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**SANS 10222-3:2008**
Edition 4

# SOUTH AFRICAN NATIONAL STANDARD

## Electrical security installations

## Part 3: Electric fences (non-lethal)

Fifth Draft

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**Table of changes**

| Change No. | Date | Scope |
|---|---|---|
| | | |

**Foreword**

This South African standard was approved by National Committee StanSA TC 68, Security Systems, in accordance with procedures of Standards South Africa, in compliance with annex 3 of the WTO/TBT agreement.

This document was published in xxxx 2008.

This document supersedes SANS 10222-3:2006 (edition 3).

SANS 10222 consists of the following parts, under the general title Electrical security
installations:

Part 1: General.

Part 2: Access control systems.

Part 3: Electric fences (non-lethal).

**Introduction**

In South Africa the Electric Machinery Regulations (Government Notice R183 of 2005-03-04), published in terms of the Occupational Health and Safety Act, 1993 (Act No. 85 of 1993) (OHS Act),which is administered by the Chief Inspector of Occupational Health and Safety of the Department of Labour, requires that all electric fence installations (non-lethal), being temporary or permanent, comply with the requirements of SANS 10222-3. It also requires that an accredited person, defined as an electric fence installer, issues an Electric Fence Certificate for an electric fence installation (non-lethal) and that the certificate be in the form of the Electric Fence Certificate published in the Electrical Machinery Regulations or in the form published in this standard.

The provisions of SANS 10222-3 applies only to the selection, application and installation of electric fencing equipment, associated appliances and accessories, which are part of the electric fence installation (non-lethal), being temporary or permanent. This standard does not apply to systems with voltages below 50 V. d.c. or 35 V a.c. or to the construction and safety of the equipment, associated appliances and accessories.

The provisions of SANS 10222-3 is concerned with ensuring the basic safety of electric fence installations (non-lethal) and decreasing the likelihood of electromagnetic interference on communication systems. To ensure the protection of people, animals and property and the proper functioning of an installation, the designer of an electric fence installation should be aware of the:

- characteristics of the electric fence equipment, associated appliances and accessories; and

- operating environment of each part of the electric fence installation.

**Contents** **Page**

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# Electrical security installations
# Part 4

Electric security fences (non-lethal)

## 1 Scope

This part of SANS 10222 gives additional instructions for the installation and connection of electric fences to those given in SANS 60335-2-76. The requirements are given to improve the safety of electric fences and to decrease the likelihood of electromagnetic interference on communication
systems.

This part of SANS 10222 is applicable to the following types of electric fences:

- Electric domestic pet control fences;

- Strip grazing electric fences;

- General agricultural electric fences;

- Game control electric fences;

- Electric security fences - General;

- Electric security fences - Specialized.

It covers electric fences powered by energizers supplied from all types of electric power sources such as batteries, solar cells, diesel or petrol generators and the electricity supply distribution systems.

## 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. Information on currently valid national and international standards may be obtained from Standards South Africa.

IEC 60417, Graphical symbols for use on equipment.

SANS 214-1 /CISPR 14-1, Electromagnetic compatibility - Requirements for household appliances, electric tools and similar apparatus - Part 1: Emission.

SANS 1063, Earth rods, couplers and connections.

SANS 10142-1, The wiring of premises - Part 1:Low-voltage installations.

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

SANS 60529/IEC 60529, Degrees of protection provided by enclosures (IP Code).

## 3 Definitions

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

**3.1**
**a.c.**
alternating current.

**3.2**
**acceptable**
acceptable to the regulator.

**3.3**
**accessible**
not permanently closed in by the structure or surface(s) of the premises.

**3.4**
**arcing**
electrical discharge between two conductors.

**3.5**
**authorized**
authorized by the regulator.

**3.6**
**bracket**
device normally fabricated out of metal with attached fence insulators, that can be attached to a structure or building element with the objective of supporting electrical fencing wires.

**3.7**
**bracket or pole facet**
A facet is a flat section on the electric fencing bracket or pole. On the one end of the facet there is either a bend (more than twenty five degree's) or the bracket or pole end. And on the other end of the facet, either a bend (more than twenty five degree's)or the bracket or pole end.

**3.8**
**building element**
part of a premises such as a wall, floor, roof.

**3.9**
**conduit**
pipe usually of diameter not exceeding 50 mm, that allows conductors and cables in electrical installations to be drawn in and to be replaced.

**3.10**
**connecting lead**
electric conductor, used to connect the energizer to the electric fence or the earth electrode.

**3.11 d.c**
**direct current.**

**3.12**
**ducting**
closed enclosure that allows insulated conductors and cables in electrical installations to be drawn in and to be replaced.

**3.13**
**dynamic bracket/pole**
brackets/poles that fulfil the functions of a passive bracket/pole and additional mechanical features/functions.

**3.14**
**earth electrode**
metal structure that is driven into the ground to be used by the energizer and connected electrically to the output earth terminal of the energizer, and that is independent of other earthing arrangements.

**3.15**
**earthed (For electric fences only.)**
connection to the general mass of earth as to ensure, at all times, an immediate discharge of electrical energy without danger.

**3.16**
**electric animal fence**
an electric fence used to contain animals within or exclude animals from a particular area.

**3.17**
**electric fence (including electric palisade or similar devices.)**
barrier that includes one or more conductors, insulated from earth, to which electric pulses are applied by an energizer.

**3.18**
**electric fence energizer**
appliance that is intended to deliver periodically voltage impulses to a fence connected to it (As described in SANS 60335-2-76.)
NOTE Electric fence energizers are hereinafter also referred to as energizers.

**3.19**
**electric security fence**
fence used for security purposes that comprises an electric fence installation.

**3.20**
**electromagnetic compatibility (EMC)**
ability of electrical/electronic equipment to function properly in its environment, which may also contain other equipment, without causing any disturbance in that environment.

NOTE EMC comprises conducted and radiated electromagnetic emissions, as well as conducted and radiated electromagnetic susceptibility.

**3.21**
**electromagnetic interference (EMI)**
any degradation of the performance of a device, equipment or system caused by an electromagnetic disturbance.

**3.22**
**electromagnetic disturbance**
any electromagnetic phenomena that may degrade the performance of a device, equipment or system, or adversely affect living or inert matter.

**3.23**
**enclosure**
part that provides protection of equipment against certain external influences and, in any direction, protection against direct contact.

**3.24**
**energy limiter**
an impedance network designed to maintain the output of an energizer to be limited to a maximum of 8 joules, when placed across a load range.

**3.25**
**fence circuit**
all conductive parts or components within an energizer, that are connected or intended to be connected galvanically to the output terminals.

**3.26**
**fence high tension cable (also known as under gate cable and high voltage lead out.)**
insulated conductor capable of insulating voltages used on a electric fence

**3.27**
**fence insulator**
a device that provides the necessary insulation between charged conductors and brackets or poles, thus preventing any leakage current between charged conductors and the neutral/earth.

**3.28**
**fence length (could also be live wire length)**
the length measured in metres , of the series length (live loop) of the live wire of an electric fence (Note: Parallel sections count as one length.)

**3.29**
**flammable**
descriptive of a material that, when heated for a minimum of 5 minutes in an oven at a minimum temperature of 300 degrees centigrade (in the manner set out in an appropriate standard such as SANS 156), is capable of burning or of giving off vapours in sufficient quantity to ignite at a pilot flame.

**3.30**
**flexible conduit**
tubing that is intended to house and to protect electric wiring and that is so designed that it is flexible.

**3.31**
**furtherest live point**
represents a point, measured along the series length of the electric fence's live wire, that is the most distant from the energy (energizer) source(s).

**3.32**
**galvanic**
process where electricity is chemically produced.

**3.33**
**galvanic effect (galvanic coupling)**
two dissimilar conductors in contact or in the same electrolytic solution, resulting in a difference of potential between them.

**3.34**
**high tension** (electric fencing)
where the peak voltage of a pulsed system exceeds 50 volts d.c or a.c. (r.m.s.).

**3.35**
**insulator** – refer fence insulator.

**3.36**
**intelligent brackets/poles**
brackets/poles that fulfill the two functions of the passive brackets/poles, plus additional mechanical and electrical/electronic features and functions (excluding the support of a fence ie. mesh fence.)

**3.37**
**intermediate bracket/pole**
brackets/poles that support electric fence wires between a set of strain brackets/poles (excluding the support of a fence ie. mesh fence.)

**3.38**
**lightning protection system**
complete system used to protect a space against the effects of lightning.

NOTE It consists of both external (structural protection and electrical equipment) and internal (electrical equipment) lightning protection systems.

**3.39**
**live part**
conductive part that may cause an electric shock.

**3.40**
**load range**
a load consisting of non-inductive resistors of either 50 Ω, 200 Ω, 500 Ω or 1 000 Ω that have a tolerance range of ± 0,5 %. Each load is used individually for the test.

NOTE The test leads between the resistor and the energizer/monitoring system output may not exceed 1 m in length. The total stored energy by such an energizer may not exceed 2,5 times the maximum permissible output energy measured across a 500 Ω resistor.

**3.41**
**normal operation**
operation of the electric fence under the following conditions:
- the electric fence energizer is fully operational and connected to a power supply; and
- with no obstruction present on the connected electric fence installation.

**3.42**
**obstruction**
any object coming into contact with an electric fence, that is not part of the electric fence installation. This also includes plant growth.

**3.43**
**off-set bracket (also known as a** wire outrigger )
bracket that supports an electric fence that is not capable of mechanically supporting itself and is clipped onto a supporting fence.

**3.44**
**parallel wiring of an electric fence (closed loops)**
where the live wire of an electric fence, has various additional live wires fixed to it, to form various live wire branches, that are rejoined to form closed loops.

**3.45**
**parallel wiring of an electric fence (open loop)**
where the live wire of an electric fence, has various additional live wires fixed to it, to form various live wire branches, that are not rejoined and do not form a loop.

**3.46**
**partitioning**
electric fence installation that consists of one energizer connected to an electric fence, which is divided into sections for monitoring purposes.

**3.47**
**passive brackets/poles**
brackets/poles that only fulfil two functions, namely, supporting electric fencing wires and itself.

**3.48**
**physical barrier**
barrier of height not less than 1,5 m and intended to prevent inadvertent contact of persons with the conductors of the electric fence, from a public area. (This can also be used in secure areas.)

NOTE Physical barriers are typically constructed from vertical sheeting, rigid bars, rigid mesh or rods of chain wire mesh.

**3.49**
**piggy back bracket**
bracket that supports an electric fence that is not capable of mechanically supporting itself and is permanently secured onto a supporting fence.

**3.50**
**pole**
free standing device with attached insulators, with the objective of supporting electric fence wires, that is not attached to another structure or building element.

**3.51**
**prospective peak voltage**
peak output voltage of the impulse generator specified in a relevant clause of SANS 60335-2-76, that would be obtained when the energizer is not connected to the test circuit.

**3.52**
**public access area**
any area where persons are protected from inadvertent contact with pulsed conductors by a physical barrier.

**3.53**
**pulsed conductors (As contemplated in SANS 60335-2-76.)**
conductors that are subjected to high voltage pulses (exceeding 50 volts d.c. or 50 volts a.c. (r.m.s.))emitted by an energizer.

**3.54**
**r.m.s.**
**root mean squared.**

**3.55**
**registered person**
a person registered by the regulator.

**3.56**
**rural area**
areas not covered under the definition of an urban area.

NOTE these area’s would mainly be made up of agricultural developments, game farms, game reserve’s etc.

**3.57**
**series wired electric fence**
electric fence installation that consists of only a single live wire closed loop, where the live wire of an electric fence has no additional live wires forming separate branches fixed to it.

**3.58**
**secure area**
area where a person is not separated from pulsed conductors below 1,5 m by a physical barrier.

**3.59**
**strain bracket/pole (electric fence)**
brackets/poles that have three functions, namely, maintaining the tension of an electric fence, supporting the attached electric fence wires and itself.

**3.60**
**surge suppressor**
a device designed to limit the surge voltage between two parts within the space to be protected, such as a spark gap, a surge diverter or a semi conductor device.

**3.61**
**voltage**
difference of electrical potential (r.m.s. values in the case of a.c.) between any two live conductors, or between one live conductor and earth.

**3.62**
**wire outrigger** see off-set bracket (3.37).

**3.63**
**wire way**
open or enclosed route or support such as a rack, tray, ladder, ducting, trunking, sleeving or conduit that is intended to contain conductors or cables.

NOTE A wire way can consist of one or more separate wire way channels, each of which is intended for different services such as installation wiring and telecommunication wiring.

**3.64**
**trunking**
closed enclosure that comprises a base with a removable cover that is intended to completely surround insulated conductors and cables in electrical installations and accommodate other electrical equipment, for example, in the case of power skirting.

**3.65**
**urban area**
area with an increased density of human-created structures in comparison to the areas surrounding it. (this would include but not be limited to residential, business and industrial zoned areas by a municipal authority, metropolitan areas, etc.)

NOTE The population density of a urban area would exceed 200 or more persons per square kilometre, but proclaimed municipal areas with a lower population density would be regarded as an urban area.

**3.66**
**zoning-hard**
electric fence installation that consists of multiple energizers located next to and connected to different independent sections of the electric fence, with the objective of providing individual energy and monitoring to each section (ie. energizer's are located as close as possible to the individual section's of the electric fence that it powers.)

**3.67**
**zoning-soft**
electric fence installation that consists of multiple energizers that singularly connected remotely to different independent sections of the electric fence, with the objective of providing individual energy and monitoring to each section (ie. some or all of the energizers could be located in one position with extended fence high tension cables and/or bare conductors connecting the energizers to various individual sections of the electric fence at remote locations.)

## 4 Fundamental requirements

### 4.1 Installation of conductors and cables

#### 4.1.1 Materials

**4.1.1.1** All conductors shall be of a conductive metal such as copper, steel, galvanized steel, aluminium, stainless steel or alloys containing these metals. Such metal shall provide the best current carrying capacity, resistance to corrosion, be of a low resistance (<10 Ω/metre) and be of sufficient tensile strength for its requirements and application.

**4.1.1.2** Materials used for the manufacture of warning signs shall be of such a composition as to withstand anticipated weather conditions and the effects of ultra-violet radiation for a minimum period of five years.

**4.1.1.3** Live conductors shall not contain any objects attached thereto that can form an entanglement, such as but not limited to, barbed wire and razor wire.

#### 4.1.2 Conductor construction shall:-

**a)** be stranded or solid.

**b) when** insulated shall withstand the highest temperature and operating voltage to which they are likely to be exposed.(Ref SANS 60335-2-76)

#### 4.1.3 Identification – energizer and junctions

**4.1.3.1** A conductor shall be identifiable at its terminations unless its purpose is obvious.

**4.1.3.2** The means of identification for an a.c. circuit shall be in accordance with SANS 10142-1.

**4.1.3.3** The means of identification of a high-tension insulated circuit may be by colours, symbols or by letters, or a combination of these as follows:

a) the neutral/earth continuity conductor shall be identified by black, green or green/yellow only or by being a bare conductor;

b) the neutral/earth continuity conductor shall be identified by symbol 5017 of IEC 60417 earth (ground);

c) the neutral/earth continuity conductor shall be identified by the letters “HT-“;

d) the live continuity conductor shall be identified by red only;

e) the live continuity conductor shall be identified by symbol 5036 of IEC 60417 dangerous voltage; and

f) the live continuity conductor shall be identified by the letters “HT+”; and

g) the colours, symbols or letters may be applied at the ends of the insulated conductor by means of durable marking (e.g. insulating sleeves with colours, symbols or letters.).

#### 4.1.4 Joints and terminations

**4.1.4.1** Joints and terminations shall not:

a) adversely affect the current-carrying capacity of the conductor;

b) adversely affect the insulation resistance of the cable in the case of insulated conductors;

c) be made in any connector, bend, elbow or tee-piece of a conduit;

d) allow the strands of a stranded conductor to spread; and

e) require strands of a stranded conductor to be cut away to allow connection of the conductors (e.g. to terminals).

**4.1.4.2** Joints on the fence bare conductors shall be:

a) made of ferrules and/or clamps;

b) soldered, where wire wrap joints are used; and

c) sealed with paint, bitumen or by soldering, to reduce the galvanic effect caused by using dissimilar materials.

**4.1.4.3** Joints on insulated high-tension conductors shall:

a) be made in accordance with the manufacturers instructions or joined by using cable couplers or manufacturers jointing kits;

b) be accessible and protected against strain; and

c) not be possible to touch any live part with the standard test finger (see SANS 60529).

## 4.2 Positioning and fixing of cables

### 4.2.1 Positioning

**4.2.1.1** An insulated fence high-tension cable shall not run:

a) in the same trench or wire way with a mains alternating current supply cable;

b) in the same wire way with the cables or wires of telecommunication, radio and signalling circuits;

c) where it is likely to be damaged by liquids such as oil, acid, acetone and alkali or by gases such as sulphur dioxide;

d) within 150 mm of hot services such as hot pipes and flues if the heat is likely to damage the cable, unless the cable is cooled or shielded from heat;

e) in a position where it is likely to be damaged, unless it is mechanically protected; and

f) parallel to any other cable(s) for a distance exceeding 200 mm if a distance between the parallel cables is less than 200 mm. In the event of one of the cables being run in steel conduit, or the other cable being steel armoured cable, this requirement should not apply.

**4.2.1.2** A bare high-tension conductor shall be positioned as follows:

a) bare high tension conductors shall be used in the composition of the physical electric fence barrier;

b) plant growth and vegetation shall be kept from coming into direct contact or causing arcing therewith and maintained regularly to comply herewith;

c) any foreign objects and conductors not forming part of the electric fence installation shall be kept from coming into direct contact or causing arcing therewith;

d) the high tension bare conductors shall be at least 30 mm from any foreign object that is not part of the electric fence installation;

e) additional factors such as wind, dew, rain, frost and snow must be taken into account when positioning the bare high tension conductors, to prevent inadvertent contact or causing arcing to any foreign objects; and

f) a bare high-tension charged conductor shall not be placed inside any wire way.

**4.2.2 Fixing**

**4.2.2.1** Insulated high-tension requirements are as follows:

a) Insulated high-tension cable(s) shall be fixed in a way that prevents a strain on terminals or connectors.

b) Insulated high-tension cable(s) that are not placed or running in wire ways shall be firmly fixed to prevent sagging or creeping.

c) Exception from a) and b) herein, shall be made to insulated cables linked to gates.

d) Insulated high-tension cables shall be fixed in place using clips, saddles, cable ties or similar non-destructive fixing methods.

**4.2.2.2** A bare high-tension conductor shall be fixed as follows:

**Comment [W1]:** Make 100% sure that the different components:
Wire, ferrules, HT cable conductor. All have the same alloy to exclude electrolysis effects, resulting in wire breaking.

a) Bare high-tension conductors shall be held in position and fixed to fence insulators in accordance with the various provisions in this standard and in accordance with the insulators manufacturer's instructions.

b) Tensioners and springs can be used in the fixing and tensioning of bare conductors between fence insulators, but shall not adversely affect the current-carrying capacity of the conductors, fixing thereto shall be in accordance with the manufacturers instructions.

c) Where two bare conductors are fixed to the same fence insulator, in the same position in the fence insulator, the conductors shall be joined together as per the requirements of section 4.1.4.2.

d) Minimize the use of dissimilar metals that will result in a galvanic effect. Should such metals be used, any joints and fixtures should be sealed with paint, bitumen or by soldering.

**4.3 Buried cables and conductors**

4.3.1 Fence high tension cables and conductors shall only be buried if they are run in conduit, pipe, trunking or in similar protection.

4.3.2 The protected fence high tension cable shall be buried:-

**Comment [W2]:** HT Cables must always be buried inside Polyethylene tubing Other means will cause water to enter.

a) in pickable ground with a minimum cover of 300 mm.

b) under roadways with a minimum cover of 500 mm and the backfill shall be properly compacted.

c) have adequate cover when buried in rock or concrete or in a building element.

4.4 **Wire ways**

**4.4.2 Installation of wire ways**

a) The wire way shall be installed such that safe maintenance is ensured.

b) Joints shall be at least as rigid as the wire way itself.

c) The wire way shall be able to withstand the environmental conditions in which it is installed.

d) No part of the wire way shall be flattened, split or damaged.

e) Cable entry points, exit points and internal surfaces of the wire way shall not be able to damage the insulation or cable during installation or subsequent use.

f) Materials that come into contact with a wire way, such as the materials of electrical equipment, electrical fittings and lubricant used when cables are being drawn, shall not react with the materials of the wire way, or with the cable insulation.

g) Metallic wire ways shall not be used as a neutral/earth conductor. A separate neutral/earth continuity conductor shall be installed.

h) All joins, fittings, entry and exit points to conduit, pipe, trunking or similar protection, shall be sealed so as to prevent the ingress of moisture, water or other foreign substances.

i) A wire way including conduit, pipe, trunking or similar protection, containing fence high-tension cables and a electric fence neutral/earth cable shall not contain other cabling.

j) Bends shall not distort the internal shape of a wire way or open any weld.

k) There shall be no openings in the side of conduit, trunking or similar protection for cables to enter or leave, except via a sealed fitting.

**4.4.3 Conduits**

a) All fittings other than bends and couplings shall be of the inspection type.

b) The inner radius of a bend in a conduit shall be at least three times the external diameter of the conduit.

**4.5 Installation of energizers**

4.5.1 Electric fence energizers and their ancillary equipment shall be installed, operated and maintained in a way that minimizes danger to persons and reduces the risk of persons receiving electric shocks unless they come into contact with the physical bare conductors of the electric fence.

4.5.2 Electric fence energizers and their ancillary equipment shall be installed, operated and maintained in a way that minimizes interference with other devices.

4.5.3 Electric fence energizers shall be installed a safe distance from flammable and other hazardous substances.

4.5.4 Cabling between the energizer and the electric fence shall be (including the electric fence neutral/earth conductor) insulated fence high-tension conductors, as per clause 4.1 and 4.2.

4.5.5 Caution shall be exercised when installing an energiser near existing electronic devices. Should the energizer be housed in a separately earthed sealed steel box, which would provide adequate shielding, this provision should not apply.

**4.6 Warning signs**

4.6.1 All electric fences shall be identified by prominently displaying warning signs.

4.6.2 Such signs shall be securely fixed to the fence posts, the fence itself, a fence element or to a building element not more than 200 mm from the electric fence.

4.6.3 The minimum warning sign dimensions shall be 200 mm × 100 mm and the lettering and symbols shall be in terms of SANS 60335-2-76.

4.6.4 Sign boards shall be fixed in accordance with 4.6.2 above between 1,5 and 2,0 metres above ground level.

4.6.5 Sign boards shall be displayed not more than 200 mm from each corner or bend in a straight length of an electric fence.

4.6.6 Sign boards shall be displayed on an access gate if present and not more than 200 mm on either side of an access area on which an electric fence is erected.

4.6.7 In urban areas sign boards shall not be more than 10 m apart.

4.6.8 In rural areas sign boards shall not be more than 100 m apart.

4.6.9 Sign boards shall be placed in clearly visible positions.

**4.7 Location of neighbouring electric fences**

Where two or more energizers are connected to an electric fence (using the same poles or brackets, but on different circuits) or where electric fences are less than 2,5 m apart, measured in a straight line. The operation of the energizers shall be coordinated to ensure that the effective combination of the pulses of all the conductors of the fence and/or the combination of the conductors of all the fences shall be within the predetermined pulse rate and magnitude range as defined by the limits of any compliant single energizer, for the elected category of fencing.

This provision does not apply to separately constructed electric fences with the lowest electric fence live wire 1,5m above ground level.

### 4.8 Electric fence insulator requirements

All electric fence insulators shall comply with Annexure G, hereof.

### 4.9 Limitations on energy output in urban areas

The energy output of an energizer shall not exceed 8 Joules when connected to a load range, or when an energizer is part of a partitioned system, the total energy output shall be controlled by an energy limiter,(such energy limiter shall be installed inside the energizer enclosure or between the energizer output and the electric fence connection point, provided that no accessible bare conductor's are present) to ensure that the total energy shall not exceed 8 Joules when connected to a load range, if such energizer is installed:

a) in an urban area;

b) within 1 000 metre's of the outer reaches of the urban area; and

c) within 1 000 metre's of any public area (ie. area's used for accommodation for gain, camp sites, picnic areas, beaches, etc.) in rural areas, but can be installed where a barrier fence with a minimum height of 1,5 metre is installed between the public area and the electric fence.

### 4.10 Energizers in standby mode

Any system that is connected to bare conductor's, that is so arranged as to emulate an electric fence installation as described herein, and that under certain conditions emits an impulse as defined herein, shall be classified as an electric fence installation.

## 5 Electromagnetic Compatibility (EMC) requirements

**5.1** Location of electric fences

**5.1.1** Electric fencing shall be installed clear of any obstructions (including vegetation) that could under normal or wet conditions come into contact or come into close proximity with the electric fence resulting in interference with a communication systems.

**5.1.2** Vegetation shall be cleared from the electric fencing structure during its installation (thereafter this requirement will be maintained by the user) and shall be cleared as follows:

a) Urban areas, care must be taken that no vegetation could in anyway get nearer than 1 m above and 200 mm below the lowest electric fence wire in the case of the electric fence being installed on top of a structure, such as a building element. In the case of the lowest electric fence wire being less than 200mm above ground level, no vegetation may be below the fence. Vegetation may not be closer than 200 mm on either side of the electric fence.

b) Rural areas, care must be taken that no vegetation could in anyway get nearer than 1 m above and 1 m on either side of the electric fence. In the case of the electric fence being installed on top of a structure, such as a building element, the fence must be clear of vegetation 200 mm below the lowest electric fence wire. In the case of the lowest electric fence wire being less than 200mm above ground level, no vegetation may be below the fence.

### 5.2 Installation near overhead power lines

For protection against electromagnetic induction from overhead power lines requirements specified in SANS 60335-2-76 shall be adhered to.

### 5.3 Installation near communication lines

#### 5.3.1 Interference with communication and signalling lines

Electric fences can cause interference on underground or aerial communication lines (or both). When installing and operating an electric fence near communication lines, steps shall be taken to prevent harmful interference into the nearby communication lines.

Guidance on methods of installing and operating fences to prevent unacceptable interference levels are provided in Annex E.

Alternating current supply wiring shall not be installed in the same conduit as signalling leads associated with the electric fence installation, but shall be installed in accordance with the requirements given in SANS 10142-1.

#### 5.3.2 Overhead communication lines

**5.3.2.1** When an electric fence connection lead or electric fence wire crosses an overhead communications line the crossing shall be at an angle larger than 45 degrees.

**5.3.2.2** An electric fence running parallel to communication lines should be avoided. For the situation where an electric fence can only be installed parallel to a communication line, requirements in 5.3.2.3, 5.3.2.4 and 5.3.2.5 shall apply.

**5.3.2.3** Where an electric fence and communication line is installed parallel for a distance less than 100 m the minimum separation distance of at least 1 m shall be maintained between the highest part of the electric fence and the communication line.

**5.3.2.4** Where an electric fence and communication line are installed parallel to each other for a distance of more than 100 m a minimum separation distance of at least 2,5 m shall be maintained between the highest part of the electric fence and the communication line.

**5.3.2.5** The minimum separation distance shall also hold for warm summer days as communication lines expand in warm conditions.

### 5.3.3 Location and installation of electric fence energizer

Electric fence energizers shall not be installed in close vicinity of alternating current or communications distribution boxes (or both). Energizers shall be installed as close to the actual fence as possible. This may be achieved by taking the electrical supply to the energizer and not the energizer to the electrical supply.

## 5.4 Electromagnetic Compatibility (EMC) requirements for energizers

All electric fence energizers shall comply with the EMC requirements for electric fence supply units as given in SANS 214-1.

## 5.5 Additional installation requirements

The electric fence energizer shall not be earthed to the same earthing system as used by the local electricity supplier or communications provider (or both). The minimum distance between the electric fence earth electrode and any alternating current electric or communications system earthing system shall be in terms of annex A.

Ensure that all ancillary equipment connected to the electric fence circuit provides a degree of isolation between the fence circuit and the alternating current supply. Special precautions must be taken if the electric fence system is connected to any communications device, such as a radio transmitter.

## 6 Electric domestic pet control fences

**6.1** General

Annexe's C, D, E and G, shall be applicable to this section, unless stated differently.

### 6.2 Energizer limitations

The energizer limitations are as follows:

a) energizers shall comply with SANS 60335-2-76;

b) maximum peak to peak voltage shall be 10 kilo volt;

c) maximum energy discharge per impulse measured at the load range shall not exceed 0,5 Joules;

d) maximum stored energy shall be 0,75 Joules; and

e) energizer can only operate from a maximum supply of 30 volts d.c. or a.c. (r.m.s.), unless the energizer is connected within 1 metre to a mains alternating current supply.(ie. a plug)

Note. In the event of the mains alternating current supply being used, as its primary supply, the energizers power supply transformer shall have its primary and secondary windings isolated from each other.

**6.3 Installation environmental considerations** (This includes the energizer, electric fence wiring and earth spikes)

**6.3.1** The system shall not be installed:-

a) in a public area;

b) on top of a building element;

c) where it can be mechanically damaged;

d) within 2,5 m of another electric fence; and

e) attached to another electric fence.

**6.3.2** The system shall be installed:-

a) inside an area enclosed from public access;

b) be a free standing structure;

c) not permanently fixed to a building element;

d) be used only for domestic animal control;

e) have a minimum of one earth spike; and

f) the electric fence "live" wire length may not exceed 100m.

**6.4 General installation requirements**

The system can only be installed by persons:

a) who read, understand and subscribe to the requirements detailed in this section; and

b) who are fully aware of the inherent danger posed by electrical systems;

## 7 Strip grazing electric fences

### 7.1 General

Annexe's A, B, C, D, E, F and G, shall be applicable to this section, unless stated differently.

### 7.2 Energizer limitations

Energizers shall comply with SANS 60335-2-76.

### 7.3 Installation environmental considerations.

**7.3.1** The system shall not be installed:-

a) in a public area;

b) on top of or fixed to a building element;

c) where it can be mechanically damaged; and

d) within 2,5 m of another electric fence.

**7.3.2** The system shall only be installed:-

a) inside an area enclosed from public access;

b) be a free standing structure;

c) be used only for animal control; and

d) in an rural area.

**7.3.3 The installation of the electric fence:-**

**7.3.3.1** Electric fence shall not exceed a maximum height of 1600 mm.

**7.3.3.2** Electric fence shall contain a maximum of four wire conductors.

**7.3.3.3** The stainless steel strands shall be no more than 0,2 mm in diameter and shall not number more than 10 strands in a single conductor. These conductors may also be woven together to form a square mesh pattern.
NOTE Conductors may also contain polymer strands interlaced with stainless strand 's woven together to form a single conductor.

**7.3.3.4** The support posts of which shall not be placed closer than 5 metres apart.

**7.3.4** The electric fence may consist of permanent and temporary installed sections.

**7.3.5** The electric fence installation shall clearly demarcate grazing areas for animals and livestock.

**7.3.6** The electric fence can only be activated, when animals or livestock is being controlled within the system. When there are no animals present, the system shall be deactivated.

**7.4 General installation requirements**

The system shall only be installed by persons:

a) who read, understand and subscribe to the requirements detailed in this section; and

b) who are fully aware of the inherent danger posed by electrical systems.

**7.5 Special precautions**

Person's installing the system shall take all reasonable precautions to safeguard persons from injury, particularly in the case of systems located near schools and living quarters.

## 8 General agricultural fences

### 8.1 General

Annexe's A, B, C, D, E, F, and G, shall be applicable to this section, unless stated differently.

### 8.2 Classification

All fences not specified under any of the other sections contained herein, shall be deemed to be general agricultural fences.

## 9 Game control fences

### 9.1 Definitions, annexe's and other sections

Annexe's A, B, C, D, E, F and G, shall be applicable to this section, unless stated differently.

### 9.2 Materials

#### 9.2.1 Fence insulator materials

Fence insulators shall comply with the requirements of Annex G.

#### 9.2.2 Off-set bracket materials

**9.2.2.1** The off-set bracket shall be manufactured out of materials able to support the wire conductors it is designed to carry.

**9.2.2.2** Off-set bracket shall be manufactured out of high tensile steel wire with a minimum strength of 850 mega Pascals' and have a minimum diameter of 3,5 mm.

**9.2.2.3** The off-set bracket shall comply with the corrosive protection requirements in annex C.

**9.2.2.4** Any other material used for an off-set bracket, shall exhibit the same mechanical strength as in 9.2.2.2.

**9.2.2.5** Off-set bracket shall be capable of withstanding the temperature and environmental conditions in the area where it is to be installed.

#### 9.2.3 Pole and bracket materials

**9.2.3.1** The bracket or pole shall be manufactured out of materials so that it is strong enough to support the wire conductors it is designed to carry.

**9.2.3.2** Brackets, where the main support is manufactured out of steel, shall have:

a) a minimum width of 19 mm and minimum thickness of 4,5 mm, in the case of a flat bar;

b) a minimum width of 19 mm and minimum thickness of 1,6 mm, in the case of a square tubing;

c) a minimum diameter of 10 mm, in the case of a round bar;

d) a minimum width and depth of 19 mm and minimum thickness of 3 mm, in the case of angle iron; and

e) any other bracket form used, including brackets manufactured out of materials other than steel, must exhibit the same strength characteristics as a) or b) or c) or d) above

**9.2.3.3** Stand alone poles shall have:-

a) minimum measurements in the case of a straining post, 75 mm diameter pipe with a wall thickness of 2 mm or 75 mm square tubing with a wall thickness of 2 mm or 60 mm x 60 mm angle iron with a wall thickness of 6mm;

b) minimum measurements in the case of a intermediate post:

i) 19 mm square tubing and thickness of 1,6 mm;
ii) 10 mm diameter if round bar is used; and
iii) 3mm thickness if a 'Y' standard is used.

c) Minimum measurements for support stays are, 50 mm diameter pipe with a wall thickness of 2 mm and shall ensure that poles remain vertical.

d) exhibit the same mechanical strength characteristics, if any other pole form or material (or both) is used, as:

i) in the case of a straining post as in (a);
ii) in the case of a intermediate post as in (b)(ii);
iii) in the case of a support stays in (c) above.

**9.2.4 Bare wire conductors-materials shall:-**

**a)** comply with corrosive protection requirements in annex C.

**b)** have sufficient mechanical strength to withstand all normal weather and electric fence design conditions.

**c)** have a minimum diameter of 2 mm, unless attached to a building element, where a smaller diameter wire can be used.

**d)** be of sufficient diameter and low impedance to maintain a high current carrying capacity and voltage to meet the intended design specification of the electric fence.

**9.2.5 Insulated wire conductor materials shall:-**

a) comply with corrosive protection requirements in annex C.

b) have sufficient mechanical strength to withstand all normal weather conditions.

c) provide a reasonable resistance against ultra violet radiation and shall not deteriorate within a minimum time period of five years.

d) be of sufficient diameter and low impedance to maintain a high current carrying capacity and voltage to meet its intended design specification of the electric fence.

**9.2.6 Miscellaneous devices**

**9.2.6.1** Shall comply with corrosive protection requirements in annex C.

**9.2.6.2** Shall have sufficient mechanical strength to withstand all normal weather conditions.

**9.2.6.3** Shall provide a reasonable resistance against ultra violet radiation and shall not deteriorate within a minimum time period of five years.

**9.2.6.4** Shall be of sufficient diameter and low impedance to maintain a high current carrying capacity and voltage to meet the intended design specification of the electric fence.

**9.3 Design**

**9.3.1** The positioning of fence insulators and wires shall be such, so as to comply with the requirements of the local authority.

**9.3.2** Poles that are manufactured out of tubing shall have a cap placed on its top end.

**9.4 Installation**

**9.4.1 General installation**

**9.4.1.1** The vertical mean distance between wires (including 'earth' and 'live' wires) shall be a minimum of 150 mm. This includes off-set, stand alone and any other supported electric fence wires on the same electric fence. The vertical mean distance shall be calculated as follows:

$$d_m = \frac{h}{w_n}$$

Where $d_m$ is a vertical mean distance between wires, in metres; h is a vertical height, at any point on the fence taken from ground level to the highest electric fence wire, in metres; $w_n$ is a number of electric fence wires. (If the supporting fence is used as an earth this will be included in the number of electric fence wires as one unit.)

**9.4.1.2** No electric fence shall be installed in a public area, unless the first live conductor is a minimum height of 1500 mm above walking or ground level (or both), or covered by a barrier fence from the public area with a minimum height of 1500 mm.

**9.4.2 Off-set bracket – installation**

**9.4.2.1** The supporting fence for the off set installation shall be mechanically strong enough for the intended purpose.

**9.4.2.2** The horizontal mean distance between straining posts shall be a maximum of 200 metres over a single span (span being wire length from tensioner to tensioner). The maximum distance between off- set brackets shall not exceed 10 meters. The horizontal mean distance shall be calculated as follows:

$$d_m = \frac{L_s}{n}$$

where $d_m$ is mean distance, in metres; $L_s$ is length of span, in metres; and n is no of off set brackets.

**9.4.2.3** The fixing position of the off-set bracket shall:-

a) have sufficient mechanical strength to withstand all normal weather conditions; and

b) have sufficient mechanical strength to withstand a 20 Newton force from any direction on the fence supporting the off-set bracket.

**9.4.3 Stand-alone fence – installation**

**9.4.3.1** The minimum distance between an electric fence and a building element and/or barrier fence shall be less than 200 mm or greater than 1000 mm.

**9.4.3.2** The building element and/or barrier fence, next to an electric fence, shall have one dimension of the opening not greater than 150 mm.

**9.5 Location to other electric fences**

a) An electric fence erected at a minimum height of 1500 mm above walking or ground level (or both), and that borders on a electric fence powered by a separate energizer, shall be erected a minimum distance of 100 mm from that electric fence.

b) If there is any position where two neighbouring electric fences meet, where one or both of the electric fence wires is lower than 1500 mm above walking or ground level (or both), a 2500 mm barrier wide fence shall be placed across both fences and thus prevent simultaneous access to both fences. Such barrier fence shall have no openings greater than 50 mm in linear dimension.

**9.6 Wireways**

a) All underground wiring shall be placed inside conduit, trunking, pipe or protective enclosure.

b) All conduit, ducts, etc. shall be adequately sealed to prevent the ingress of water.

**9.7 Barrier fences shall**

a) have a minimum height of 1500 mm.

b) have one dimension of the opening not greater than 150 mm.

## 10 Electric security fences – General

### 10.1 Definitions, annexe's and other sections

Annexe's A, B, C, D, E, F, G and H shall be applicable to this section, unless stated differently.

### 10.2 Materials

#### 10.2.1 Fence insulator materials

Fence insulators shall comply with the requirements of annex G.

**10.2.2** Wall-top bracket materials

**10.2.2.1** The bracket's shall be manufactured out of materials so as to support the wire conductors it is designed to carry.

**10.2.2.2** Brackets manufactured out of steel, shall in the case of:

a) flat bar have a minimum width of 19 mm and minimum thickness of 4,5 mm;

b) square tubing have a minimum width of 19 mm and minimum thickness of 1,6 mm;

c) round bar with a minimum diameter of 10 mm;

d) angle iron with a minimum width and depth of 19 mm and minimum thickness of 3 mm; and

e) any other bracket form used, including brackets manufactured out of materials other than steel, must exhibit the same strength characteristics as a) or b) or c) or d) above.

**10.2.2.3** Where the bracket's are manufactured out of steel, corrosive protection shall comply with the requirements of Annex C.

**10.2.2.4** The bracket's shall be capable of withstanding the temperature and environmental conditions in the area where it is to be installed.

**10.2.2.5** Devices used for fixing a fence insulator to a bracket, shall:

a) have sufficient mechanical strength to support the fence insulator, together with the fence under normal weather conditions to which it may be subjected;

b) have corrosive protection in terms of annex C;

c) provide a resistance against ultra violet radiation and shall not deteriorate within a minimum time period of five years.

**10.2.2.6** In extreme environmental conditions, generally accepted corrosive norms may not be applicable. However, the minimum requirement shall conform to the coastal requirements as specified in Annex C.

**10.2.3 Piggy back brackets – materials**

**10.2.3.1** Sections 10.2.2.1, 10.2.2.3, 10.2.2.4, 10.2.2.5 and 10.2.2.6 shall apply.

10.2.3.2 Brackets, where the main support is manufactured out of steel, shall in the case of:

a) round bar have a minimum diameter of 10 mm;

b) square tubing have a minimum width of 19 mm and minimum thickness of 1,6 mm;

c) industry 'Y' standards with a minimum thickness of 3 mm;

d) angle iron with a minimum width and depth of 19 mm and minimum thickness of 3 mm; and

e) manufactured out of rolled steel or any other material that shall exhibit the same mechanical strength as the brackets described in a) or b) or c) or d) above.

**10.2.4 Stand-alone pole materials**

**10.2.4.1** Sections in 10.2.2.1, 10.2.2.3, 10.2.2.4 and 10.2.2.5 shall apply.

**10.2.4.2** Poles manufactured out of steel, shall in the case of a straining post, be round or square tubing with a minimum diameter of 75 mm and a minimum wall thickness of 2 mm or 60 mm x 60 mm angle iron with a wall thickness of 6mm;

**10.2.4.3** Pole's manufactured out of steel, shall in the case of a intermediate post:

a) be square tubing and have a minimum width of 19 mm and minimum thickness of 1,6 mm;

b) be round bar with a minimum diameter of 10 mm;

c) be angle iron with a minimum width and depth of 19 mm and thickness of 3 mm;

d) for industry 'Y' standards with a minimum thickness of 3 mm; and

e) be manufactured out of rolled steel or any other material that shall exhibit the same mechanical strength as a) or b) or c) or d) above.

**10.2.4.4** Poles manufactured out of steel, shall in the case of support stays have a minimum diameter of 50 mm and a minimum wall thickness of 2 mm.

**10.2.5 Bare-wire conductor materials**

a) Shall have corrosive protection in terms of annex C.

b) Shall have sufficient mechanical strength to withstand all normal weather conditions.

c) Shall be of sufficient diameter and low enough impedance to maintain a high enough current carrying capacity and voltage to meet its intended design specification of the electric fence.



**Comment [W3]:** Sufficient is not good enough.
The important point is the current lack of specification on the intended performance of an electric fence.
Stinger Electronics has defined that for high security fences a minimum energy of **5 Joule** must be available at any point of a sector. This definition has also been accepted by ESKOM.
This definition automatically dictates what type of wire has to be used for a given perimeter length.
We do have a simple Excell program to calculate the type of wire, the max. length and the number of energizers to be used to fulfill the 5 Joule requirement.

**10.2.6 Insulated wire conductors – materials**

a) Shall have corrosive protection in terms of annex C.

b) Shall have sufficient mechanical strength to withstand all normal weather conditions.

c) Shall be of sufficient diameter and low enough impedance to maintain a high enough current carrying capacity and voltage to meet its intended design specification of the electric fence.

d) Shall provide a reasonable resistance against ultra violet radiation and shall not deteriorate within a minimum time period of five years. This excludes insulated wire conductors housed inside closed wireways, conduit, trunking, conduit or similar protective enclosures.

**10.2.7 Miscellaneous devices and accessories**

**10.2.7.1** Miscellaneous devices and accessories refers to all devices attached to the electric fence to fulfil various functions but not limited to fence tensioning, devices for fixing brackets to building elements,other devices which are part of the electric fence, etc.

**a)** Shall comply with the corrosive protection in terms of annex C.

**b)** Have sufficient mechanical strength to withstand all normal weather conditions and design conditions.

**c)** Have resistance against ultra violet radiation and shall not deteriorate within a minimum time period of five years.

**10.3 Design**

**10.3.1 Bracket and pole design**

a) The positioning of fence insulators on brackets and poles shall be such that the maximum distance between electric fence bare wires is 100 mm on a bracket or pole facet.(Distances may be longer between neighbouring insulators placed on adjoining bracket or poles facet's.)

b) Brackets and poles that are manufactured out of tubing shall have a cap placed on its top end or any other sealing method that provides similar protection.

**10.4 Installation**

**10.4.1 Wall-top fence installation**

a) Vertically installed brackets shall have a minimum of two fastening devices securing it to a building element, save where such bracket is manufactured from round bar with a minimum diameter of 10 mm, in which case it shall be knocked into a pre-drilled hole designed to accept such bracket, and may be fixed with adhesive. In the case of brackets welded to a building element, such weld shall exhibit the same strength as the two fastening devices mentioned herein and the weld shall be protected against corrosion with anti corrosion surface coatings .

b) Horizontally installed brackets shall have a minimum of two fastening devices securing it to a building element, with the exception of light weight brackets, installed horizontally that contain a maximum of four bare wire conductors, can have one fastening device. In the case of brackets welded to a building element, such weld shall exhibit the same strength as the two fastening devices mentioned herein and the weld shall be protected against corrosion with anti corrosion surface coatings.

c) The lowest live wire strand installed on building elements shall be a minimum height of 1 500 mm above walking or ground level (or both), when bordering a public area.

d) Brackets shall be installed a maximum distance of 3 000 mm apart. With the exception where obstructions are encountered on wall's , such as pillars protruding above the wall top. In these cases the maximum distance between brackets can be up to 5000 mm apart, but the average distance over the overall length of the wall top installation between brackets cannot exceed 3000 mm.

e) Fastening devices used in brick and concrete walls shall penetrate a minimum of 50 mm into the wall.

f) The wall top fence shall be adequately stayed so as to maintain its strain and remain vertical.

**10.4.2 Piggy-back fence installation**

**10.4.2.1** A piggy-back fence shall not be installed in a public area, unless the lowest live electric fence wire is a minimum height of 1 500 mm above walking and/or ground level or protected by a barrier fence from the public area with a minimum height of 1 500 mm.

**10.4.2.2** The minimum distance between the piggy-back electric fence and a building element and/or barrier fence shall be less than 200 mm or greater than 1000 mm.

**Comment [W4]:** Keep the distance between the palisade and the fence wires at max. (200mm) to avoid voltage loss due to excess capacitance. This means a piggy back construction will give best results).

**10.4.2.3** The building element and/or barrier fence, next to the piggy-back electric fence, shall have one dimension of the opening not greater than 150 mm.

**10.4.2.4** Where piggy-back fences are welded onto an existing building element, sufficient measures should be taken to guard against corrosion.

**10.4.2.5** A piggy-back fence shall be fixed at a minimum of two positions to a building element.

**10.4.2.6** For straining purposes, a piggy-back fence shall be adequately stayed at a maximum of every sixty meters.

**10.4.3 Stand-alone fence installation**

**10.4.3.1** A stand-alone fence shall not be installed in a public area, unless it's lowest live electric fence strand is a minimum height of 1 500 mm above walking or ground level (or both) or covered by a barrier fence from the public area, with a minimum height of 1 500 mm.

**10.4.3.2** The minimum distance between the stand-alone electric fence and a building element and/or barrier fence shall be less than 200 mm or greater than 1000 mm.

**10.4.3.3** The building element and/or barrier fence, next to the stand-alone fence, shall have one dimension of the opening not greater than 150 mm.

**10.4.3.4** All main support/strain poles shall be embedded in concrete into the ground. In the event of main support/strain poles embedded or fastened by alternative methods, such method will provide the same mechanical strength as though it was embedded into concrete.

**10.4.3.5** For straining purposes, a stand-alone fence shall be adequately stayed at a maximum of every one hundred meters.

**10.5 Location to other fences**

**10.5.1** A electric fence erected with the lowest live wire strand at a minimum height of 1500 mm above walking or ground level (or both) and that borders on a electric fence powered by a separate energizer, shall be erected a minimum distance of 100 mm from that electric fence.

**10.5.2** If there is any position where two neighbouring electric fences meet, where one or both of the electric fence wires is lower than 1 500 mm above walking or ground level (or both), a barrier fence of a minimum height of 2 500 mm should be placed across both fences and thus prevent simultaneous access to both fences. Such barrier shall have no openings greater than 50 mm in linear dimension. The distance between the barrier fence and the electric fence shall be either a maximum of 100 mm or a minimum of 1 000 mm and shall be so constructed so as to exclude access between both fences.

**Comment [W5]:** Why not have a max. 50 mm opening in all cases??

**10.6 Wireways**

**10.6.1** All underground wiring shall be placed inside a sealed wireway, conduit, trunking or pipe.

**10.6.2** All conduit, ducts, etc. shall be adequately sealed to prevent the ingress of water.

**11. Electric security fences – Specialized:**

**11.1 Definitions, annexe's and other sections:-**

Annexe's A, B, C, D, E, F, G and H shall be applicable to this section, unless stated differently.

**11.2 General:**

a) All movable and special fence components, must:-

i) Be able to withstand the temperature and environmental conditions in the area where it is to be installed;
ii) Have sufficient mechanical strength to support itself under operational conditions and under normal weather conditions to which it may be subjected.;
iii) Have sufficient corrosive protection in terms of Annex C;

iv) Provide a resistance against ultra violet radiation and shall not deteriorate within a minimum time period of five years.

b) All the sections under Electric security fences - General are applicable to electric fences categorized under this section.

**11.3 Dynamic and Intelligent systems:-**

a) All moving parts shall be so installed so as not protrude into a public area, even while in motion.

b) Monitoring cables shall be so installed or insulated so as to prevent persons in a public area from getting a shock there from.

**11.4 Partitioning and Zoning systems:-**

Monitoring and/or fence high tension cables shall be so installed or insulated so as to prevent persons in a public area from getting a shock there from.

**11.5 Electrified palisade systems:-**

Shall adhere to all the specifications and requirements as contained in the various sections herein.

**Annex A**
(normative)

**Earthing of Electric fences**

**A.1 General requirements**

a) These requirements shall apply to all electric fence installations, excluding domestic pet control fences and temporary sections of strip grazing systems.

b) All earth electrodes shall be a minimum length of 1,1 metres.

c) Earth electrodes shall be manufactured out of galvanized steel, copper clad steel, copper or stainless steel.

d) Earth electrodes should be inserted into the ground as vertically as possible. In the event of loose rocky areas, the earth electrodes can be inserted at a maximum angle of 45 degrees.

e) All the earth wires on an electric fence shall be connected together when connected to an earth electrode.

f) The connecting lead used to connect to any earth electrode, from the energizer or the electric fence wire conductor, shall be of a similar or larger diameter than the electric fence's wire conductors. (This will exclude stainless steel wire, unless the diameter is a minimum of 2 mm.)

g) In the case of very rocky areas, where earth spikes cannot be inserted, such measures shall be taken so as to provide an earthing system that will provide the same characteristics as though an earth spike was inserted.

**A.2 Installation near other earthing systems**

a) A distance of at least 2 metre's shall be maintained between the energizer earth electrode and any other earthing system connected parts such as the power supply system protective earth or the telecommunication system earth, unless specified in b).

b) The distance between any electric security fence or domestic pet control fence (or both) earth electrode and other earth systems shall be not be less than 2 metres, except when associated with a graded earth mat.

**A.3 Installation near energizer**

a) These requirements shall apply to all electric fence installations, excluding domestic pet control fences.

b) Three earth electrodes shall be installed in a close proximity to the electric fence energizer. The earth electrodes shall be linked together and inserted at a minimum distance of the length of the earth spike from each other.

c) The energizer shall be connected to the earth electrode with an insulated wire conductor connecting lead. The earth electrode shall be connected to the electric fence earth conductor.

**Comment [W6]:** Connection must rather be a short as possible length of Bamba strip. Reason is that lightning pulse rise time is extremely steep. The large area of the Bamba strip poses a very low impedance to this pulse.

**Comment [W7]:** The earth pegs should be no more than 2.5 meters away from the energizer. Lightning diverters should be placed in close vincinity of the earth rods. Fence wires (also the earth wire) should be **first** connected to the lightning diverters and from there be connected to the energizer.

**A.4 Additional earth electrodes**

a) Electric security fences or domestic pet control fences (or both) shall have earth electrodes inserted at a maximum distance of thirty metres apart, measured from the energizer or fence connection point.

b) All other electric fence systems shall have earth electrodes inserted at a maximum distance of one hundred metres apart, measured from the energizer or fence connection point.

c) These additional earth electrodes will exclude the three earth electrodes installed near the energizer.

**A.5 Connection of earthing system to energizer output**

a) A directly connected earthing system to the energizer output, is a system where the earthing system is directly connected to the earth side of the high tension transformer.

b)A indirectly connected earthing system to the energizer output, is a system where the earthing system is indirectly connected to the earth side of the high tension transformer, via a number of methods including, spark gap devices and other methods. Such devices must however be in a position to dissipate any surges that may appear on the high-tension transformer in excess of 15 000 volts.

**A.6 Earthing of electric fences located inside or on top of buildings**

a) Where an energizer or electric fence (or both) is located more than ten metres from open ground for earthing purposes, (i.e. installations located inside and on top of buildings):-

   i) The specifications as mentioned above that are applicable to security systems shall be applicable to these systems.

   ii) The connecting lead used to connect to any earth electrode, from the energizer or the electric fence wire conductor, shall have a minimum diameter equal to that of the electric fence's largest diameter wire conductors.

**A.7 Minimum earth resistance between earth electrodes**

a) A maximum earth resistance of 300 ohms, should be maintained between electric fence earth electrodes.

b) The measurement hereof is to be done with an earth resistance meter.

c) Note: In areas where the soil in very sandy or rocky (or both) or in landfill sites, this may not be achievable.

**Annex B**
(normative)

**Lightning protection requirements for electric fences**

**B.1 General requirements for lightning arrestors are:**

a) Shall comply with the requirements for fence insulators in Annex G, regarding deformation/deviation after heating and porosity.

b) Shall comply with the requirements of Annex C.

c) Shall provide a resistance against ultra violet radiation and shall not deteriorate within a minimum time period of five years.

d) The maximum arc over voltage of a lightning arrestor shall be twenty thousand volts.

**Comment [W8]:** Rather 15000V, as 20000 is too close to the arcing spec of the HV transformer

**B.2 Installation**

Shall be capable of withstanding all the mechanical stresses that the wire conductor connected to and its fixture to the electric fence will be subject to, in terms of normal expected weather conditions.

**B.3 Installation near energizer**

a) This requirement applies to all electric fence installations, excluding domestic pet control fences.

b) At the point of connection (between the electric fence and the energizer) or as close to it as possible a lightning arrestor(s) shall be connected to the 'live' wire(s) and an earth electrode. In the case of monitored systems two lightning arrestors shall be used, ie. one on the outgoing 'live' wire and one on the return 'live' wire. In the case of unmonitored systems only one arrestor would be required. The three earth electrodes installed near the energizer may be used for earthing the lightning arrestor.

**Annex C**
(normative)

**Corrosion protection requirements for electric fences**

**C.1 Test method**

The test used shall be in accordance with SANS 7253:1996, Paints and varnishes – Determination of resistance to neutral salt spray. (fog)

**C.2 Minimum requirement for all products used inland from the coast**

a) Inland from the coast will be deemed to be the area beyond the linear distance of six kilometres from the high water mark.

b) All surfaces must be tested for a minimum time period of five hundred hours and under normal visual conditions, show:-

i) in the case of non-metallic surface coatings, no major signs of corrosion;

ii) in the case of metallic surface coatings, no major signs of corrosion in excess of twenty five percent of the surface area being tested.

**C.3 Minimum requirement for all products used in the coastal areas**

a) Coastal area will be the area within the linear distance of six kilometres from the high water mark.

b) All surfaces must be tested for a minimum time period of two thousand hours and under normal visual conditions, show:

i) in the case of non-metallic surface coatings, no major signs of corrosion;

ii) in the case of metallic surface coatings, no major signs of corrosion in excess of twenty five percent of the surface area being tested.

**Annex D**
(informative)

**Electric Fence Maintenance**

**D.1 General maintenance**

In order to maintain the fence in a satisfactory condition, the recommendations given in D.1.1 to D.1.4 should be followed, by the user and the installer (or both):

**D.1.1** Do monthly overview and 3 monthly detailed inspections on the electric fence.

**D.1.2** The monthly overview inspection should comprise of the following actions:

a) Walk/drive along the length of the electric fence and note and correct all obviously visible faults on the fence.

b) Clear the fence of all vegetation and debris (for example plastic bags) that could cause arcing of high-voltage pulses and that could lower the effectiveness of the fence. (i.e. arcing between an electric fence and vegetation can cause fires).

c) Tighten wires that are visibly slackened.

d) Fix all broken parts of the fence.

**D.1.3.** The 3 monthly detailed inspection should comprise of the following actions:

a) Walk along the length of the electric fence and inspect all components of the fence for faults. (i.e. a clicking sound is audible at places where arcing occurs.)

b) Fix all faults reported prior to inspection, tighten all loose wires, replace and repair all faulty fence components.

c) Inspect the electric fence energizer installation and ensure compliance herewith.

d) Inspect the energizer and electric fence earthing system. Tighten loose connection wires, replace worn-out clamps and corroded components.

e) Clear the fence of all vegetation and debris (for example plastic bags).

f) Inspect the fence insulators and ensure they are in a satisfactory condition. Broken and deformed fence insulators must be replaced.

g) Look for electric fence wires touching any other component not forming part of the electric fence installation and rectify to ensure compliance herewith.

h) Check the fence for tautness of wires and tighten faulty wires.

i) Inspect all joints and replace broken or rusted clamps (or both). Ensure soldered joints are still electrically sound.

j) Inspect the electric fence installation for faults at gates.

**D.1.4.** The inspections of the fence should not be limited to the items listed in this annex, but should include any other item found to be non compliant herewith.

**D.2. Duties of an installer when maintaining a fence**

The following additional duties should be carried out:-

a) In the event of an electric fence user refusing, hindering or not co-operating in the rectification of any items found to be in non-compliance herewith, the electric fence installer should issue such user with a written notification of such non-compliance.

b) The peak high voltage should also be checked, at the furthest point from the energizer.

c) In the case of a security fence, the cut and earth short test should be carried out as detailed in Annex H.

d) Supply a full copy of this annexure to the user and discuss and explain its contents so that the user is fully aware of the required maintenance on the electric fence.

**Annex E**
(normative)

**Protection of communication lines against interference from electric fences**

**E.1 Introduction**

Electric fences have the potential to cause electromagnetic interference on communication lines and radio services. These disturbances could mainly be prevented by adhering to good planning principles and proper installation practices. A well designed and maintained electric fence is unlikely to emit excessive interference.

**E.2 Planning principles**

Survey the site before starting with the designing of the electric fence layout. Take note of instances where a communication line is installed in close vicinity of the electric fence to be erected. Always strive to keep the physical distance between the fence and the communication line as big as possible.

If the electric fence must be installed near to the communication line ensure that the quality of the fence insulators and other components used on the fence is of similar or better quality than stipulated in this document. Some tend to cause an electrical break through between fence live wires and the structure it is connected to. This break through could generate noise on the communication line.

Keep the separation distance between the communication line and the electric fence live wire as large as possible, again not closer than what is given in this standard.

Where two or more energizers are connected to an electric fence or where electric fences are at a space of less than 2,5 metres from another, the operation of the energizers should be co-ordinated to ensure effective pulses on any conductor or combination of conductors of the fence, and the combination of fences should be within a predetermined pulse rate and magnitude range as defined by the limits of any compliant single energizer, for the elected category of fencing. Do not connect or install any part of the electric fence to the communication poles or structures.

Do not install the electric fence around communication poles. Do not install the electric fence in such a way that it could cause a safety risk to the employees of the communication company. The employees of the communication company must be able to work on the communication equipment unhindered, unobstructed and without any safety risk (zero possibility of being shocked).

It is good practice not to use a live wire as the upper most wire on the electric fence where a communication line runs parallel to the electric fence.

Installation practices where the go and return of the wires are next to each other will have a cancelling effect on the electromagnetic field which will normally decrease the probability of interference.

Adhere to the earthing requirements as stipulated in this document. It is also important not to earth the electric fence next to an earthing point of the communication system (common earth).

The electric fence energizer shall comply with the required EMC standard SANS 214-1. Clear the area around the electric fence from any obstacles or vegetation that could cause the electric fence to arc. Maintain the fence by following the requirements in this document.

**Annex F**
(normative)

**Installation requirements between overhead power conductors and electric fences:**

All requirements shall be in terms of SANS 60335-2-76.

**SANS 10222-3:2008**
Edition 4

**Annex G**
(normative)

**Electric fence insulator requirements**

**G.1 Fence insulators shall have the following general properties:**

a) Fence insulators attached to a bracket and/or pole shall be manufactured out of materials capable of providing sufficient insulation between the wire conductor and any other conductive component attached to the bracket or pole (or both), that could form a short circuit.

b) The fence insulator shall provide insulation under all normal weather conditions in the area where it is installed.

c) The minimum direct distance between the wire conductor on the fence insulator and the nearest conductive part capable of forming a short circuit shall be 5 mm through the fence insulators material.

d) Fence insulators shall provide a resistance against ultra violet radiation and shall not deteriorate within a minimum time period of five years.

e) The fence insulator shall be capable of withstanding all the mechanical stresses that the wire conductor it supports will be subject to, in terms of normal expected weather conditions.

**G.2 Requirements for fence insulators manufactured out of polymers and polyester based composite materials (or both)**

Fence insulators shall be tested as follows:-

a) The fence insulator shall be placed in an oven and maintained at a minimum temperature of 65 degrees centigrade for a minimum period of thirty minutes. Thereafter the fence insulator shall be removed from the oven and shall show no visible signs of deformation.

b) The fence insulator deviation shall be determined as follows:-

i) The longest length of the fence insulator shall be measured prior to placing in the oven (Unheated length).

ii) The same length will be re-measured after heating in the oven (Heated length).

iii) The percent linear change shall be calculated as follows:-

$$\Delta L = \frac{L_{UH} - L_H}{L_{UH}} \times 100$$

where
$\Delta L$ is percent linear change;
$L_{UH}$ is Unheated length, in metres; and
$L_H$ is Heated length, in metres.

The deviation shall be not more than five percent.



**Comment [W9]:** We require a specification, where we can test the performance of individual energizers.
The spec. for our insulators is as follows:
Sea water contains approx. 3.5% salt.
Electric fences close to the sea experience this salt water spray during storm conditions.
We feel that any insulator should work properly under these conditions.
Our spec therefore states that the insulator should be mounted in the normal position and be sprayed wet with a 3.5% salt solution. The voltage on the conductor should be taken up to 18000V without any arcing visible.
We find that any insulator which passes this test will under normal circumstances never give rise to false alarms or be responsible for emitting electric interference due to arcing.

**Comment [W10]:** The 5 mm distance will provide approx. 5KV insulation during dry conditions. When wet, or sprayed with the salt solution, this voltage will decrease dramatically. We therefore feel that a distance of 15 to 20 mm is more appropriate.

**Comment [W11]:** Should be specified and the insulator should be tested against this spec.

**Comment [W12]:** This test does not belong in this SANS 10222-3 document.

**G.3 Requirements for fence insulators manufactured out of ceramic materials**

Fence insulators shall be tested as follows:

a) The fence insulator shall be placed in an oven and maintained at a minimum temperature of 1 000 degrees centigrade for a minimum period of thirty minutes.

b) The fence insulator shall show no visible signs of deformation.

c) The fence insulator deviation shall be determined as follows:

i) The longest length of the fence insulator shall be measured prior to placing in the oven (Unheated length).

ii) The same length will be re-measured after heating in the oven (Heated length).

iii) The percent linear change shall be calculated as follows:

$$\Delta L = \frac{L_{UH} - L_H}{L_{UH}} \times 100$$

where

$\Delta L$ is percent linear change;

$L_{UH}$ is Unheated length, in metres; and

$L_H$ is Heated length, in metres.

The deviation shall be not more than five percent.

**G.4 General requirements for water absorption**

The deviation for all fence insulators shall be within the following requirements, for water absorption, which shall be calculated as follows:

a) A fence insulator shall be kept at a minimum temperature of 25 degrees centigrade, for a minimum period of eight hours in order to be completely dry.

b) This dry fence insulator will be weighed to determine its dry weight.

c) This fence insulator shall be fully submerged in water, at a minimum temperature of 25 degrees centigrade, for a minimum period of twelve hours.

d) The fence insulator shall be removed from the water and the surface lightly dried with a towel.

e) The fence insulator will then be weighed immediately in order to determine its saturated weight.

f) Calculate the absorption, using the following formula:-

$$A = \frac{W_S - W_d}{W_d} \times 100$$

where

$A$ is the absorption;
$W_s$ is the saturated weight, in kilograms; and
$W_d$ is the dry weight, in kilograms.

The deviation shall be not more than three percent.

**G.5 General requirements for mechanical strength:**

All fence insulators shall show no distortion when a minimum weight of 250 grams is suspended from any position on an fence insulator, at a minimum temperature of 45 degrees centigrade for a minimum period of one hour.

**Annex H**
(normative)

**Electric fence monitoring requirements**

Minimum requirements for electric fence monitoring systems

**H.1 General cut and earth short test requirements**

a) An energizer with monitoring system is to be placed in a position where it is clear of any obstructions.

b) Conduit with a maximum diameter of 28 mm and a minimum length of 10 metres shall be placed linearly in a horizontal position. Three lengths of high-tension cable shall be placed inside the conduit. The one end of the high-tension cables shall be suitable for connection to the energizer/monitoring system. The cables shall be connected to the "live" output, "live" input and earth terminals of the energizer. The opposite end, of the high-tension cables, shall have insulated clamps fixed onto the ends of all three wires. There shall be enough slack in the high-tension cable, so that the clamps can be kept a minimum of 100 mm apart.

**H.1.1 Standard test method for cut wire**

a) Energizer or monitoring system is to be initially switched off.

b) The "live" output clamp and the "live" input clamp are to be clamped together to form an electrical continuous circuit and the earth clamp must be kept a minimum of 100 mm away from the two "live" clamps.

c) In the case of certain specialized systems, the monitoring system may have to be re-calibrated to allow for the different length of wire.

d) Energizer or monitoring system is to be switched on and run for a minimum period of one minute, without a cut wire or fence alarm (or both) being activated.

e) While the energizer or monitoring system is still operational, the two "live" clamps are to be separated, by a minimum distance of 100 mm.

f) An alarm condition must then be activated by the energizer or monitoring system.

**H.1.2 Standard test method for earth short**

a) Energizer or monitoring system is to be initially switched off.

b) The "live" output clamp and the "live" input clamp are to be clamped together to form an electrical continuous circuit and the earth clamp must be kept a minimum of 100 mm away from the two "live" clamps.

c) In the case of certain specialized systems, the monitoring system may have to be re-calibrated to allow for the different length of wire.

d) Energizer or monitoring system is to be switched on and run for a minimum period of one minute, without a earth short or fence alarm (or both) being activated.

e) While the energizer or monitoring system is still operational, the earth clamp is to be clamped onto the “live” wire.

f) An alarm condition must then be activated by the energizer or monitoring system.

**H.2 Installation tests for monitoring systems**

These tests are only applicable to installed electric fences with monitoring systems.

**H.2.1 Determination of testing point on monitored electric fence**

**H.2.1.1** The process of determining the testing point is determined as indicated in H.2.1.2 to H.2.1.5.

**H.2.1.2** The electric fence live wire length needs to be calculated.

**H.2.1.3** The fence length is then to be divided by two, so as to determine the theoretical half way position on the live loop. (From this position there is equal lengths in linear metres of the electric fence “live” loop on both sides.)

**H.2.1.4** From this position, the closest convenient point is located, (ie. where there is a fence link with joins on the “live” loop) so that the live wire can be disconnected. (ie. a cut/broken “live” wire can be created.)

**H.2.1.5** This would then represent the testing point.

**H.2.2 The cut or broken wire test**

**H.2.2.1** The process in H.2.2.2 to H.2.2.8 needs to be followed in order to test the installed electric fencing system, for cut or broken wire monitoring.

**H.2.2.2** Initially, the “live” loop is to be electrically continuous.

**H.2.2.3** The energizer or monitoring system is then switched on and left to operate for a minimum period of one minute. During this period, the alarm should not be activated.

**H.2.2.4** The energizer or monitoring system should thereafter be switched off, or in the case of low voltage monitoring systems, the voltage can be turned down to a safe level.

**H.2.2.5** The “live” wire link at the testing point now needs to be separated.

**H.2.2.6** In the case of a low-voltage monitoring system, the alarm should be activated.

**H.2.2.7** In the case of a high voltage monitoring system, the energizer or monitoring system needs to be switched on, after which the alarm should be activated.

**H.2.2.8** If no alarm is activated the test would not be successful.

**H.2.2.9** The “live” fence circuit used for monitoring purposes, shall be wired in series.

**H.2.3 The earth short test**

**H.2.3.1** The process in H.2.3.2 to H.2.3.8 needs to be followed in order to test the installed electric fencing system, for earth short monitoring:

**H.2.3.2** Initially, the “live” loop is to be electrically continuous.

**H.2.3.3** The energizer or monitoring system is then switched on and left to operate for a minimum period on one minute. During this period, the alarm should not be activated.

**H.2.3.4** The energizer or monitoring system should thereafter be switched off, or in the case of low-voltage monitoring systems, the voltage can be turned down to a safe level.

**H.2.3.5** A conductor needs to be connected between the “live” wire loop and the “earth” wire at the testing point.

**H.2.3.6** In the case of a low-voltage monitoring system, the alarm should be activated.

**H.2.3.7** In the case of a high voltage monitoring system, the energizer or monitoring system needs to be switched on, after which the alarm should be activated.

**H.2.3.8** If no alarm is activated the test would not be successful.

**Annex I**
(informative)

**Certification: (Electric Fence Certificate – EFC)**

I.1 Every user or lessor of an electric fence, as the case may be, shall have an original valid Electric Fence Certificate.(As from …….date…)

I.2 The Electric Fence Certificate shall be accompanied by a test report in a format approved by the chief inspector.

I.3 Certificates are transferable, provided the certificate is less than two years old.

I.4 Every user or lessor of an electric fence, as the case may be, shall on request produce the Electric Fence Certificate for that installation to an inspector.

I.5 Where an addition, alteration, replacement or change has been effected to an electric fence installation for which an Electric Fence Certificate was previously issued, the user or lessor of such installation shall obtain a certificate for at least the addition, alteration, replacement or change.

I.6 A registered person shall only issue an Electric Fence Certificate obtainable from the chief inspector and with a unique number issued by the chief inspector.

**Comment [W13]:** The inspector should be an independent and very well informed person. (**who is insensitive to bribery offers.)**

**DEPARTMENT OF LABOUR**
OCCUPATIONAL HEALTH AND SAFETY ACT, 1993.
ELECTRIC FENCE CERTIFICATE.

| Electric Fence Certificate in accordance with SANS 10222-3 and SANS 60335-2-76. | Certificate No. | |
|---|---|---|
| | Certificate Type. (Tick appropriate block) | |
| | Initial Certificate | Supplementary Certificate |

Supplement No._____to Initial Certificate No._____as issued no:_____

Identification of the relevant Installation
(Address or other unique reference, where applicable)

Physical address:_____

_____

GPS Coordinates:_____

Suburb/Township:_____

District/Town/City:_____

Erf/Lot/Plot no/Farm name:_____

Declaration by registered person

I_____(ID no._____)

A registered person declare that I have personally carried out the inspection and testing of the electric fence installation described in the attached test report as per the requirements of SANS 10222-3 and deem the installation to be compliant therewith and reasonably safe when properly used.

I have entered the number of this certificate to the attached test report/s.

I declare that the persons responsible for the design, specification, construction and inspection, test and commissioning have completed the relevant sections of the test report.

Registered person registration number_____date of registration_____

Signature_____

Contact details of registered person: Tel No:_____

Cell No:_____

E-mail:_____