

# **DRAFT TANZANIA STANDARD**

**(Draft Standard)**

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Electric Fences – Design, installation and maintenance

**TANZANIA BUREAU OF STANDARDS**

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## Foreword

This draft Tanzania Standard is being prepared by the Alarm and Electronic Security Systems Technical Committee of the Tanzania Bureau of Standards (TBS), under the supervision of the Electrotechnical Divisional Standards Committee (EDC)

In reporting the results of a test or analysis made in accordance with provision of this Tanzania Standard, if the final value observed or calculated is to be rounded off, it shall be done in accordance with TZS 4: 1999 *Rules for rounding-off numerical values*.

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## 0. INTRODUCTION

Due to the increasing number of electric security fencing installations and the various and sometimes conflicting codes of practise in operation, this standard has been developed in order to provide a specification that can be used across the electric security fencing industry.

The standard 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.

## 1. SCOPE

This Standard specifies requirements for the design, installation and maintenance of electric security fences.

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

It does not outline the specific method to be used in construction. Construction specifics are covered in the appointed approved manufacturer's 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.

*TZS 2014/ IEC 62642 (all parts) Alarm systems - Intrusion and hold-up systems*

*TZS 311 Code of practice for electrical installations*

*TZS 3840-1/ ISO 6892-1 Metallic materials – Tensile testing – Part 1: Method of test at ambient temperature*

*TZS 1795/ EAS 135 Steel wire and steel wire products for fencing – Specification*

*TZS 2893/ ISO 1461, Hot dip galvanized coatings on fabricated iron and steel articles - Specifications and test methods*

*IEC 60335-2-76 Household and similar electrical appliances - Safety - Part 2-76: Particular requirements for electric fence energizers.*

## 3. DEFINITIONS

For the purpose of this Standard, the following definitions shall apply

### 3.1 accessory equipment

ancillary equipment required for operation of the electrified security system.

*EXAMPLE Switching equipment, expansion modules, interface modules.*

*NOTE See Foreword for the recommended skill level.*

### **3.4 back-up battery**

battery source to facilitate the activation and transmission of an alarm condition for a short duration if the normal power supply has been tampered

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

### **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

### **3.7 earth electrode**

metallic object intended to provide effective electrical contact with earth. **EXAMPLE** An electrical earth **stake**.

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

### **3.8 electric security fence**

array of uninsulated 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 does not exceed 150 m to help identify the location of attack or tampering.*

### **3.11 fence earth system**

### **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

### **3.23 perimeter**

outer boundary of an enclosed area

### **3.24 power supply**

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

### **3.25 physical barrier**

barrier to 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

*NOTE For example, 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/ wall top electric fence**

fence 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 IEC 60335-2-76.

A back-up battery shall be installed to ensure operation of the system during mains failure for a period of no less than 8h.

The back-up battery shall conform to TZS 2014-6/ IEC 62642-6 and would only apply to the common control equipment.

*NOTE This would facilitate the activation of an alarm transmission and low battery signal if the normal power supply has been lost for any reason.*

#### **4.1.4 Wiring**

All mains electrical wiring shall be in accordance with TZS 311.

## **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 TZS 2893/ 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 TZS 1795/ EAS 135 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 1 200 N/mm<sup>2</sup> and a maximum force of 3.77 kN, when tested in accordance with TZS 3840-1/ ISO 6892-1.

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 Ohms 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.

*NOTE Due consideration should be given to the suitability of any existing fence or*

## **5.2 Full screen fence**

### **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.

### **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.

## **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.*

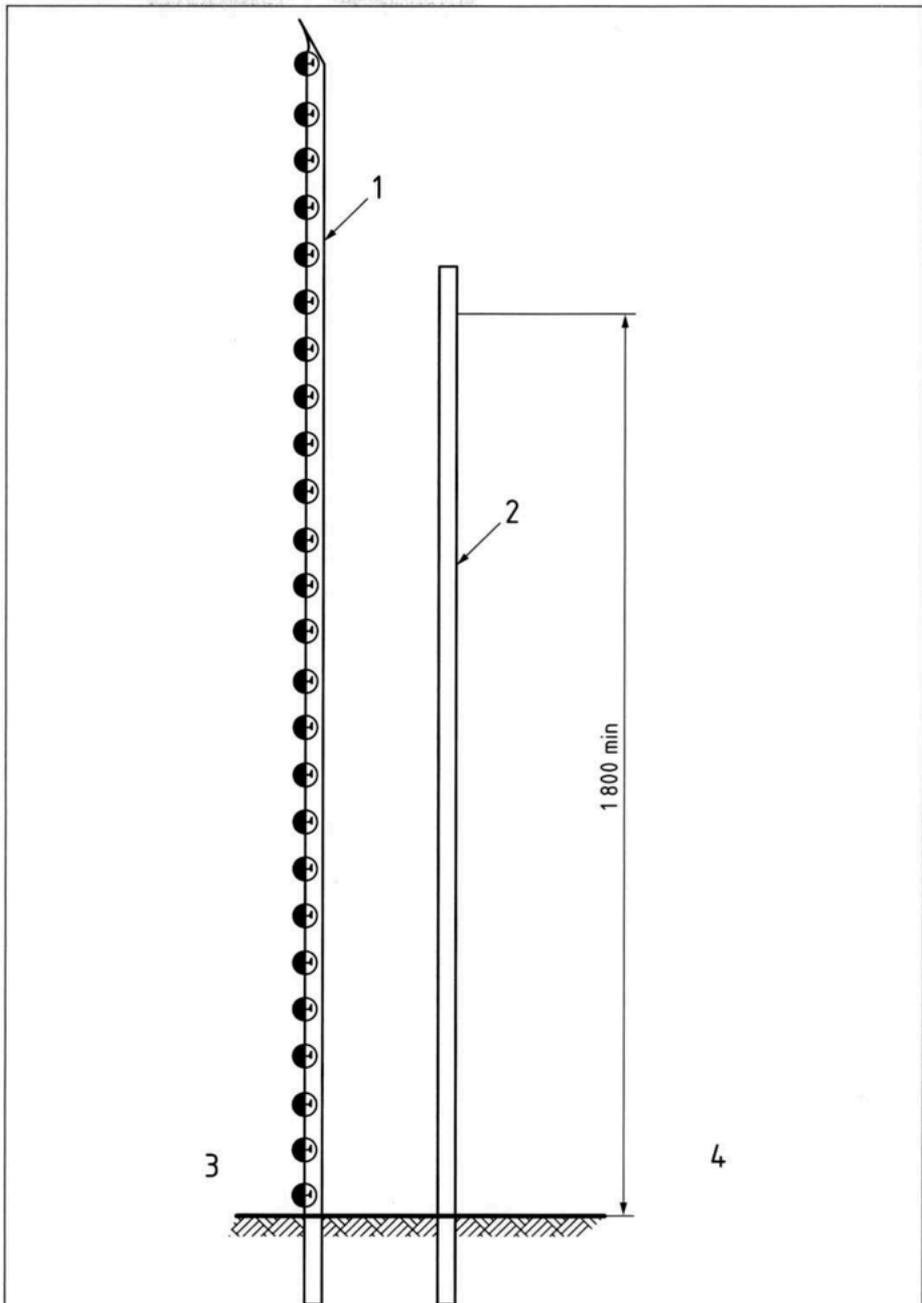
Electric security fencing systems mounted to the top of a wall shall be no less than 1.8 m from ground level.

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.

## **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.

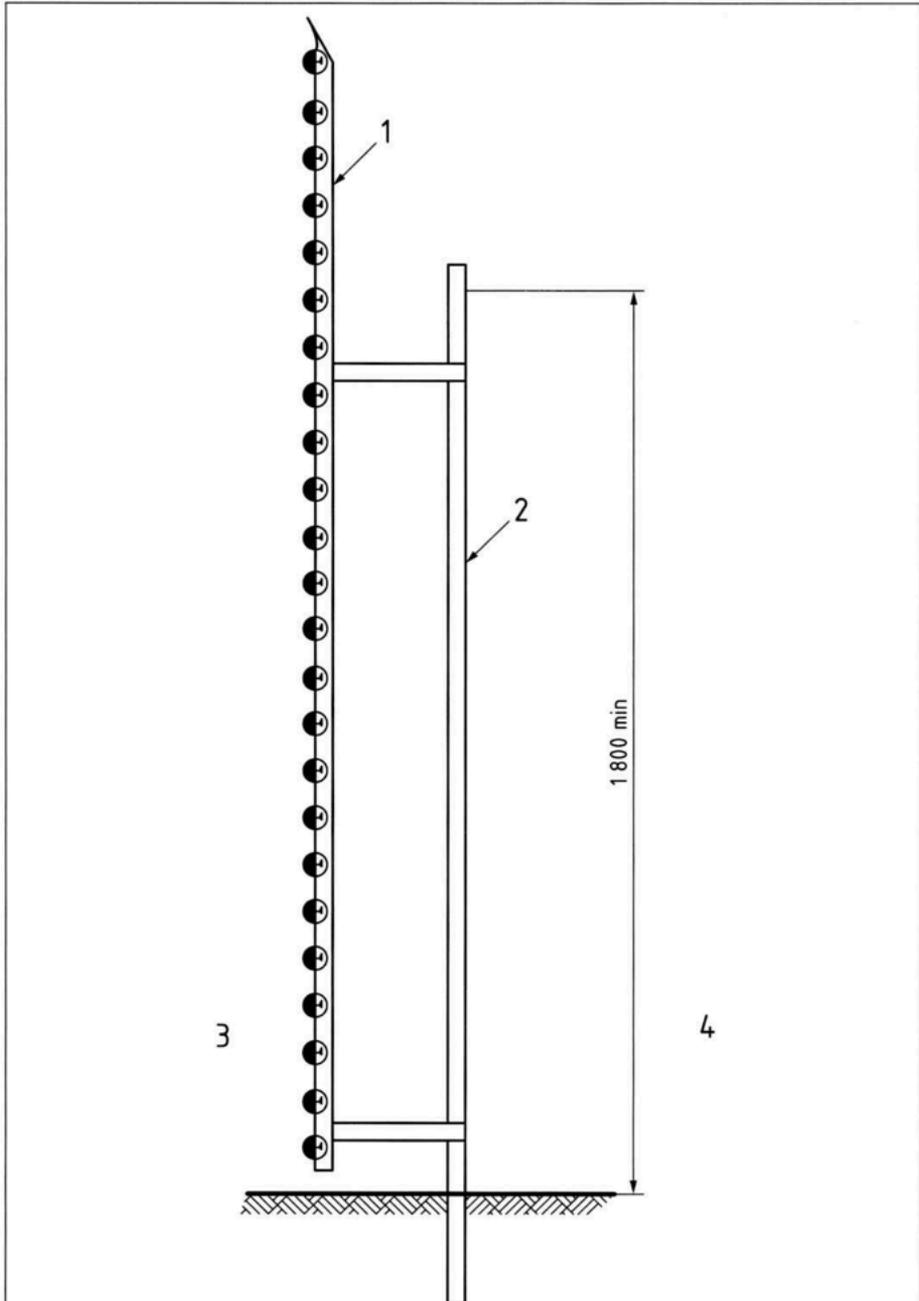
Figure 1 Construction of a freestanding system



**Key**

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

Figure 1 Construction of a fence mounted system

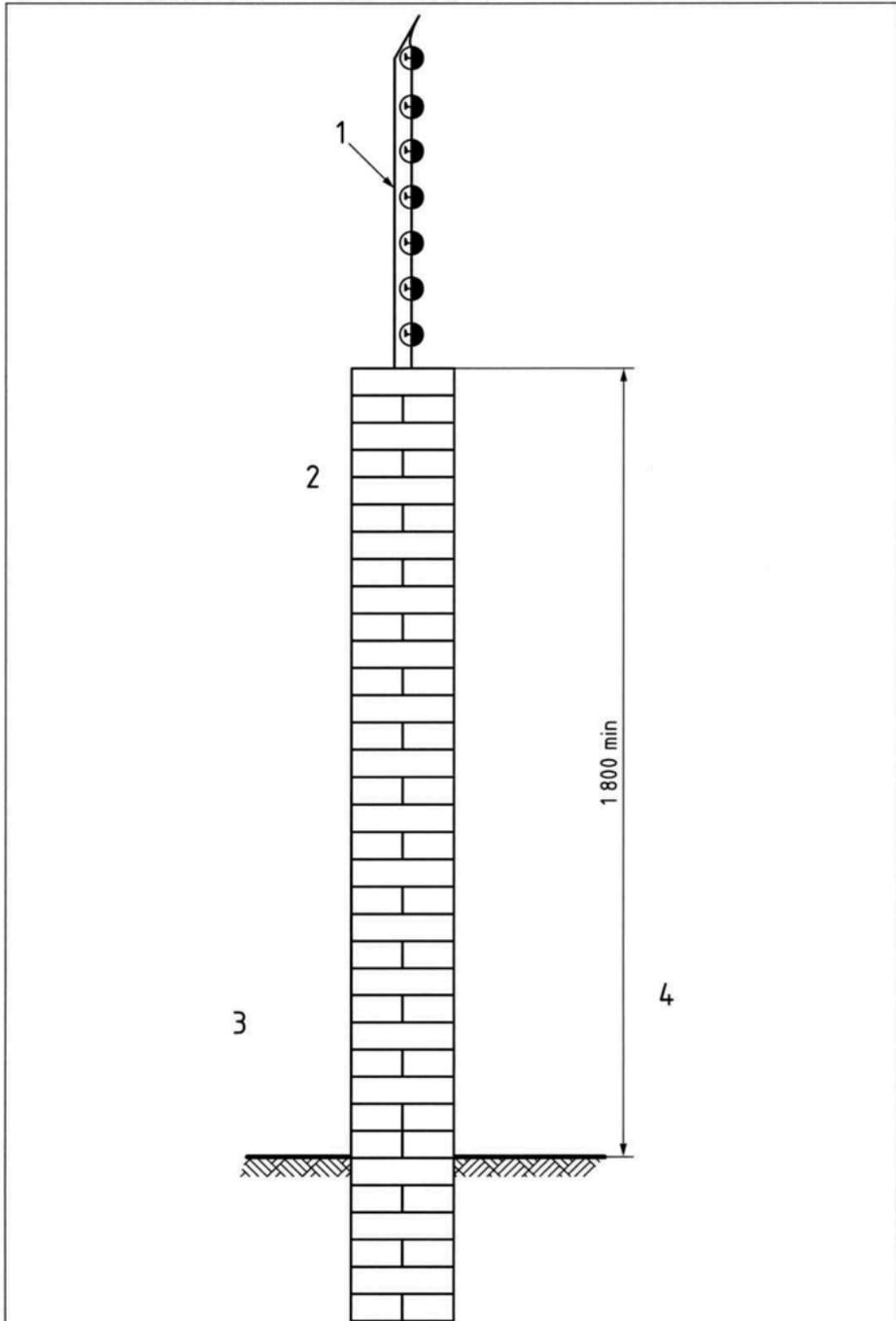


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**Key**

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

Figure 1 Construction of a wall mounted/walltop electric system



**Key**

- 1 Electric fence post supporting insulators and wires

## 5.5 Strain point rigidity

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

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

## 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 uninsulated 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 be 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

Installation of a multi-wire electric security fence system shall be supervised by a trained lead installer.

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 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 OSHA laws and regulations  
*NOTE 2 These include The Occupational safety and health (building and construction industry) rules, 2015*
- d) The safe operating and installation requirements;
- e) Installation procedures;
- f) Demonstration procedures; and
- g) Written, oral and practical tests.

Installation of a multi-wire electric security fence system shall 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 organization and the installer so that independent verification can be undertaken if required 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.

Spacing between strained pulsed conductors and earth or LV conductors 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 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 conduct.

Fence feed and fence return lead-out cables exceeding 3m 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 IEC 60335-2-76.

Warning signs shall be placed:

- a) At each entry/exit point;
- b) Between each change in elevation or direction; and
- c) At intervals not exceeding 10m.

#### 6.5.1 Earthing

The electric security fencing system earth shall not be connected to the existing site earth

*NOTE The electric security fence may be connected to existing perimeter security fence earthing systems*

## **6.6 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*

## **6.7 Separation between the electric security fence system and the 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.*

## **6.8 Mounting the electric security fence**

### **6.8.1 Separation between the intermediate posts**

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

### **6.8.2 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.

### **6.8.3 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 Figures 4a to 4e.

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 4a Example of an anti climb configuration

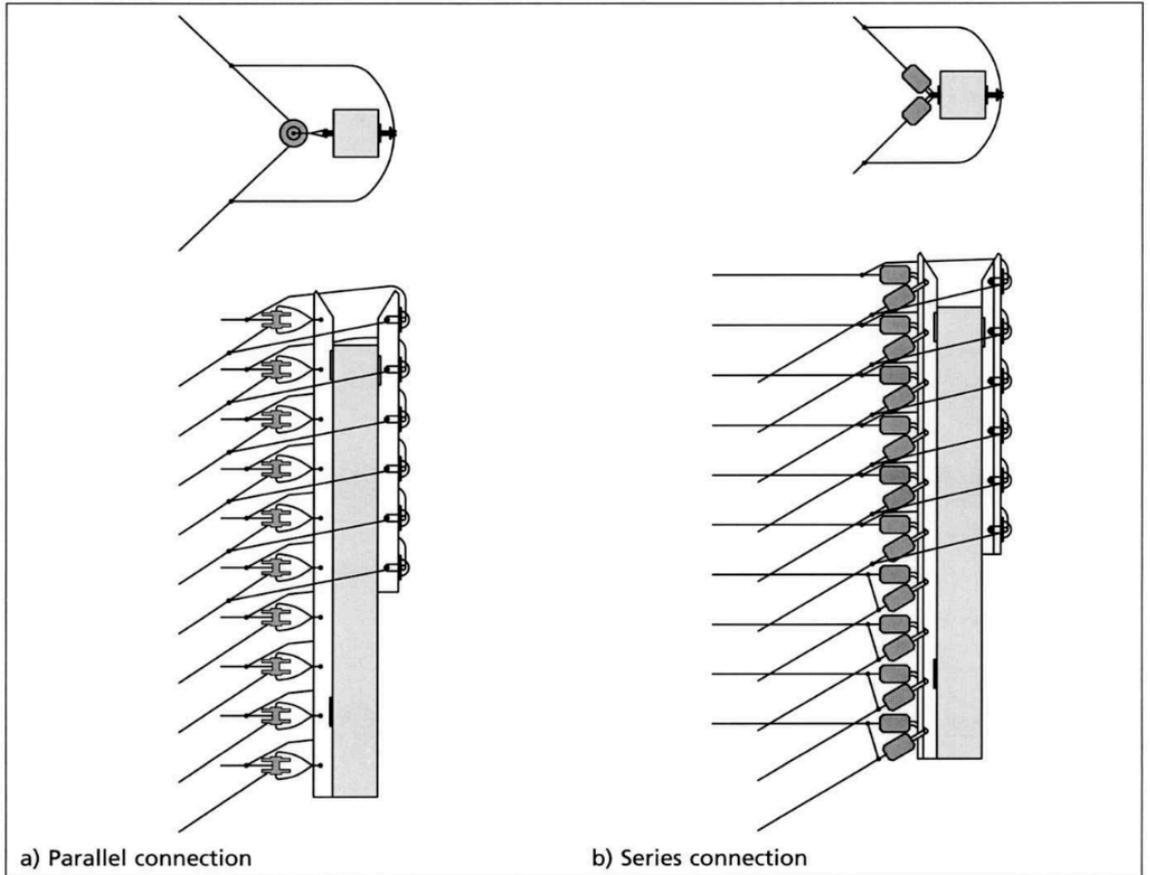


Figure 4b Example of an anti climb configuration

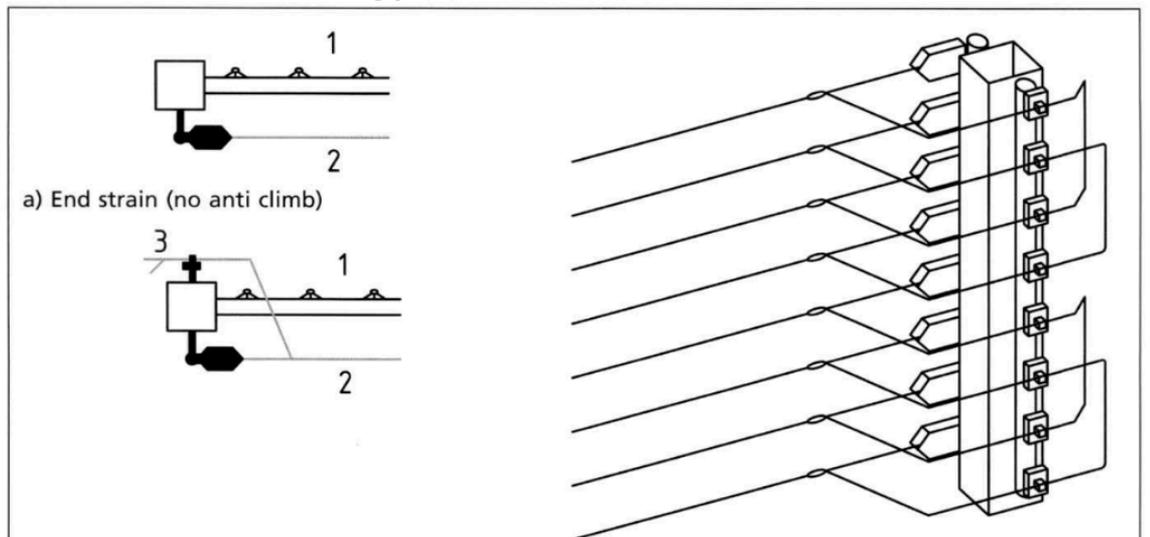
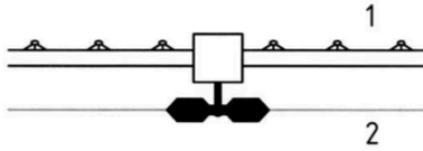
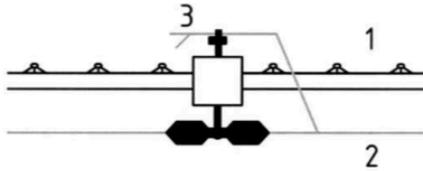


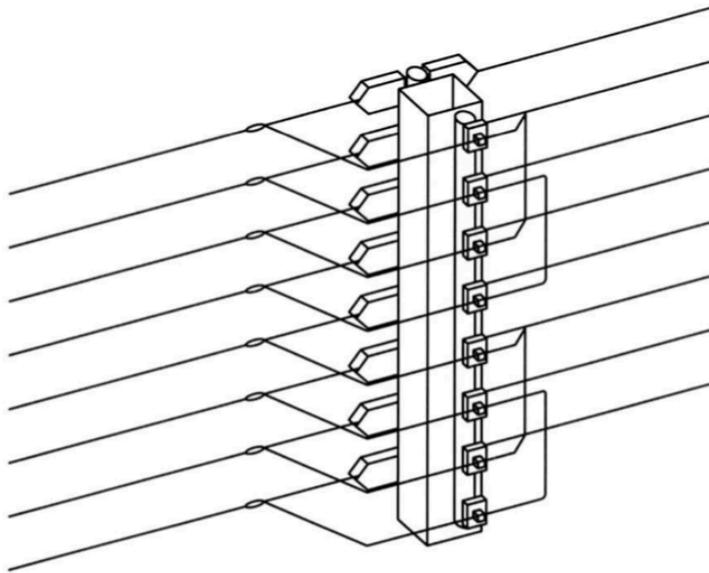
Figure 4c Example of an anti climb configuration



a) Double end strain (no anti climb)



b) Double end strain (anti climb)



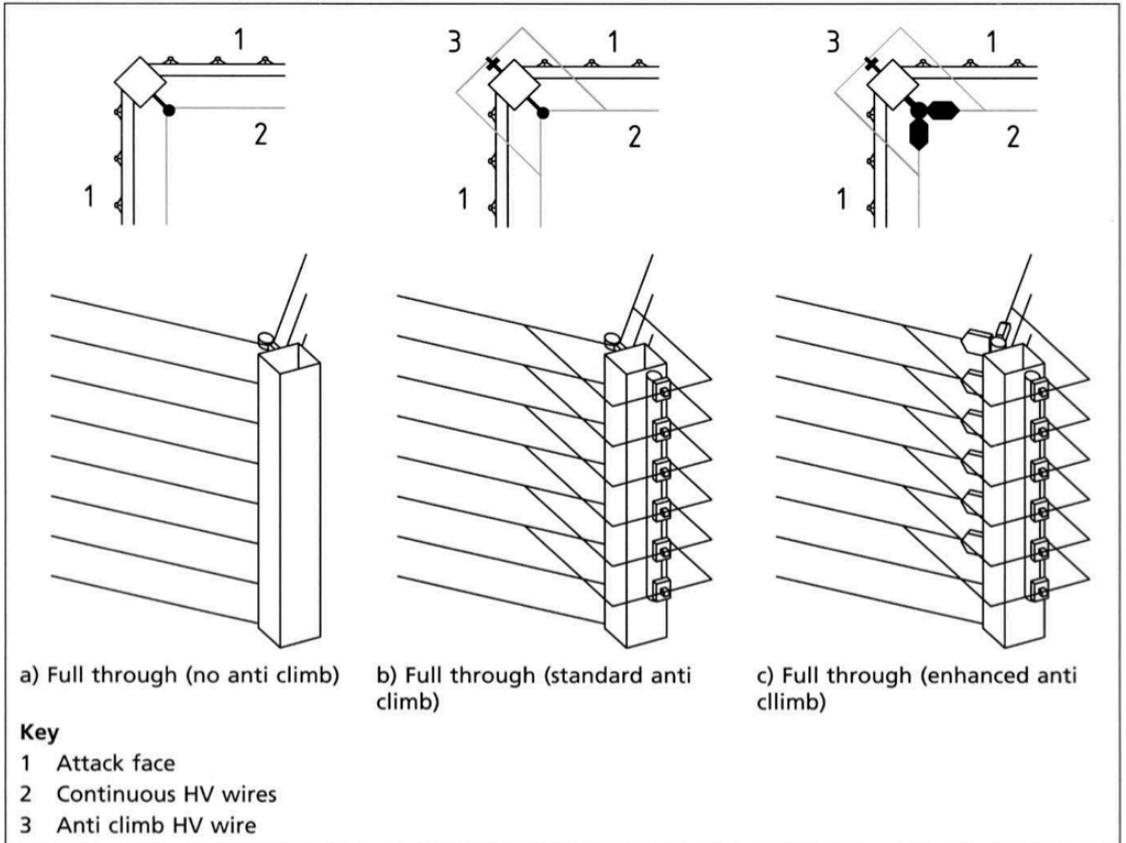
c) Double end strain (anti climb)

**Key**

- 1 Attack face
- 2 HV wires
- 3 Anti climb wire

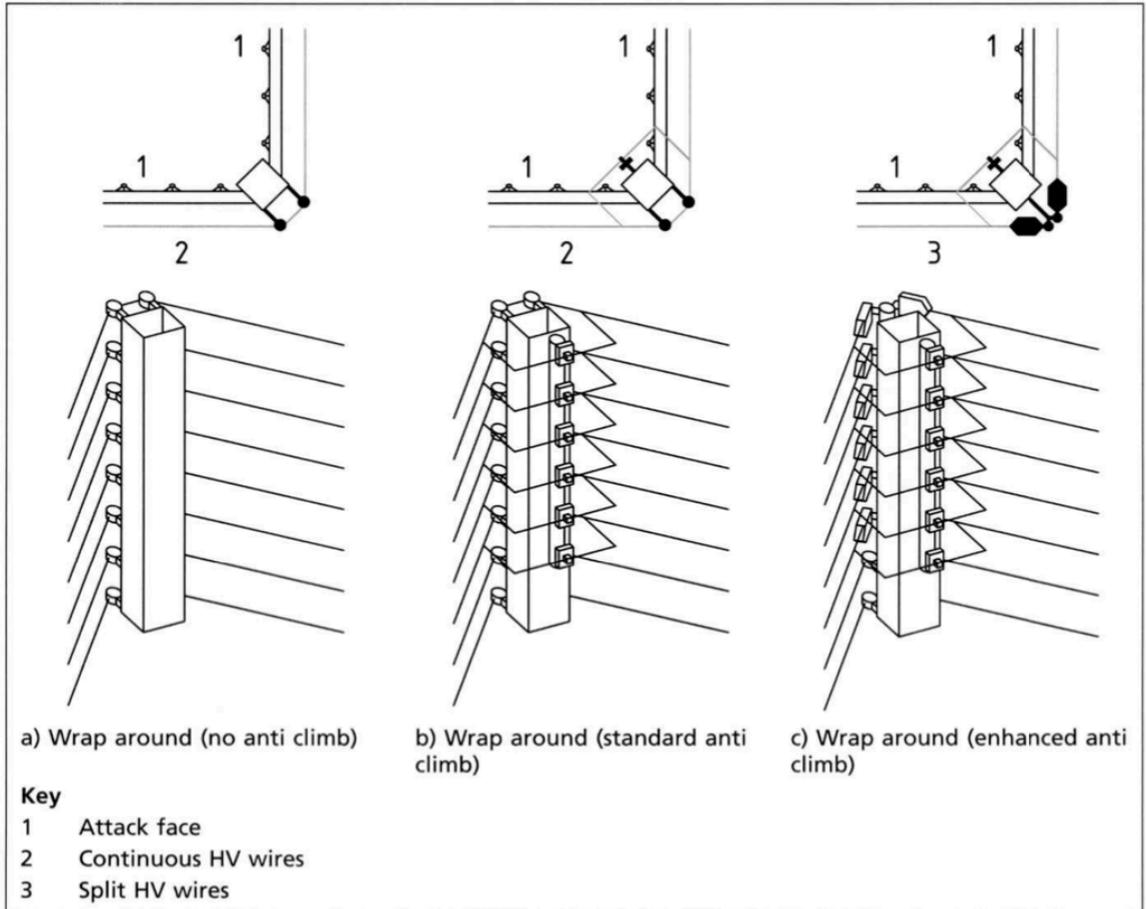
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Figure 4d Example of an anti climb configuration



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Figure 4e Example of an anti climb configuration



## 6.9 Vegetation contact

Vegetation contact with any conductors shall be avoided.

## 6.10 Gates

### 6.10.1 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.

### 6.10.2 Gate security

## **6.11 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.

*NOTE A zone separation barrier is not required when all the energizers on the system are synchronized.*

## **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 in accordance with the manufacturer's recommendations, including readings of each fence zone voltage and resistance, which shall be taken and recorded.

### **8.2 Operations and maintenance manual**

Each installation shall be formally maintained and an operations and maintenance manual shall be provided to the customer and shall include the following:

- a) electric security fencing system layout and zones;
- b) electric fence installation specification;
- c) original commissioning data;
- d) details of the recommended periodic maintenance program including the next maintenance check and the contact details of the organization for maintenance and call-out;
- e) full operational instructions;

- i) 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.

### **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:*

- 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.*

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