends that the 'electrical distance' should be equal to the distance defining the outer limit of the 'live working zone' and that this should be equal or greater than the 'minimum working distance' i.e. 200 mm as above.

BS EN 50110-1:1997 Clause A.4 explains that it is necessary to add an additional distance, the 'ergonomic component', to the 'electrical distance' to take account of certain factors such as:

- a) unintentional movement of the worker carrying out the work;
- b) the inability to judge correctly the required distance, especially when it is large as required for higher voltages;
- c) the difficulty of maintaining the correct distance, especially when it is small as required for lower voltages;
- d) the accidental movement of conductive objects worn or handled by the worker or which are in the vicinity of the worker.

It follows that the Live Zone in EREC G55 terms should be established by applying an 'ergonomic component' to the 'electrical distance' as stated above. For Low Voltage the 'electrical distance' is taken as 200 mm.

Having regard for the definition of 'ergonomic component', as there is no intention to approach the 'electrical distance' with the body or non-insulated tools then none of the above factors (items a-d) appear relevant with the exception of the judgement of the distance. As it is low voltage, the distance is small and it is being estimated alongside the point of reference of conductors with a small separation then an 'ergonomic component' of 100 mm will be used (an increase of 50% of the 'electrical distance').

Therefore, the Live Zone for Low Voltage for EREC G55 is determined as:

'electrical distance' (200 mm) + 'ergonomic component' (100 mm) = Live Zone (300 mm)

B.3.4 Comparison of EREC G55 with BS EN 50110-1 2013 Standard

Comparing the EREC G55 LV distances with the guidance in the later 2013 Standard, it can be seen that in Table A.1 of BS EN 50110 -1 :2013, *Operation of electrical installations* for low voltage, the **Minimum acceptable distance in air defining the outer limit of the live working zone** is defined as "**no contact**" and the **Minimum acceptable distance in air defining the outer limit of the vicinity zone** is defined as 300 mm. Adopting an LV Live Zone distance of 300 mm and an LV Vicinity Zone distance of 1000 mm in EREC G55 therefore gives a considerable margin of safety over the guidance in the 2013 version of BS EN 50110-1.

Table B.1 — Comparison of LV distances in EREC G55 with BS EN 50110-1:2013

Standard		Distance (mm)		Distance (mm)
EREC G55	Live Zone	300	Vicinity Zone	1,000
BS EN 50110-1:2013 Table A.1	Minimum acceptable distance in air defining the outer limit of the live working zone	“no contact”	Minimum acceptable distance in air defining the outer limit of the vicinity zone	300

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