BRITISH STANDARD

Fences –

Part 17: Specification for electric security fences – Design, installation and maintenance

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Contents

Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 18, an inside back cover and a back cover.

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Foreword

Publishing information

This part of BS 1722 was published by BSI and came into effect on 30 November 2006. It was prepared by Technical Committee B/201, *Fences*. A list of organizations represented on this committee can be obtained on request to its secretary.

Information about this document

BS 1722 is published in the following parts:

- *Part 1: Specification for chain link fences;*
- *Part 2: Specifications for strained wire and wire mesh netting fences;*
- *Part 4: Specification for cleft chestnut pale fences;*
- *Part 5: Specification for close-boarded and wooden palisade fences;*
- *Part 7: Specification for wooden post and rail fences;*
- *Part 8: Specification for mild steel (low carbon steel) continuous bar fences and hurdles;*
- *Part 9: Specification for mild steel (low carbon steel) fences with round or square verticals and flat horizontals;*
- *Part 10: Specification for anti-intruder fences in chain link and welded mesh;*
- *Part 11: Specification for prefabricated wood panel fences;*
- *Part 12: Specification for steel palisade fences;*
- *Part 13: Chain link fences for tennis court surrounds;*[1)]
- *Part 14: Specification for open mesh steel panel fences;*
- *Part 16: Specification for organic powder coatings to be used as a plastics finish to components and mesh;*
- *Part 17: Specification for electric security fences – Design, installation and maintenance;*
- *Part 18: Specification for steel mesh site perimeter temporary fencing systems.*[2)]

Information about this document

Due to the increasing number of electric security fencing installations in the UK during the past 10 years and the various and sometimes conflicting codes of practice in operation, this British Standard has been produced in order to provide a specification that can be used across the electric security fencing industry.

The specification is applicable in situations where the electric security fence is designed to provide both a deterrent effect and a physical security barrier. It therefore sets out the minimum criteria for the physical characteristics for the wire to be used in the barrier.

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1) Obsolescent.
2) Part 18 is in development and will be published as a Draft for Development (DD).

The British Standard does the following:

a) addresses the specification and quality for manufactured products;

b) provides guidance for the client in their selection of installation companies which, by their compliance with this standard, have the ability to design, install and maintain an electric security fence system;

c) addresses competences and training requirements of electric security fence installers.

This British Standard is based on PAS 47:2003. PAS 47 was to provide an interim code of practice for electric security fences.

Use of this document

It has been assumed in the drafting of this part of BS 1722 that the execution of its provision is entrusted to appropriately qualified and experienced people. Before installation commences the Lead Installer and all other operatives i.e. assistant installers should hold a current FISS/CSCS registration card (green card) or equivalent.

At the time of publication of this British Standard the registration cards are validated by the Joint Fencing Industry Skills Scheme (FISS) and Construction Scheme Skills Certification Scheme (CSCS). FISS/CSCS maintains a national register of fence installers and operatives. There might be other schemes available.

NOTE *For further information on training, see* ***6.1***.

Presentational conventions

The provisions of this standard are presented in roman (i.e. upright) type. Its requirements are expressed in sentences in which the principal auxiliary verb is "shall".

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

Requirements in this standard are drafted in accordance with *The BSI guide to standardization – Section 2: Rules for the structure, drafting and presentation of British Standards*, subclause **11.3.1**, which states, "Requirements should be expressed using wording such as: 'When tested as described in Annex A, the product shall ...'". This means that only those products that are capable of passing the specified test will be deemed to conform to this standard.

Contractual and legal considerations

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a British Standard cannot confer immunity from legal obligations.

1 Scope

This British Standard specifies requirements for the design, installation and maintenance of electric security fences. This standard is not intended to cover the installation of any carrier fence or supporting structure and therefore should be read in conjunction of the appropriate part of BS 1722 for the type of carrier fence employed.

NOTE Due consideration should be given to the suitability of any existing fence or structure before the erection of the electric fencing.

It is applicable to installations where the electric security fence is to provide both a deterrent effect and a physical barrier.

It is not intended that this British Standard outlines the specific method to be used in construction. Construction specifics are covered in the appointed approved manufacturers installation courses and material available only to accredited installation dealers and marketing partners.

2 Normative references

The following referenced documents 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.

BS 4737 (all parts), *Intruder alarm systems in buildings*

BS 7671, *Requirements for electrical installations – IEE Wiring Regulations – Sixteenth edition*

BS EN 10002-1, *Tensile testing of metallic materials – Part 1: Method of test at ambient temperature*

BS EN 10244-2, *Steel wire and wire products – Non-ferrous metallic coatings on steel wire – Part 2: Zinc or zinc alloy coatings*

BS EN 50131-1, *Alarm systems – Intrusion systems – Part 1: General requirements*

BS EN 60335-2-76:2005, *Household and similar electrical appliances – Safety – Particular requirements for electric fence energizers*

BS EN ISO 1461, *Hot dip galvanized coatings on fabricated iron and steel articles – Specifications and test methods*

PD 6662, *Scheme for the application of European Standards for intruder and hold-up alarm systems*

3 Terms and definitions

For the purpose of this British Standard, the following terms and definitions apply.

3.1 accessory equipment
product other than the security controllers or security energizers, e.g. switching equipment, expansion modules, interface modules

3.2 ancillary equipment
electrical equipment used in the security installation

3.3 assistant installer

person directly under the supervision of the installer

NOTE See Foreword for the recommended skill level.

3.4 back-up battery

battery source of no less than 8 hours to facilitate the activation and transmission of an alarm condition for a short duration if the normal power supply has been tampered with

NOTE 1 This is not considered to be an alternative power supply. An example of an alternative power supply is a back-up generator.

NOTE 2 This should conform to the BS EN 50131-1 and would only apply to the common control equipment. This would facilitate the activation of an alarm transmission and low battery signal if the normal power supply has been lost for any reason.

3.5 configuration

means of uniquely connecting electric security fence wires to suit the geographical and security requirements of the site

3.6 deterrent pulse

short duration of electricity measuring no more than 5 J when measured into a 500 Ω load separated by a minimum of 1 s intervals

3.7 earth electrode

metallic object intended to provide effective electrical contact with earth (e.g. an electrical earth stake)

NOTE This is part of the electric security fence earth system.

3.8 electric security fence

array of un-insulated strained conductors held in supporting intermediate insulators for the purpose of protection of people, property and/or information

NOTE 1 Used for security detection and deterrent purposes, the electric security fence is connected to a security energizer controller. It is typically constructed as an array of conductive wires (deterrent pulsed and earth or LV conductors).

NOTE 2 The electric security fence could be internal, external, a self-standing barrier, or part of another barrier. The electric security fence can be angled and is intended to be in free air.

3.9 energizer

appliance intended to regulate and control the supply of electric energy to electric security fencing systems

3.10 fence zone

identifiable section of the electric security fencing system which can be divided electrically into multiple fence zones

NOTE 1 Sometimes known as the "fence circuit".

NOTE 2 Each individual zone should not exceed 150 m to help identify the location of attack or tampering.

3.11 fence earth system

system that ensures a conductive path between the energizer and an effective earth for the electric security fencing system

NOTE "Earth" is used in this document to mean the potential of the physical surrounding terra firma. In some regions the term "ground" is used.

3.12 full screen fence

horizontal array of high tensile wires held in supporting intermediate insulators, either self-standing or mounted on a physical barrier support, offering security coverage from the fence base level to no less than 600 mm above the physical barrier height

NOTE The term "full screen fence" is intended to include gates.

3.13 gate

intentional access point for passing goods or persons through the perimeter

NOTE A gate leaf is the movable part of a gateway.

3.14 hazardous area

area in which an explosive/flammable atmosphere is present, or is potentially present, in quantities such as to require special precautions for the construction, installation and use of potential ignition sources

3.15 inadvertent contact

contact with the pulsed conductor other than that which occurs as a conscious and deliberate effort to penetrate the physical barrier

3.16 installer

person responsible for fence installation

*NOTE See Foreword and **6.1** for the recommended skill level and training requirements.*

3.17 intermediate insulator

specific security device of durable non-hygroscopic insulating material for supporting a pulsed conductor and designed specifically for the purpose of security detection, insulating and frangibility in the case of an intruder attack

3.18 intermediate post

one of a number of posts that are positioned between two strain positions and that support the electric security fence conductors

3.19 LV signal

monitoring voltage used on the electric security fencing system that is not the deterrent pulse produced by an energizer

3.20 lead-out cable

insulated electric conductor which is designed specifically for the transmission of high voltage pulses

3.21 lead installer

person in charge of supervising the installation

NOTE See Foreword for the recommended competency/skill level.

3.22 mantrap

construction that can prevent a person from withdrawing from repeated shocks from the electric security fence system

3.23 perimeter

outer boundary of an enclosed area

3.24 power supply
220 V – 240 V unswitched power supply to the electric security fence system

3.25 physical barrier
barrier, at least 1.8 m high, minimizing the risk of inadvertent contact by the public with the pulsed conductors of the attack face of the electric security fencing system

3.26 pulsed conductor
conductor that is subjected to high voltage pulses by the energizer

3.27 secure area
internal or non-public area that is being protected

NOTE This area might be an area where a person is not separated from pulsed conductors below 1.8 m by a physical barrier.

3.28 security energizer controller
specifically designed equipment comprising a unit that supplies safe deterrent pulses to electric security fences, detection zones, and all necessary control circuitry to enable full security options, e.g. timed alarms, secure set/unset features, internal back-up battery, and enclosure tamper devices

3.29 strain position
position at which an uninsulated conductor is tensioned or terminated

NOTE Typically at end of zones, changes of direction or level.

3.30 wall mounted/walltop electric fence
fence constructed above 1.8 m and mounted onto the top of a wall structure

4 Equipment

4.1 Electrical equipment

4.1.1 Energizers

All energizers shall conform to the requirements of BS EN 60335-2-76.

4.1.2 Alarm control and communication

When electric security fences are integrated with an intruder alarm system the control and communication equipment shall conform to BS 4737 or BS EN 50131-1 and PD 6662.

NOTE Specifications can also include reference to accessory equipment, such as floodlighting and CCTV.

4.1.3 Wiring

All mains electrical wiring shall be in accordance with BS 7671.

4.2 Mechanical equipment

4.2.1 Electric security fence posts and components

All steelwork associated with electric fence posts and components shall as a minimum be hot dipped galvanized to BS EN ISO 1461.

The maximum fence post spacing shall not exceed 3 m.

4.2.2 Fence wire

All electrified security fence wire shall be made of high tensile steel wire and shall be either galvanized to BS EN 10244-2 or zinc and aluminium alloy coated (95% zinc : 5% aluminium). It shall have either:

a) a minimum diameter of 2 mm; or

b) a minimum tensile strength of 1200 N/mm^2 and a minimum maximum force of 3.77 kN, when tested in accordance with BS EN 10002-1.

The spacing between adjacent wires shall be a minimum of 50 mm and a maximum of 100 mm.

The resistance of the wire and the volt drop per meter shall be determined at the design stage, with a maximum permissible total loop resistance of 300 Ω per zone.

5 Design

5.1 General

The electric security fencing system shall be designed, installed, operated and maintained so that, under normal conditions of operation, persons are protected against inadvertent contact with pulsed conductors and the structure is not a mantrap.

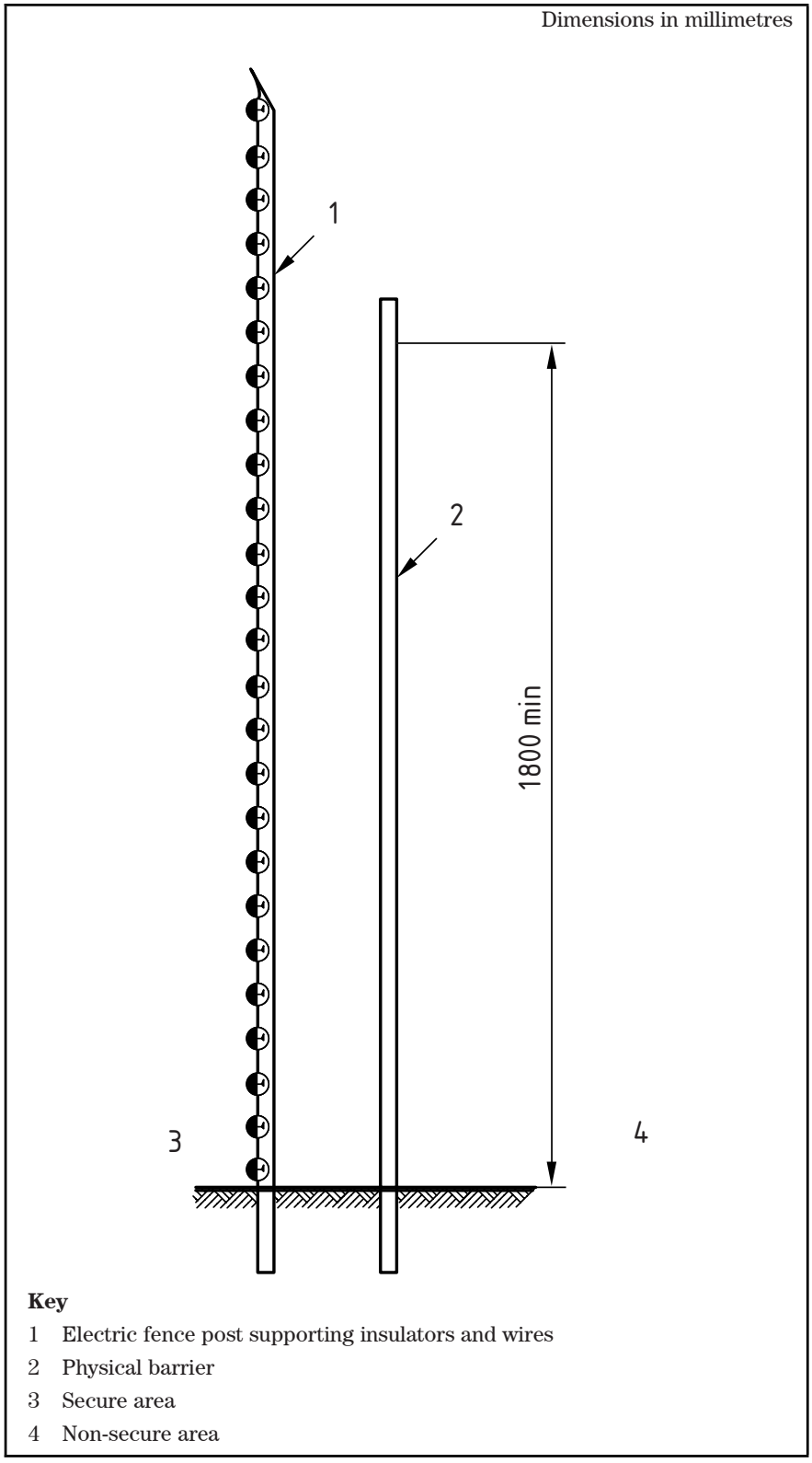
A site survey and a risk assessment shall be carried out prior to installation, and shall take into account any hazardous areas.

5.2 Full screen fence (see 3.12)

5.2.1 Freestanding system

Freestanding systems shall be constructed in accordance with Figure 1. The distance between the electric security fence system and the physical barrier shall be either more than 100 mm but no more than 200 mm or more than 1 m, and the physical barrier shall be no less than 1.8 m high.

Figure 1 **Construction of a freestanding system**



Key

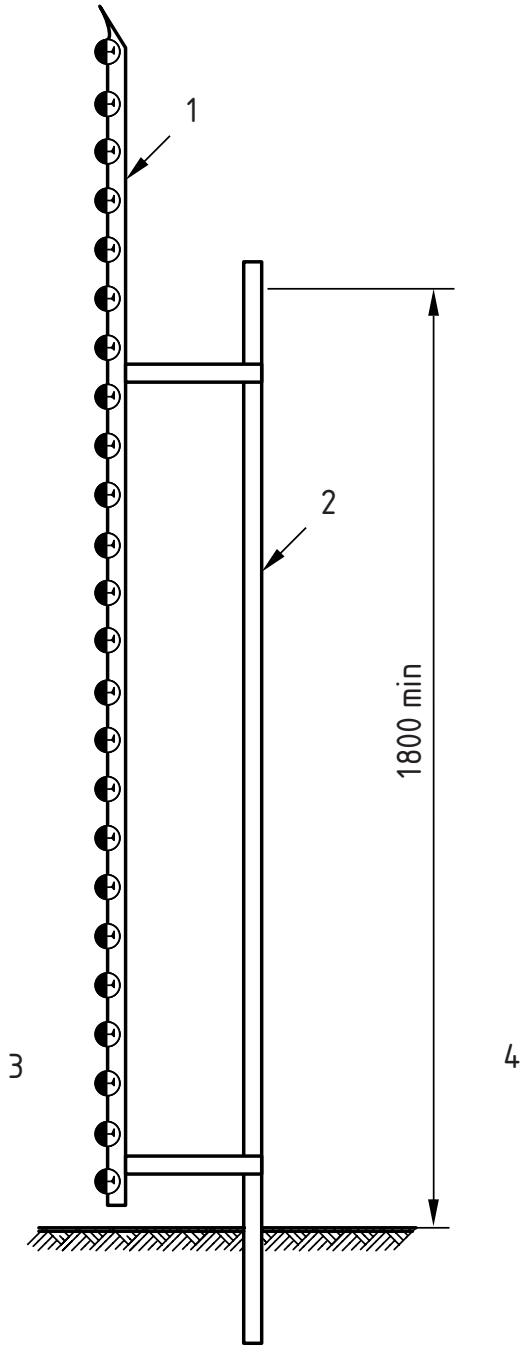
1 Electric fence post supporting insulators and wires
2 Physical barrier
3 Secure area
4 Non-secure area

5.2.2 Fence mounted system

Fence mounted systems shall be constructed in accordance with Figure 2. The distance between the electric security fence system and the physical barrier shall be more than 100 mm but no more than 200 mm and the physical barrier shall be no less than 1.8 m high, with the bottom wire a maximum of 125 mm from ground level.

Figure 2 **Construction of a fence mounted system**

Dimensions in millimetres



Key

1 Electric fence post supporting insulators and wires
2 Physical barrier
3 Secure area
4 Non-secure area

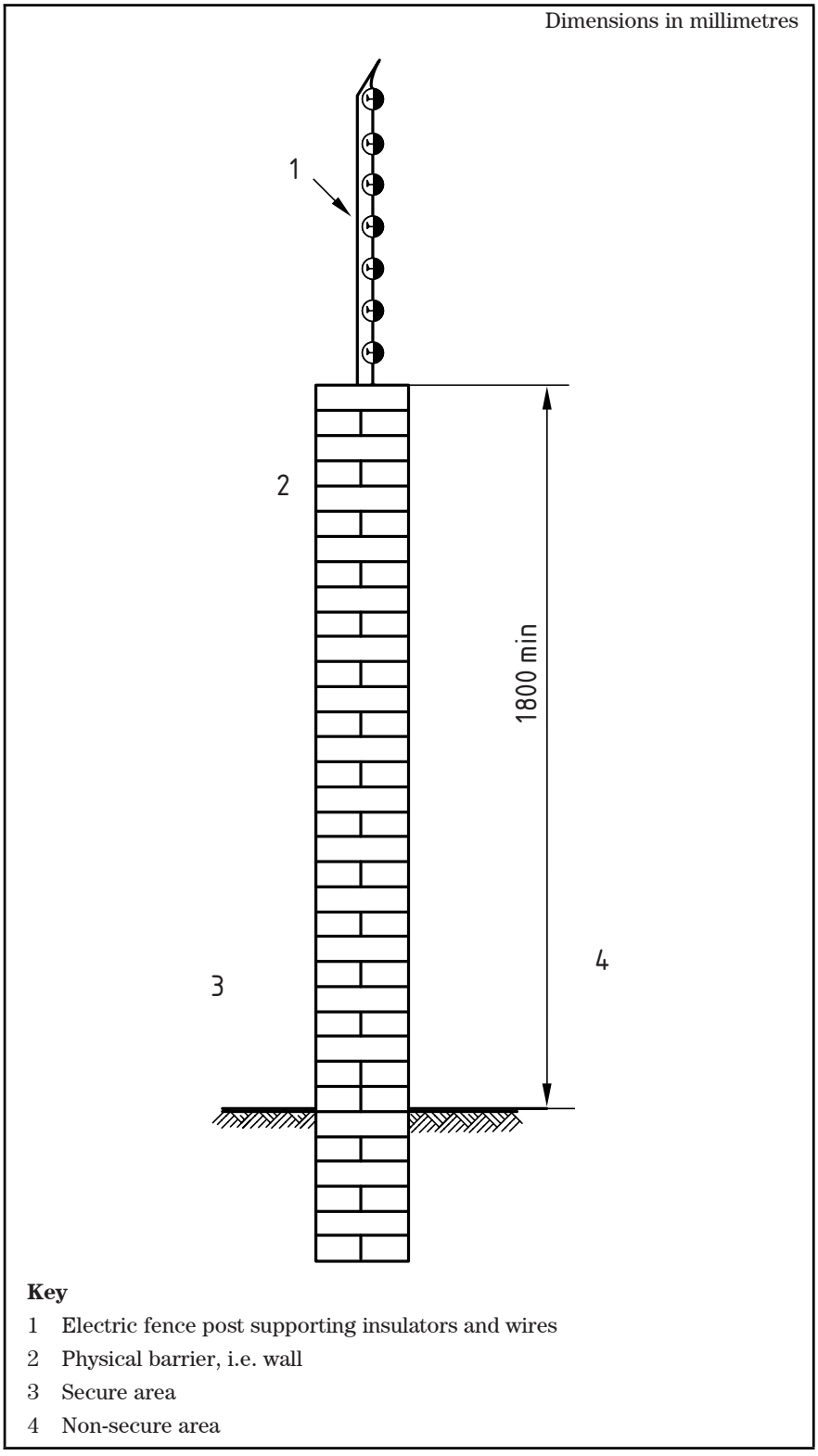
5.3 Wall mounted/walltop electric fence

NOTE Where the construction of the wall permits, the electric security wires should be vertically above the attack face of the wall.

Electric security fencing systems mounted to the top of a wall shall be no less than 1.8 m from ground level.

The wall mounted/walltop electric security fence system shall be constructed in accordance with Figure 3. The top of the system shall be a minimum of 1 m above the height of the wall, with the bottom wire a maximum of 125 mm from the wall top.

Figure 3 **Construction of a wall mounted/walltop electric fence**



Key

1 Electric fence post supporting insulators and wires
2 Physical barrier, i.e. wall
3 Secure area
4 Non-secure area

5.4 Insulation

Strained pulsed conductors and connecting leads on the electric security fencing system construction, shall be supported on intermediate insulators or insulated material or covered with a suitable insulated material, e.g. pulsed wire insulation sleeving.

5.5 Strain point rigidity

NOTE The final design is based on ground conditions, application, preferred materials and bracing.

In the design process, the anticipated additional strain of a tensioned electric security fence shall be determined for all straining positions.

5.6 Barbed, razor wire or any other hostile wall/fence toppings

An electric security fence and any associated structure, such as the physical barrier, shall not contain barbed, razor wire or any other hostile wall/fence toppings that might therefore cause entrapment.

5.7 Power and communication line crossing

Crossings with overhead power lines shall be avoided wherever possible. If such a crossing cannot be avoided, it shall be made underneath the power line and as near as possible at right angles to it.

The fence shall be positioned at minimum distances in accordance with Table 1 to minimize the possibility of making simultaneous contact with it and any other overhead line and the appropriate electricity supply utility, company or authority consulted.

Table 1 **Minimum separation distances between electrified security fences and un-insulated overhead power lines**

Power line voltage	**Minimum separation** (m)
Low voltage	3
Exceeding low voltage and up to 33 kV	4
Exceeding 33 kV	8

Electrified security fencing or connecting leads shall not cross above overhead power or communication lines.

Electrified security fence wires or connecting leads shall not be fixed to poles or supports used for low voltage or high voltage overhead power lines or communication lines.

6 Installation

6.1 General

NOTE 1 See Foreword.

NOTE 2 This requirement is primarily intended to establish that a minimum physical level of restraint is maintained.

Installation of a multi-wire electric security fence system shall be supervised by a Lead Installer.

An electric security fence shall be installed so that, under normal conditions of operation, persons cannot come into accidental contact with electric security fence conductors.

All company personnel involved in the specification of multi-wire electric security fencing products, or employed as the Lead Installer for any installation, shall have successfully completed a verifiable formal training course.

As a minimum the contents of the course shall cover:

a) the specification and technical capabilities of the equipment being offered for sale;

b) how to conduct a site survey and the parameters for advising on location and installation options;

c) the methods of pulsed wire operation, installation properties at high pulsed volts and the related legislation and Health and Safety Executive recommendations.

NOTE These include The Health and Safety at Work Act 1974 *[1]*, The Management of Work Regulations 1999 *[2]*, The Electricity at Work Regulations 1989 *[3]*, The Fire Precautions (Workplace) (Amendment) Regulations 1999 *[4]*, The Occupiers Liability (Scotland) Act 1960 *[5] and* The Occupiers Liability Acts 1957 and 1984 (England and Wales) *[6]*.

d) the safe operating and installation requirements;

e) installation procedures;

f) demonstration procedures;

g) written, oral and practical tests.

Installation of a multi-wire electric security fence system shall only be supervised by a Lead Installer who has completed an appropriate manufacturer-specific training course for the manufacturer-specific installation being undertaken.

Records of training shall be maintained for all current and past personnel for at least 6 years. A system shall be maintained for updating current employees/representatives/agents of material changes in the training course. Refresher courses shall be held as and when necessary.

Detailed training records of organizations and individuals shall be maintained by both the training organization and the installer so that independent verification can be undertaken if required.

6.2 Protection

Electric security fence energizer control equipment and ancillary equipment shall be installed, operated and maintained in a manner that protects it from damage, tampering, and the weather. All equipment shall be mounted in an environmentally protected location or enclosure to a minimum of IP65.

6.3 Electric security fence strained pulsed conductors

6.3.1 Earth or LV conductors on electric security fencing systems

NOTE Earth or LV conductors form part of an electric security fence.

Spacing between strained pulsed conductors and earth or LV conductor wires shall not exceed 100 mm.

6.3.2 Wire tension

Electric security fencing wires shall be supported and tensioned to maintain the original geometry of the fence with a maximum distance between strain points of 150 m.

6.3.3 Insulation from buildings and structures

Strained pulsed conductors shall be installed so that a minimum clearance of 25 mm, through air, is maintained from any part of a building or structure (including pipes and wiring) and so that a clearance of 25 mm is maintained from any earthed fence components.

6.4 Cabling

6.4.1 Lead-out cables

Lead-out cables shall be mechanically secure or within an exclusive duct.

6.4.2 Different cabling types

Different cabling types (e.g. mains supply, LV signal and electric security fence wiring) shall not be installed in the same ducting conduit.

Fence feed and fence return lead-out cables exceeding 3 m shall be separated by a minimum of 100 mm to minimize cross induction.

6.4.3 Protection of underground cabling

Lead-out cables shall be protected against tampering or damage by ducting.

6.5 Warning signs

An electric security fence shall be identified by prominently placed warning signs. Signs shall be legible from both the secure area and the non-secure area and be in accordance with BS EN 60335-2-76:2005, **BB.2**.

Warning signs shall be placed:

a) at each entry/exit point;

b) between each change in elevation or direction;

c) at intervals not exceeding 10 m.

6.6 Earthing

All earthing shall be carried out in accordance with BS EN 60335-2-76.

The electric security fencing system earth shall not be connected to the existing site earth unless it is the specific perimeter fence earth.

Exposed conductive parts of both the physical barrier and the electric security fence support structure shall be earthed.

Where ground conditions reduce the effectiveness of the earth, additional earth electrodes shall be installed.

Lightning protection earth systems shall be physically separated from the fence earth system.

6.7 Connections

All connections within the electric security fence system shall have good electrical contact.

Permanent connections shall be clamped.

NOTE Joints of dissimilar metals should be avoided.

6.8 Separation between the electric security fence system and physical barrier

If the security electric fence is attached to an existing physical barrier it shall be mounted more than 100 mm but no more than 200 mm from the fence fabric. In all other cases it shall be a minimum of 1 m from any other physical obstruction.

Separation between exposed pulsed wires and earthed metal shall be maintained at 25 mm or greater, measured along the shortest air path.

NOTE These restrictions are intended to reduce the possibility of persons making inadvertent contact with the strained pulsed conductors and to prevent them from becoming wedged between the electric security fence and the physical barrier, thereby being exposed to multiple shocks from the energizer.

6.9 Mounting the electric security fence

6.9.1 Separation between the intermediate posts

Intermediate posts shall be spaced no more than 3 m apart.

6.9.2 Bracing

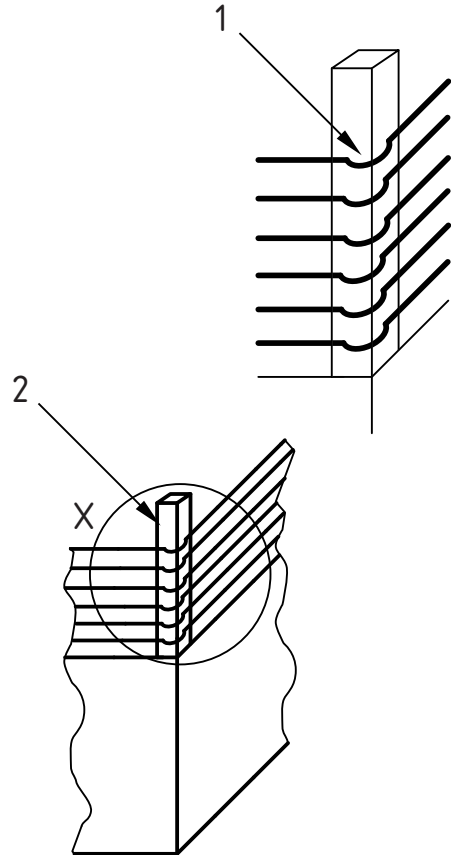
Bracing shall not compromise the security of the perimeter, i.e. it shall not provide a climb position for an intruder. Bracing shall be within the secure area.

6.9.3 Anti-scaling (Anti-climb)

The electric security fence (including the strain positions, mounting positions, gates, etc.) shall, if anti-scaling is required, be configured to resist or detect scaling as illustrated in Figure 4.

All anti-scaling wires shall be series connected to provide cut detection wherever possible. Where this is not possible, then parallel connection shall be used.

Figure 4 **Anti-scaling configuration**



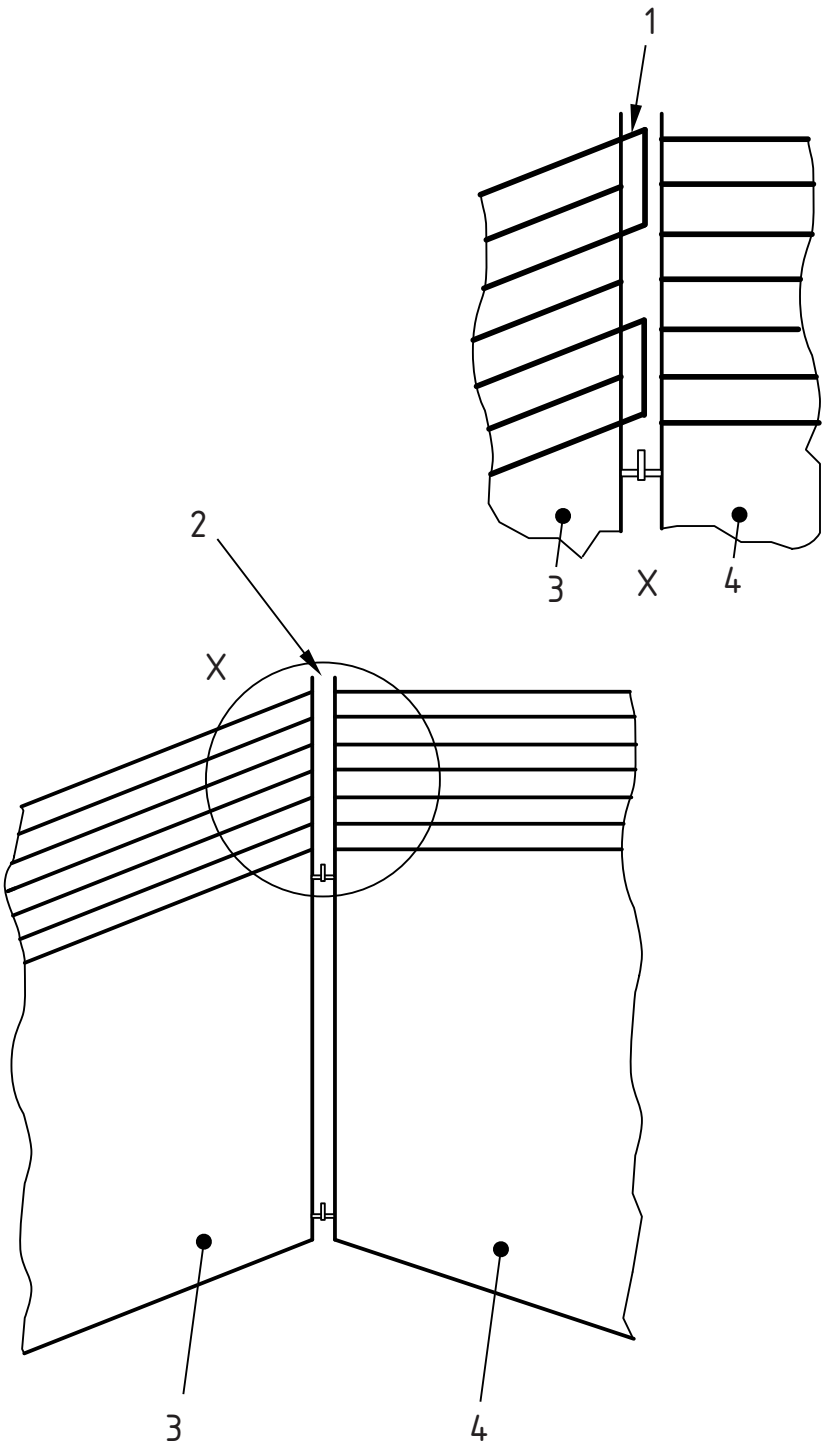
a) External corner

Key

1 Anti-scale loops

2 Area of risk

Figure 4 **Anti-scaling configuration** (*continued*)



b) Internal corner

Key

1 Anti-scale configuring
2 Vulnerable point
3 Fence
4 Gate

6.10 Vegetation contact

Vegetation contact with any conductors shall be avoided.

6.11 Gates

6.11.1 Safety and detection

Gates in an electric security fencing system shall be capable of being secured and opened without the operator receiving a shock. This shall be achieved by including a switching device on the gate to remove the pulses and identify entry. This device shall activate within 50 mm of the gate opening from the closed position.

6.11.2 Gate security

Gates that represent access points shall incorporate a suitable locking device to ensure that gates are secured against unauthorized entry.

All connections between fence posts and gates shall be installed in such a manner that they are sufficiently flexible to allow full operation of the gate.

NOTE Any main entrance/exit point should be configured as a separate independent zone.

6.12 Zone separation barrier

For any two adjacent electrified security fence zones fed from different energizers, a spacing of not less than 2.5 m shall be maintained between the zones, except where the zones are separated by a physical barrier of at least 1 m in length. The physical barrier shall not contain any openings greater than 50 mm. The distance between the end of the separation barrier and the electrified security fence shall be at least 1 m.

A zone separation barrier is not required when all the energizers on the system are synchronized and the total combined output energy from adjacent zones is not more than 5 J when measured into a 500 Ω load.

7 Operation of an electric security fence

The conductors of an electric security fencing system shall not be energized unless all authorized persons, within or entering the secured area, have been informed of its function and purpose.

Once installed and commissioned, the electric security fencing system shall not become operational until the customer's nominated representative has had training in its use.

8 Documentation and maintenance

8.1 Commissioning

Each installation shall be formally commissioned and maintained in accordance with the manufacturer's recommendations, and readings of fence voltage and joule Ω shall be taken and recorded.

8.2 Operations and maintenance manual

An operations and maintenance manual shall be provided to the customer and shall include the following:

- electric security fencing system layout and zones;
- electric fence installation specification;
- original commissioning data;
- details of the recommended periodic maintenance program including the next maintenance check and the contact details of the organization for maintenance and call-out;
- full operational instructions;
- completed inspection sheet together with electric security fence analysis readings that shall include voltage loop resistance and energy into a 500 Ω load for each individual electrical zone;
- manufacturer's certificate of conformity;
- installer's contact details;
- a statement that no modification is permitted except by an approved installer, and that if any modification is made, then a revised certificate of conformity shall be issued by the approved installer;
- emergency services notification letter (see Annex A).

8.3 Maintenance

Maintenance shall be scheduled to occur at a minimum of twice a year, or more frequently if specified by the manufacturer.

NOTE Due to the nature of the equipment and the protection provided to property, the manufacturer and the installer should maintain close contact with the following:

a) police forces;

b) fire and rescue services;

c) insurance companies.

Such contact should include the provision of:

- *full technical information packs;*
- *technical presentations and demonstrations;*
- *training courses.*

Annex A (informative) Example emergency services notification letter

The following is an example of the letter that should be used to advise the emergency services that an electric security fence has been installed.

To - Chief Constable * / Fire Officer*

[relevant constabulary/fire brigade]*

[relevant town, etc.]

[relevant county]

Dear Sir,

RE--- [Address of installation]

Please be advised that a [company name] electric security fence has been installed at the above location.

We respectfully request that you inform your relevant station, and crime prevention * and operational personnel for the area.

This type of system has been installed on many sites throughout the UK over the past [10 years], and many* crime prevention / community officers are aware of them. They conform to all relevant Health and Safety / legal requirements.

Further information if required may be obtained from:

The installer [relevant company and contact]

The manufacturer [relevant company and contact]

Thank you for your co-operation in this matter.

[Signed by installers]

* Insert information as appropriate e.g. Chief fire officer and fire prevention officer.

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Other publications

[1] GREAT BRITAIN. *The Health and Safety at Work Act 1974*. London: The Stationery Office.

[2] GREAT BRITAIN. *The Management of Work Regulations 1999*. London: The Stationery Office.

[3] GREAT BRITAIN. *The Electricity at Work Regulations 1989*. London: The Stationery Office.

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[5] GREAT BRITAIN. *The Occupiers Liability (Scotland) Act 1960*. London: The Stationery Office.

[6] GREAT BRITAIN. T*he Occupiers Liability Acts 1957 and 1984 (England and Wales)*. London: The Stationery Office.

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