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SOUTH AFRICAN NATIONAL STANDARD

Electrical security installations

Part 3: Electric fences (non-lethal) and manufactures requirements

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Edition 5

Table of changes

Change No.	Date	Scope

Foreword

This South African standard was approved by National Committee SABS TC 68, *Electrical and electronic security systems*, in accordance with procedures of the SABS Standards Division, in compliance with annex 3 of the WTO/TBT agreement.

This document was published in xxxx 2013.

This document supersedes SANS 10222-3:2012 (edition 4.1).

This document is referenced in the Compulsory specification for Electrical Machinery Regulations, as published by Government Notice No. R250 (Government Gazette 34154) of 25 March 2011.

Reference is made in 3.52 to "relevant national legislation". In South Africa, this means Regulation 14 of the Electrical Machinery Regulations, as published by Government Notice No. R250 (Government Gazette 34154) of March 2011.

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

Part 1: General.

Part 2: Access control.

Part 3: Electric fences (non-lethal).

Annexes A to H form an integral part of this document.

Introduction

In South Africa the Electric Machinery Regulations (Government Notice No. R250 (Government Gazette 34154) of 25 March 2011, 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), 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 as an example.

The provisions of SANS 10222-3 apply 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), 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 are 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

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

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Electrical security installations

Part 3:
Electric fences (non-lethal) and manufactures requirements

1 Scope

1.1 This part of SANS 10222 gives additional requirements 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.

1.2 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; and

– Electric security fences – Specialized.

1.3 It covers electric fences powered by energizers supplied from all types of electric power sources such as batteries, solar cells, diesel or petrol generators or any alternative power sources.

1.4 The standard also includes manufactures requirements.

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 can be obtained from the SABS Standards Division.

IEC 60417, *Graphical symbols for use on equipment*.

SANS 156, *Moulded-case circuit-breakers.*

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

SANS 7253, *Paints and varnishes – Determination of resistance to neutral salt spray (fog).*

SANS 10087, *The handling, storage, distribution and maintenance of liquefied petroleum gas in domestic, commercial, and industrial installations.*

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

SANS 60335-2-76: 2006/IEC 60335-2-76: 2006, *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
accessible
not permanently closed in by the structure or surface(s) of the premises

3.2
alternating current
a.c.
an electric current that reverses its direction at regularly recurring intervals

3.3
ampere hour
Ah
rating (expressed in ampere-hours or Ah) of the amount of current that a fully charged battery can supply for 20 hours without having the terminal voltage fall below a preset value and temperature. (In the case of a 12 volt flooded lead acid battery, the preset voltage would be approximately 10,5 volts at an approximate temperature of 27 degrees centigrade.)

3.4
arcing
electrical discharge between two conductors

3.5
battery charger
device that supplies electrical energy in a controlled manner, to a battery with the objective being to replenish electrical energy used.

3.6
bracket
device normally fabricated out of metal or alternative material with similar properties, 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
pole facet
flat section on the electric fencing bracket or pole

NOTE On the one end of the facet there is either a bend more than 25 degrees or the bracket or pole end and on the other end of the facet, either a bend (more than 25 degrees) or the bracket or pole end.

3.8
building element
part of premises such as a wall, floor or 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
electric current that flows in one direction only

3.12
deep-cycle batteries
lead acid battery that can be discharged to less than 30% of its nominal rated capacity and then recharged, pending the batteries age, on a daily basis. (These batteries have thicker lead plates and substantially larger enclosures than equivalent standard automotive lead acid batteries.)

3.13
ducting
closed enclosure that allows insulated conductors and cables in electrical installations to be drawn in and to be replaced

3.14
dynamic bracket/pole
brackets/poles that fulfill the functions of a passive bracket/pole and additional mechanical features/functions

3.15
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

3.16
earthed
connected to the general mass of earth as to ensure, at all times, an immediate discharge of electrical energy without danger

NOTE Applies to electric fences only.

3.17
electric animal fence
electric fence used to contain animals within or exclude animals from a particular area

3.18
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

NOTE Electric fence also includes electric palisade or similar devices.

3.19
electric fence energizer
appliance that is intended to deliver voltage impulses periodically to a fence connected to it (As described in SANS 60335-2-76.)

NOTE Electric fence energizers are hereinafter also referred to as energizers.

3.20
electric security fence
fence used for security purposes that comprises an electric fence installation

3.21
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.

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

3.23
electromagnetic interference
EMI
any degradation of the performance of a device, equipment or system caused by an electromagnetic disturbance

3.24
enclosure
part that provides protection of equipment against certain external influences and, in any direction, protection against direct contact

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
under gate cable
high voltage lead out
insulated conductor capable of insulating voltages used on an electric fence

3.27
fence insulator
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
length measured in metres, of the physical electric fence(physical structure)

3.29
fence live wire length
length measured in metres, of the series length (live loop) of the live wire of an electric fence

NOTE 1 Fence length could also be live wire length.

NOTE 2 Parallel sections count as one length.

3.30
flammable
descriptive of a material that, when heated for a min of 5 min in an oven at a minimum temperature of 300 °C (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

3.31
flexible conduit
tubing that is intended to house and to protect electric wiring and that is so designed that it is flexible.

3.32
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).

3.33
galvanic
process through which electricity is chemically produced

3.34
galvanic effect
galvanic coupling
two dissimilar conductors in contact or in the same electrolytic solution, resulting in a difference of potential between them

3.35
High density population 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 high density population area would exceed 400 or more persons per square kilometre, but proclaimed municipal areas with a lower population density would be regarded as a low density population area.

3.36
high tension
electric fencing
where the peak voltage of a pulsed system exceeds 50 V

3.37
insulator
see fence insulator (3.24)

3.38
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 i.e. mesh fence)

3.39
intermediate bracket/pole
brackets/poles that support electric fence wires between a set of strain brackets/poles (excluding the support of a fence i.e. mesh fence)

3.40
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.

3.41
live part
conductive part that may cause an electric shock

3.42
low density population area
areas not covered under the definition of high density population area.

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

3.43
maintenance battery charger and back-up system
The battery supplies power to the energizer and/or monitoring system in the event of mains power failure. But the battery charger only replenishes charge lost by the battery due to its internal battery losses and does not replace charge used in the event of mains power failure.

3.44
normal operation
operation of the electric fence under the conditions where
– the electric fence energizer is fully operational and connected to a power supply; and
– there is no obstruction present on the connected electric fence installation

3.45
obstruction
any object coming into contact with an electric fence, that is not part of the electric fence installation

NOTE This also includes plant growth.

3.46
off-set bracket
wire outrigger
bracket that supports an electric fence that is not capable of mechanically supporting itself and is clipped onto a supporting fence

3.47
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

3.48
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

3.49
partitioning
sectorising
electric fence installation that consists of one energizer and monitoring system connected to an electric fence, which is divided into sections for monitoring purposes **Amdt 1**

3.50
passive brackets/poles
brackets/poles that only fulfill two functions, namely, supporting electric fencing wires and itself

3.51
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

NOTE Physical barriers are typically brick wall, precast concrete, vertical sheeting, rigid bars, rigid mesh or rods of chain wire mesh.

3.52
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

3.53
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

3.54
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

3.55
public access area
any area where persons are protected from inadvertent contact with pulsed conductors by a physical barrier

3.56
public area
area within a secure area, to which any person can gain legal access without permission from the land owner or where members of the public are allowed to enter (i.e. housing complexes, sports grounds, exhibitions, etc,)

NOTE Areas adjacent to such public areas, without a building element or some other method restricting access are also deemed to be public areas.

3.57
pulsed conductors (As contemplated in SANS 60335-2-76)
conductors that are subjected to high voltage pulses (exceeding 50 V d.c. or 50 V a.c. (r.m.s.) emitted by an energizer

3.58
r.m.s.
root mean squared

3.59
Registered electric fence system installer
person registered by the regulator.

3.60
remote-area battery charger and power supply system
battery supplies power to the energizer and/or monitoring system in the event of mains power failure or the system is powered by an alternative power source, such as photovoltaic panels. The battery charger replenishes charge lost by the battery due to its internal battery losses and the charge used on a daily basis. (This will vary as the battery ages.) (These batteries are classified as deep cycle batteries in the case of lead acid batteries.)

3.61
secure area
area where a person is not separated from pulsed conductors below 1,5 m by a physical barrier

3.62
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

3.63
stand-by battery charger and back-up system
the battery supplies power to the energizer and/or monitoring system in the event of mains power failure. The battery charger replenishes charge lost by the battery due to its internal battery losses and the charge used in the event of mains power failure. The minimum time required for the battery to fully recharge, will be declared by the manufacturer. (This will vary as the battery ages.)

3.64
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

3.65
surge suppressor
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 semiconductor device

3.66
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

3.67
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.

3.68
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 an urban area would exceed 400 or more persons per square kilometre, but proclaimed municipal areas with a lower population density would be regarded as an urban area.

3.69
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

3.70
wire outrigger see off-set bracket (3.39)

3.71
wireway
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 wireway can consist of one or more separate wireway channels, each of which is intended for different services such as installation wiring and telecommunication wiring.

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, alloys containing these metals or conductive material exhibiting similar characteristics. Such conductors shall provide the best current carrying capacity, resistance to corrosion, be of a low resistance (<10 Ω/metre) and be of sufficient tensile strength (as per manufacturer's specification) 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

Conductor construction shall:

a) be stranded or solid; and

b) when insulated, withstand the highest temperature and operating voltage to which they are likely to be exposed (see 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, letters, or a combination of these as follows:

a) the neutral/earth continuity conductor shall be identified by colours 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 the colour red only;

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

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 at the energizer connection point (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 or clamps (or both);

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 manufacturer's instructions or joined by using cable couplers or manufacturer's jointing kits;

b) be accessible (visible inspection box) and protected against strain; and

c) be made in such a way that it would 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 wireway with a mains alternating current supply cable;

b) in the same wireway with the cables or wires of telecommunication, radio and signaling 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;

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 shall not apply.

g) in high risk areas such as chemical plants, gas storage areas (see SANS 10087), flammable liquids, explosives, etc. In this, the safety requirements of the relevant specifications shall be taken into account.

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 with the conductor or causing arcing, and should be maintained regularly;

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;

d) the bare high-tension 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 shall be taken into account when positioning the bare high-tension conductors, to prevent inadvertent contact or causing arcing to any foreign objects; and

f) bare high-tension charged conductors shall not be placed inside any wireway.

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 wireways 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:

a) Bare high-tension conductors shall be held in position and fixed to fence insulators in accordance with the various provisions in this part of SANS 10222 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 manufacturer's 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 4.1.4.2.

d) The use of dissimilar metals that will result in a galvanic effect shall be minimized. Should such metals be used, any joints and fixtures shall 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:

a) be buried in pickable ground with a minimum cover of 300 mm;

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

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

4.4 Wireways

4.4.1 Installation of wireways

Wire-ways shall be installed as follows.

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

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

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

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

e) Cable entry points, exit points and internal surfaces of the wireway shall not be capable of damaging the insulation or cable during installation or subsequent use.

f) Materials that come into contact with a wireway, 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 wireways 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 wireway including conduit, pipe, trunking or similar protection, containing fence high-tension cables and an electric fence neutral/earth cable shall not contain other cabling.

j) Bends shall not distort the internal shape of a wireway 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.

4.4.2 Conduits

Conduits shall be as follows:

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 (including the electric fence neutral/earth conductor) shall be insulated fence high-tension conductors, in accordance with 4.1 and 4.2.

4.5.5 Caution shall be exercised when installing an energizer 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 compliance with SANS 60335-2-76.

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

4.6.5 Sign boards shall be displayed not more than 2 000 mm from each corner or bend in a straight length of an electric fence. **Amdt 1**

4.6.6 Sign boards shall be displayed on an access gate or not more than 500 mm on either side of an access area on which an electric fence is erected. **Amdt 1**

4.6.7 In high density population areas, sign boards shall not be more than 10 m apart. **Amdt 1**

4.6.8 In low density population areas, sign boards shall not be more than 100 m apart. **Amdt 1**

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 or the combination of the conductors of all the fences (or both) 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 1,5 m above ground level or if a non-electrified barrier fence is installed, measuring a minimum of 2,5 m across and a minimum height of 1,5 m, placed in front of both fences.

4.8 Electric fence insulator requirements

All electric fence insulators shall comply with annex A, hereof.

4.9 Energizer in standby mode

Any system that is connected to bare conductors, that is so arranged as to emulate an electric fence installation as described in this part of SANS 10222, and that under certain conditions, emits an impulse as defined in this part of SANS 10222, shall be classified as an electric fence installation.

4.10 Compliance

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

4.11 Power limitations

4.11.1 High density population

4.11.1.1 Energy output limitation of an installed energizer in a high density population area shall be as follows:-

a) In high density population areas, where the population exceeds 400 or more persons per square kilometer, the energy output of an electric fence energiser shall be limited to a maximum of 8 Joules under any load condition.

b) In the event of an energizer's output exceeding 8 Joules under any load condition, an approved limiting device must be fitted between the energizer output and the electric fence. In the case of more than one electric fence being attached to such an energizer, each attached electric fence must have a separate approved limiting device fitted between the energizer output and each individual electric fence. The effect of the fitted limiting device will be to ensure that the maximum output of the energizer as measured after the limiting device, will not exceed 8 Joules to the fence line under any load condition. The limiting device together with the energizer should be fully compliant with SANS 60335-2-76. All lead out cables between the energizer and the limiting device must be high voltage insulated cable.

4.11.1.2 Energisers from which the output exceeds 8 joules under any load condition, unless an appropriate limiting device has been installed as described above, shall not be installed:-

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

b) 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.

4.11.2 Low density population

Energy output limitation of an installed energizer in a low density population area, where the population has less than 400 persons per square kilometer, the energy output shall comply with SANS 60335-2-76.

4.12 Metrology

4.12.1 Voltage and current measurements shall be done by an appropriate measurement meter as recommended by the manufacturer of the energizer used and installed on the electric fence.

4.12.2 In the event of an appropriate measurement meter not being recommended by the manufacturer, or an alternate accurate measurement is required, then a digital oscilloscope shall be used. Such digital oscilloscope shall:-

a) have appropriate high voltage probes;

b) be set to real time sampling;

c) have synchronized trigger and the largest possible image of the pulse (as specified in SANS 60335-2-76) shall be displayed;

d) have a minimum sampling rate of 20 Megahertz; and

e) Ideally have an interface to a micro computer, to enable further data processing and recording.

4.13 User instructions and manuals

An installer shall hand over or make available user instructions and manuals to the user of an electric fence.

4.14 Back up battery installation requirements

4.14.1 Back up battery

a) The battery enclosure and location shall be installed in accordance with the installation requirements.

b) The battery installed shall be of manufacture specifications.

c) The battery case shall not have cracks, broken parts or loose terminals.

d) The batteries connectors shall not be broken or have cracks.

e) The battery terminals shall have not have corrosion, dirt or acid on the case top where applicable, use the manufacturers prescribed cleaning method.

f) The battery electrolyte fluid level shall be as specified by the manufacture specification.

g) All back-up batteries shall be installed in such a manner as to provide adequate protection against:-

i) accidental acid spillage;

ii) leakage of gases;

iii) high battery temperature;

iv) external contaminants, that can cause a health hazard, when coming into contact with the battery.(ie. salt water.)

h) All back-up batteries shall be installed in such a manner as to provide protection against cold temperatures, rain, snow and any other elements that may damage or impede the batteries functionality.

4.15 Electronics maintenance

4.15.1. Battery maintenance

4.15.1.1 Visual inspection:-

a) check if battery enclosure and location is in terms of the installation requirements;

b) check if the battery is in terms of the manufacturers specifications;

c) check for cracks in the battery case and broken or loose terminals;

d) check for cracked or broken cables or connectors;

e) check for corrosion on terminals and dirt or acid on the case top;

f) check for loose cable connections;

g) check the electrolyte fluid level, in the case of flooded lead acid batteries; and

g) check for compliance with **4.14.1** a) to h).

4.15.1.2 Physical tests:-

a) check open circuit voltage and ensure it is within the manufacturer's specification;

b) if required by the manufacturer, check battery with the manufacturers recommended tester;

c) physical state of charge test shall be performed as follows:

i) disconnect and remove the battery and measure peak voltage after period of 5min.

ii) reconnect the battery with the mains power supply disconnected and allow the system to operate for a minimum period of 5min and a maximum period of 6min ensuring that the energiser operates over this period of time under normal operating conditions.

iii) measure the peak battery voltage after the elapsed time above. (ensuring the mains power supply remains disconnected).

iv) the final battery voltage measured in the above should not be less than 12% of the initial battery voltage measurement.

4.16 Security electric fencing testing procedures

4.16.1 Installation tests for monitoring systems

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

4.16.1.1 Determination of testing point on monitored electric fence

a) The electric fence live wire length needs to be calculated;

b) 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.);

c) 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.); and

d) This would then represent the testing point.

4.16.1.2 The cut or broken wire test

a) Initially, the “live” loop is to be electrically continuous.

b) 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 activated.

c) 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.

d) The “live” wire link at the testing point now needs to be separated.

e) In the case of a low-voltage monitoring system, the alarm should be activated.

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

g) If no alarm is activated the test would not be successful.

h) The “live” fence circuit used for monitoring purposes, shall be wired in series.

4.16.1.3 The earth short test

a) Initially, the “live” loop is to be electrically continuous.

b) 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.

c) 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.

d) A conductor needs to be connected between the “live” wire loop and the “earth” wire at the testing point.

e) In the case of a low-voltage monitoring system, the alarm should be activated.

f) 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.

g) If no alarm is activated the test would not be successful.

4.16.1.4 Continuity and obstruction test

For security energiser installations the following fence circuit test shall be done:

a) The high tension output and input wires shall be disconnected from the energiser and checked for continuity with an ohm meter. This test must be done in terms of the energiser manufacturers requirements.

b) Any high tension wire (disconnected from the energiser) and the earth wire shall have a minimum resistance of normally 5 kΩ. This minimum resistance value is subject to the energiser manufacturers requirements.

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 system.

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) In urban areas, care shall 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 200 mm above ground level, no vegetation shall be allowed below the fence. Vegetation shall not be closer than 200 mm on either side of the electric fence.

b) In rural areas, care shall 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 shall be clear of vegetation 200 mm below the lowest electric fence wire. In the case of the lowest electric fence wire being less than 200 mm above ground level, no vegetation shall be below the fence.

5.2 Installation near overhead power lines

For protection against electromagnetic induction from overhead power lines, the 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 with the nearby communication lines.

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

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 compliance 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˚.

5.3.2.2 An electric fence running parallel to communication lines shall be avoided. In cases where an electric fence can only be installed parallel to a communication line, requirements specified in 5.3.2.3 to 5.3.2.5 (inclusive) shall apply.

5.3.2.3 Where an electric fence and communication line are installed parallel to each other 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) (see SANS 10142-1).

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 accordance with of annex C.

Ensure that all ancillary equipment connected to the electric fence circuit provides the equivalent degree of isolation as the primary to secondary isolation of an electric fence energizer as specified

for ancillary equipment in the annex BB of SANS 60335-2-76 between the fence circuit and the alternating current supply. Special precautions shall 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

Annexes D, E, B and A shall be applicable to this clause, 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 kV;

c) maximum energy discharge per impulse measured at 500 Ω load range shall not exceed 0,5 J;

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

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

NOTE In the event of the mains alternating current supply being used, the energizer should comply with the applicable requirements for either type A, type B, type C or type D energizers according to SANS 60335-2-76.

6.3 Installation environmental considerations

This includes the energizer, electric fence wiring and earth spikes.

6.3.1 The system shall not be:

a) on top of a building element;

b) where it can be mechanically damaged;

c) within 2,5 m of another electric fence; unless the energy and timing of the pulses on the multiple electric fences meet the output requirements for a single energizer specified in SANS 60335-2-76 ; or

d) attached to another electric fence.

6.3.2 The system shall:

a) be installed inside an area enclosed from public access;

b) be a free standing structure;

c) not be permanently fixed to a building element;

d) be used only for domestic animal control; and

e) have a minimum of one earth spike.

6.4 General installation requirements

The system shall only be installed by persons

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

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

7 Strip grazing electric fences

7.1 General

Annexes A, B, C ,D and F shall be applicable to this clause, unless stated differently. Guidelines for the maintenance of strip grazing electric fences are given in annex E.

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; or

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

7.3.2 The system shall be installed only:

a) inside an area enclosed from public access;

b) as a free standing structure;

c) for animal control; and

d) in a low density population area.

7.3.3 The electric fence shall be installed as follows.

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

b) Electric fence shall contain a maximum of four wire conductors.

c) The support posts shall not be placed closer than 5 m apart on average.

d) The electric fence may consist of permanent and temporary installed sections.

e) The electric fence installation shall clearly demarcate grazing areas for animals and livestock.

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 clause; and

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

7.5 Special precautions

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

8 General agricultural electric fences

8.1 General

Annexes A, B, C, D, F and G shall be applicable to this clause, unless stated differently. Guidelines for the maintenance of agricultural electric fences are given in annex E.

8.2 Classification

All other fences not covered in this part of SANS 10222, shall be deemed to be general agricultural fences.

9 Game control electric fences

9.1 Definitions, annexes and other sections

Annexes A, B, C, D, F and G shall be applicable to this section, unless stated differently. Guidelines for the maintenance of game control electric fences are given in annex E.

9.2 Materials

9.2.1 Fence insulator materials

Fence insulators shall comply with the requirements of annex A.

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 The off-set bracket shall be manufactured out of high tensile steel wire with a minimum strength of 850 MPa 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 D.

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

9.2.2.5 The 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 Where the main support is manufactured out of steel, brackets 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, shall exhibit the same strength characteristics as a) or b) or c) or d) above.

9.2.3.3 Stand alone poles shall be as follows:

a) In the case of a straining post, the minimum measurements shall be:

   i) 75 mm diameter pipe with a wall thickness of 2 mm;

   ii) 75 mm square tubing with a wall thickness of 2 mm; and

   iii) 60 mm x 60 mm angle iron with a wall thickness of 6mm.

b) In the case of an intermediate post, the minimum measurements shall be:

   i) 19 mm square tubing and thickness of 1,6 mm;

   ii) 10 mm diameter if round bar is used; and

   iii) 3 mm thickness if a 'Y' standard is used.

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

d) Stand alone poles shall 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); and

   iii) in the case of a support stays in (c) above.

9.2.4 Bare wire conductors materials

Bare wire conductor materials shall:

a) comply with corrosive protection requirements in annex D;

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; and

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

Insulated wire conductor materials shall:

a) comply with corrosive protection requirements in annex D;

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

c) provide a reasonable resistance against ultra-violet radiation and have a minimum life span of five years; and

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

Miscellaneous devices shall:

a) comply with corrosive protection requirements in annex D;

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; and

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.

9.3 Design

9.3.1 The positioning and construction of the electric fences shall be such that they comply with the requirements of the local authority.

9.3.2 Poles that are manufactured out of tubing shall have caps placed on the 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 in metres at any point on the fence taken from ground level to the highest electric fence wire; and

W_n is a number of electric fence wires.

NOTE 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's minimum height is 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 or sufficient warning signs are installed. These signs shall be no more than 10 m apart when within 100 m to public amenities and accommodation. Entrance points shall clearly display warning signs drawing the public's attention to the electrified fencing.

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 distance between straining posts shall be a maximum of 200 m over a single span (span being wire length from tensioner to tensioner). The mean distance between off-set brackets shall not exceed 10 m. The mean distance shall be calculated as follows: **Amdt 1**

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

where

d_m is mean distance in metres;

L_s is length of span in metres; and

n is number 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 N 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 or barrier fence (or both) shall be less than 200 mm or greater than 1000 mm.

9.4.3.2 The building element or barrier fence, next to an electric fence (or both), 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, supplied by independently timed energizers, where one or both of the electric fence wires is lower than 1500 mm above walking or ground level (or both), there shall be a 2500 mm distance between the fences or a barrier which prevents the simultaneous touching of both fences. Where a barrier is used, it 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; wire extruded with a polyethylene sheath designed for use as underground electric fencing wire shall qualify as being in a protective enclosure.

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

9.7 Barrier fences

Barrier fences shall have:

a) a minimum height of 1500 mm; and

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

10 Electric security fences – General

10.1 Definitions, annexes and other sections

Annexes A, B, C, D, F, G and H shall be applicable to this clause, unless stated differently. Guidelines for the maintenance of electric security fences are given in annex E.

10.2 Materials

10.2.1 Fence insulator materials

Fence insulators shall comply with the requirements of annex A.

10.2.2 Wall-top bracket materials

10.2.2.1 The brackets shall be manufactured out of material that ensures their ability to support the wire conductors they are 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, have a minimum diameter of 10 mm;

d) angle iron, have 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, shall exhibit the same strength characteristics as a) or b) or c) or d) above.

10.2.2.3 Where the brackets are manufactured out of steel, corrosive protection shall comply with the requirements of annex D.

10.2.2.4 The brackets 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 D;

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 comply with the coastal requirements as specified in annex D.

10.2.3 Piggy back brackets materials

10.2.3.1 Subclauses 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 Where the main support is manufactured out of steel, brackets 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, have a minimum thickness of 2 mm;

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

10.2.3.3 In the case of brackets manufactured out of rolled steel or any other material, it 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 Subclauses 10.2.2.1, 10.2.2.3, 10.2.2.4 and 10.2.2.5 shall apply.

10.2.4.2 In the case of a straining post, poles manufactured out of steel shall be round or square tubing with a minimum diameter of 75 mm and a minimum wall thickness of 2 mm or 60 mm × 60 mm angle iron with a wall thickness of 6 mm.

10.2.4.3 In the case of an intermediate post, poles manufactured out of steel shall:

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 2 mm; and

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

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

10.2.5 Bare-wire conductor materials

Bare wire conductor materials shall:

a) have corrosive protection in terms of annex D;

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

c) 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.

10.2.6 Insulated wire conductors – Materials

Materials for insulated wire conductors shall:

a) have corrosive protection in terms of annex D;

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

c) 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; and

d) 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, pipe or similar protective enclosures.

10.2.7 Miscellaneous devices and accessories

Miscellaneous devices and accessories refer to all devices attached to the electric fence to fulfill 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. shall:

a) comply with the corrosive protection in terms of annex D;

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

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

10.3 Design

The design of bracket and pole shall be as follows:

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 facets).

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

c) All brackets and poles used shall be passive designs.

10.4 Installation

10.4.1 Wall-top fence installation

Wall-top fence shall be installed as follows:

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 and the weld shall be protected against corrosion with anti corrosion surface coatings.

b) Each horizontally installed bracket shall have a minimum of two fastening devices securing it to a building element. In the case of a light weight bracket installed horizontally, that contains a maximum of four bare wire conductors, only one fastening device will suffice. 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 walls, 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 its 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. Sufficient warning signs shall be installed. These signs shall be more than 10 m apart when within 100 m to public amenities and accommodation. Entrance points shall clearly display warning signs drawing the public's attention to the electrified fencing.

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

10.4.2.3 The building element or barrier fence (or both), 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 60 m.

10.4.3 Stand-alone electric fence installation

10.4.3.1 A stand-alone electric fence shall not be installed in a public area, unless its 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 or barrier fence (or both) shall be less than 200 mm, or greater than 1000 mm.

10.4.3.3 The building element or barrier fence (or both), next to the stand-alone electric 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 methods shall provide the same mechanical strength as though embedded into concrete.

10.4.3.5 For straining purposes, a stand-alone electric fence shall be adequately stayed at a maximum of every 100 m.

10.5 Location to other fences

10.5.1 An 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 an 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 energized by independently timed energizers are closer than 2,5 m, where both of the electric fence wires are not higher than 1 500 mm above walking or ground level (or both), a barrier fence of a minimum height of 1 500 mm shall be placed between both fences to prevent simultaneous access to both fences. Such barrier shall have no openings greater than 50 mm in all directions. 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.

10.6 Wireways

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

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, annexes and other clauses

Annexes A, B, C, D, F, G and H shall be applicable to this clause, unless stated differently. Guidelines for the maintenance of specialized electric security fences are given in annex E.

11.2 General

a) All movable and special fence components shall:

i) be able to withstand the temperature and environmental conditions in the area where they are to be installed;

ii) have sufficient mechanical strength to support themselves under operational conditions and under normal weather conditions to which they may be subjected;

iii) have sufficient corrosive protection in terms of annex D;

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

b) All the subclauses under clause 10 are applicable to electric fences categorized under this clause.

11.3 Dynamic and intelligent systems

a) All moving parts shall be so installed so as not to 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 from them.

11.4 Partitioning and zoning systems

Monitoring or fence high-tension cables (or both) shall be so installed or insulated so as to prevent persons in a public area from getting a shock from them.

11.5 Electrified palisade systems

They shall adhere to all the specifications and requirements as contained in this part of SANS 10222.

12 Electric security fences – Manufactures

12.1 Monitoring system requirements

Minimum requirements for electric fence monitoring systems, in terms of cut and earth short tests.

12.1.1 Initial setup:

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

2. Conduit with a maximum inner diameter of 20 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.

12.1.2. Standard test method for cut wire

1. Energizer or monitoring system is to be initially switched off.

2. 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.

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

4. 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.

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

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

12.1.3. Standard test method for earth short

~~a)~~1. Energizer or monitoring system is to be initially switched off.

~~b)~~2. 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)~~3. 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)~~4. 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)~~5. While the energizer or monitoring system is still operational, the earth clamp is to be clamped onto the “live” wire.

~~f)~~6. An alarm condition must then be activated by the energizer or monitoring system.

12.2 User interface for security energizers

All security energizers will clearly indicate their operating status, functions and methods of control, either on the main energizer and monitoring system enclosure (if no remote controlling device is attached ie. no attached key pad) and/or on a remote device used for controlling the system.(ie. key pad)

Note: In the event of the remote control device (being a specified system supplied by the manufacturer) is unable to display the functions mentioned below the manufacturer should provide a method whereby the operating status can be determined.

12.2.1 The following minimum functions, will be clearly labelled and displayed:-

a) Energizers high voltage is activated or deactivated.

b) Monitoring system has triggered an alarm condition.

c) Battery low voltage indication.

d) Mains power failure indication.

12.2.2 In the event of additional features that materially alter the main functions of the energizer and/or monitoring system under certain conditions, from normal operating status to an alternate status, must also be clearly displayed. This includes, but is not limited to:-

a) In the event of power failure, programmed or preset changes in energizer output.

b) Changes in systems power output, in the event of an earth short.

12.2.3 The following methods of control will be clearly indicated:-

a) Where the energizers high voltage can be turned on and off.

b) Where the monitoring systems alarm can be turned on and off. (In the event on the high voltage function, also fulfilling the alarm function, then only the energizers high voltage control needs to be shown.)

12.3 Back up battery and charger requirements

12.3.1 User information

The manufacturer and/or supplier of the battery charger shall supply the following information to the user, either in a manual or printed on the battery enclosure:-

a) The type a battery suitable for the battery charger, ie. flooded lead acid, Valve Regulated Lead Acid, Lithium Ion, etc.

b) The batteries rated amp hour.

c) In the event of a battery specific charger, the preferred battery manufacturer(s).

d) The type of charger, namely; Maintenance battery charger and back-up system; Standby battery charger and back-up system; and Remote area battery charger and power supply system.

e) In the event of the charger being a Standby battery charger and back-up system, the manufacturer will declare the minimum time required for the battery to fully recharge.

f) In the event of the energizer and/or monitoring system changing its operational function during battery use, details of such functional changes.

12.3.2 User interface:

On the battery enclosure and/or on a remote control device (such as a key pad) a display will show the following information for the user:-

a) A warning if the battery or batteries are faulty.

b) In the event of the functional changes during battery use, the nature of the functional changes.

12.3.3 General requirements:

All batteries, used within their manufacturers designated charger specifications shall have a minimum life expectancy of 12 months, unless the manufacturer declares a shorter minimum life expectancy. (Such declaration must be made in a manual or printed on the battery enclosure.)

This clause will not apply under the following conditions:-

a) Battery chargers and batteries used for purposes other than that intended by the manufacturers declarations.

b) Battery chargers and batteries damaged by lightning, other surges, natural elements, abuse and used for purposes other than for their designed purpose.

c) Batteries that are not adequately maintained.

12.3.4 Security electric fencing systems

Only standby and remote charging systems shall be used for security energizers

12.4 Communications methods and protocols

Communication terminals and ports made available on an energizer and/or monitoring system for external communications to third party devices, shall provide the following communication methods and protocols.

12.4.1 Communication methods between energisers and security radio transmitters

These outputs shall consist of a terminal connection device suitable for connecting external signal cables.

12.4.1.1 Relay output communication methods shall be as follows:-

a) An output from a relay, of which the output switches shall be normally open and will close when activated by the energizer and/or monitoring system.

b) A pulse output suitable for controlling a relay's electromagnetic coil. The pulse output shall be approximately 12VDC and/or -12 VDC. The output will normally have approximately 0VDC output between the terminals.

c) The duration of the activation of the relay shall be a short pulse of a minimum duration of 5 seconds. (ie. outputs for radio transmitters.)

12.4.1.2 Data communication method:

The output communication method shall be a serial transmission.

Annex A
(normative)

Electric fence insulator requirements

A.1 General properties of fence insulators

Fence insulators shall have the following general properties:

a) Fence insulators attached to a bracket or pole (or both) 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. The insulators shall comply with the energizer manufacturer's recommendations.

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.

A.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 ºC for a minimum period of 30 min. 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 maximum length of the fence insulator shall be measured prior to placing in the oven (unheated length).

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

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

$$\Delta L = \frac{L_{un} - L_h}{L_{un}} \times 100$$

where

ΔL is percent linear change;

L_{un} is the unheated length, in metres; and

L_h is the heated length, in metres.

The deviation shall be not more than 5 %.

A.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 ºC for a minimum period of 30 min.

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

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

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

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

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

$$\Delta L = \frac{L_{un} - L_h}{L_{un}} \times 100$$

where

ΔL is percent linear change;

L_{un} is the unheated length, in metres; and

L_h is the heated length, in metres.

The deviation shall be not more than 5 %.

A.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 ºC, for a minimum period of 8 h 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 ºC, for a minimum period of 12 h.

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

e) The fence insulator shall 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 3 %.

A.5 General requirements for mechanical strength

All fence insulators shall not distort more than 20 % from their original form when a minimum weight of 250 g is suspended from any position on a fence insulator, at a minimum temperature of 45 °C for a minimum period of 1 h.

A.6 Insulator impulse testing

Insulators shall be able to withstand impulses supplied by the electric fence energizer.

To check if an insulator is suitable to be used with an energizer it can be tested by test A6.2

A6.1 Impulse generation specification

The test is made by means of an impulse generator producing positive and negative pulses having a front time of 8µs and a time to half-value of 80µs, the tolerance being
± 5% for the peak value
± 30% for the front time
± 20% for the time to half-value

Small oscillations in the impulse are allowed, provided their amplitude near the peak of the impulse is less than 5% of the peak value. For oscillations during the first half of the front time, amplitudes up to 10% of the peak value are allowed.

The shape of the impulse is adjusted with the insulator circuit disconnected.

The impulse generator to be used for the test shall have an energy content of at least 0.5J at a test voltage of 20000V.

A6.2 Impulse test

Two insulators shall be mounted on the fence bracket they are intended to be used on. The spacing between the insulators shall be 100mm.

A 500mm fence is created with two of these brackets and with the largest size fence wire the insulator is specified for.

The brackets are installed in the position (horizontal/vertical/other) which they are intended to be used in. If the brackets are made out of non conductive material they should be mounted on a metal plate the size being 10mm larger then the width and length of the bracket.

In case of a straining insulator to be tested they should be mounted in the same way as they would be used in practice and a 500mm fence with four insulators and two fence wires should be created with the largest size fence and straining wire the insulator is specified for. The fence wires should be spaced 100mm apart.

Connect the two brackets, metal mounting plates or straining wires to one pole of the impulse generator. Connect the other pole of the impulse generator to the fence wire.

Apply five positive and five negative impulses, each having a peak voltage of 2x the peak value of the energizer output voltage from the energizer to be used with the insulator.
The interval between consecutive impulses should beat least 1 second.
No disruptive discharges shall occur.

A.6.3 Voltage and energy tester.

The tests are to be made by means of an impulse generator producing a positive impulse having a maximum front time of 8 micro seconds and a minimum half peak value of 80 micro seconds.

A.6.3.1 Insulators shall be tested as follows:-

The insulator shall be linked to a voltage and energy tester, so that:-

The first test shall have the tester's first probe placed in the normal position of an electric fence wire (as mounted during installation) and the second probe placed at the shortest distance between the first probe and in the position of nearest conductor simulating an Installed insulator.

The second test shall have the tester's first probe placed in the normal position of an electric fence wire (as mounted during installation) and the second probe at the shortest creepage distance between the first probe and in the position of the nearest conductor simulating an installed insulator.

a) The selected testing voltage and energy level shall be done simultaneously.

b) The minimum testing temperature shall be 25 degrees centigrade with a minimum humidity of 80%.

c) The test will be repeated for ten impulses with no more than a 1,5 second interval betweenimpulses for each test.

d) No disruptive discharge shall take place during the tests.

A6.3.2 Certification:-

The insulator test certificate shall contain the following information:-

a) Date of test.

b) Insulator description and product name.

c) Peak voltage used for test.

d) Temperature and humidity during test.

e) The porosity tests as describe in SANS 10222-3 shall also be included on the test certificate.

f) Description of any addition tests.

g) Manufacturer shall detail Installation methods and instructions.

Annex B
(normative)

Protection of communication lines against interference from electric fences

B.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.

B.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 is to be installed close to the communication line, ensure that the quality of the fence insulators and other components used on the fence is similar to or better than the one stipulated in this document. Some insulators tend to cause an electrical breakthrough between the electric fence live wires and the structure it is connected to. This breakthrough 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, not any closer than what is stipulated in this part of SANS 10222.

Do not attach the electric fence to telecommunication poles and/or equipment.

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.

In installations where the go and return of the wires are next to each other, there will be a cancelling effect on the electromagnetic field which will normally decrease the probability of interference.

Adhere to the earthing requirements as stipulated in this part of SANS 10222. 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 part of SANS 10222.

Annex C
(normative)

Earthing of electric fences

C.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 1,2 m with a minimum diameter of 10 mm.

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 areas with loose rocks, the earth electrodes can be inserted at a maximum angle of 45 °.

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, measures shall be taken to provide an earthing system that will provide the same characteristics as those applicable when an earth spike is inserted.

C.2 Installation near other earthing systems

a) A distance of at least 2 m shall be maintained between the energizer earth electrode and any other earthing system's 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 m.

C.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 earth wire from the energizer connected to the three energizer electrodes (or more as required by the manufacture) shall be of the HT insulated type wire placed in a conduit.

C.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 30 m apart, measured from the energizer or fence connection point.

b) Game, strip grazing and general agricultural electric fence systems shall have earth electrodes inserted at a maximum distance of one 100 m apart, measured from the energizer or fence connection point.

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

C.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) An indirectly connected earthing system to the energizer output is a system where the earthing

c) 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 shall however be in a position to dissipate any surges that may appear on the high-tension transformer in excess of 15 000 V.

C.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 10 m 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.

C.7 Earth resistance between earth electrodes

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

b) The measurement of this can be verified with an earth resistance meter.

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

Annex D
(Informative)

Testing of the electric fence earth system

Earth resistivity varies with soil composition, moisture content of the soil and temperature. Moisture and temperature are more constant deeper down in the earth so it is important that earth spikes are driven into the ground to their full length.

The required number of earth spikes near the energizer, depend on the maximum output energy (output current) of the energizer. The higher the energy rating of the energizer the more earth spikes are required.

The specification specifies a minimum of three earth spikes.

To ensure that there is an adequate earth system, the following procedure and measurement can be performed.

At the furthest point away from the energizer drive an earth spike into the ground and short this spike to the fence live wire. In case of an electric security fence use the earth spike furthest away from the energizer and disconnect it from the earth wire and short it to the live wire.
Disconnect one of the three earth spikes installed near the energizer.
Switch the energizer on and measure with a fence meter the voltage between the point where the live wire is shorted to the earth spike and one of the fence earth wires. The reading should be less than 2000V.
Measure also with the fence meter the voltage between the disconnected earth spike and one of the earth spikes connected to the energizer. The reading should be below 300V.

If the measured voltage is greater, switch off the energizer and drive in additional earth spikes at the recommended spacing and connect them to the existing earth system. Repeat the process until the measured voltage is reduced to an acceptable level.

Annex E
(normative)

Corrosion protection requirements for electric fences

E.1 Test method

The test used shall be in accordance with SANS 7253.

E.2 Minimum requirements 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 6 km from the high water mark.

b) All surfaces shall be tested for a minimum time period of 500 h 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 25 % of the surface area being tested.

E.3 Minimum requirements for all products used in the coastal areas

a) Coastal area will be the area within the linear distance of 6 km from the high water mark.

b) All surfaces shall be tested for a minimum time period of 2 000 h 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 25 % of the surface area being tested.

Annex F
(normative)

Electric fence maintenance

F.1 General maintenance

In order to maintain the fence in a satisfactory condition, the recommendations given in F.1.1 to F.1.4 should be followed by the user:

F.1.1 Do a monthly overview and a detailed inspection on the electric fence every three months.

F.1.2 The monthly overview inspection should comprise 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 that can cause fires).

c) Tighten wires that are visibly slackened.

d) Fix all broken parts of the fence.

F.1.3 The inspection (see E.1.1) 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.

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 that they are in a satisfactory condition. Broken and deformed fence insulators shall 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 that soldered joints are still electrically sound.

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

F.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.

F.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 non-compliant, 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 G
(normative)

Installation requirements between overhead power conductors and electric fences

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

Annex H
(normative)

Lightning protection requirements for electric fences

H.1 General requirements for lightning arrestors

Lightning arrestors shall:

a) comply with the requirements for fence insulators in annex A, regarding deformation/deviation after heating and porosity;

b) comply with the requirements of annex D;

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

have a maximum internal arc over voltage of 20 000V.

H.2 Installation

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

H.3 Installation near energizer

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

b) At the point of connection (between the electric fence and the energizer) or as close to it as possible, 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, i.e. one on the outgoing ‘live’ wire and the other 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.

c) The lightning arrestor connection terminals cannot be installed in such a position as to be subject to any tensioning, but shall be connected to the electric fence by separate connecting wires.

Annex I
(normative)

Certification (Electric Fence System Certificate of Compliance)

I.1 Every user or lessor of an electric fence, as the case may be, shall have an original valid Electric Fence System Certificate of Compliance.

I.2 The Electric Fence System Certificate of Compliance 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 System Certificate of Compliance 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 System Certificate of Compliance was previously issued, the user or lessor of such installation shall obtain a certificate for at least the addition, alteration, replacement or change.

H.6 ~~A registered person shall only issue an Electric Fence System Certificate of Compliance which has a unique number obtainable from the Chief Inspector~~.

I.6 An example of an Electric Fence System Certificate of Compliance is given below.

I.7 A map of the electric fence installation, clearly showing various aspects of the installation shall be attached to the test report.

DEPARTMENT OF LABOUR

DEPARTMENT OF LABOUR

OCCUPATIONAL HEALTH AND SAFETY ACT, 1993

ELECTRIC FENCE SYSTEM CERTIFICATE OF COMPLIANCE

<table>
<tr><td rowspan="3">Electric Fence System Certificate of Compliance in accordance with regulation 12(4) and 13(1) of the Electrical Machinery Regulations, 2011.</td><td colspan="2">Certificate No.</td></tr>
<tr><td colspan="2">Certificate Type
(Tick appropriate block)</td></tr>
<tr><td>Initial Certificate</td><td>Supplementary Certificate</td></tr>
<tr><td colspan="3">Supplement No. ..... to Initial Certificate No. ..... as issued on: .....</td></tr>
<tr><td colspan="3">Identification of the relevant installation
(Address or other unique reference, where applicable)

Physical address:
.....
.....
Name of premises: ..... GPS Coordinates: .....
Suburb/Township: ..... Pole number: .....
District/Town/City: ..... Erf/Lot No.: .....</td></tr>
<tr><td colspan="3"></td></tr>
</table>

Declaration by registered electrical fence installer		
I _____ (ID No._____), a registered electric fence system installer, declare that I have personally carried out the inspection and testing of the electric fence system described above as per the requirements of regulation 13(1), and deem the installation to be reasonably safe when properly used.		
Registered person registration number: ..... Date of registration ..... Signature: ..... Date:		
Contact details of registered person:	Tel No.	
	Fax No.	
	Cell No.	
	Email	
	Address	....
Declaration by user or lessor **I declare that I am aware of my responsibilities in terms of regulation 12 of the Electrical Machinery Regulations and undertake to operate and maintain the electric fence system in a safe manner.** Recipient Name: ..... Signature: ..... Date:		

ADDENDUM A - INSPECTION AND TESTS (new and existing installations)

Tests:

Peak high voltage reading at furthest point from energizer (KV):_____
Model number, manufacturer and series number of test meter/oscilloscope used:
_____

In the case of a monitored system, has the requirements of SANS 10222-3 been fully satisfied: _____

Inspection:

~~a)~~1. Are all components correctly selected:_____

~~b)~~2. Are all bordering public areas protected from the electric fence:_____

~~c)~~3. Components have been correctly installed:_____

~~d)~~4. Are all electric fencing live and electric fencing earth conductors properly bonded, mechanically sound and electrically continuous:_____

~~e)~~5. Are all brackets, off-set brackets or poles (or both) properly installed and mechanically sound:_____

~~f)~~6. The installation complies with its requirements, as specified in this certificate , as contained in SANS 10222-3, referring to the requirements as laid out for FUNDAMENTAL REQUIREMENTS, EARTHING OF ELECTRIC FENCES, LIGHTNING PROTECTION REQUIREMENTS FOR ELECTRIC FENCES, CORROSION PROTECTION REQUIREMENTS FOR ELECTRIC FENCES, PROTECTION OF COMMUNICATION LINES AGAINST INTERFERENCE FROM ELECTRIC FENCES, INSTALLATION REQUIREMENTS BETWEEN OVERHEAD POWER CONDUCTORS AND ELECTRIC FENCES and any other applicable section of SANS 10222-3.

~~g)~~7. The installation complies with the general safety principles of SANS 10222-3: (Additional working papers can be added)
_____

Comments:_____

_____

_____

Comments on parts of electric fence not covered by this certificate:

_____

_____

ADDENDUM B – MULTIPLE RESPONSIBILITY

3.1 MATERIAL SPECIFICATION or PROCUREMENT. I/We, being the person(s) for the material specification or procurement for the electric fence installation, particulars relating to the electric fence are described in the covering Electric Fence Certificate, CERITFY that the equipment and components that I/we have procured is to the best of my/our knowledge and belief in accordance with SANS 10222-3. The extent of liability of the signatory is limited to the installation related to the description in the covering Electric Fence Certificate.

For the MATERIAL SPECIFICATION or PROCUREMENT

Name (in block letters):_____ ___

Position:_____

For and on behalf of:_____

Address:_____ ____

_____

Signature:_____Date:_____

3.2 INSTALLATION. I/We, being the person(s) for the installation of the electric fence, particulars relating to the electric fence are described in the covering Electric Fence Certificate, CERTIFY that that I/we have installed the electric fence components to the best of my/our knowledge and belief in accordance with SANS 10222-3. The extent of liability of the signatory is limited to the installation related to the description in the covering Electric Fence Certificate.

For the INSTALLATION:

Name (in block letters):_____

Position:_____

For and on behalf of:_____

Address:_____

Signature:_____Date:_____