The purpose of electric cable is to convey electrical energy from the point where it is available to a point where it is required. In order to do this safely and reliably, the cable needs certain attributes.

1. The voltage rating of the cable must be equal to, or greater than, the voltage rating of the system into which it is connected.

2. The current carrying capacity of the cable must be equal to, or greater than, the current to be carried, taking into account any applicable current de-rating factors.

3. The short circuit and earth fault rating of the cable must be greater than the prospective short circuit and earth fault currents that the electrical system may impose on the cable.

4. The cable must be compatible with, and able to withstand, the environmental conditions in which it is installed.

5. Special attention must be paid to contributing factors such as cable voltage drop and the nature of the supplied load.

Cables are made for the following voltages. 300/500 V; 600/1 000 V; 1,9/3,3 kV; 3,8/6,6 kV; 6,35/11 kV; 8,7/15 kV; 12,7/22 kV and 19/33 kV; as well as high voltage cables from 44 kV to 275 kV.

**Voltage rating**

The first of the two numbers is the phase-to-earth rating, and the second number is the phase-to-phase voltage rating. Both 300/500 V and 600/1 000 V cables are the voltage ratings typically used in the wiring of domestic and small commercial installations.

Municipalities and industry primarily use 6,35/11 kV cables for the distribution of electricity. The other higher voltage ratings mentioned are less common.

**Current rating**

Electric cable manufacturers publish tables of current ratings applicable to the size and type of cables they manufacture. Different current ratings apply for cables, depending on the size of the conductor, and whether the cable is installed underground, in free air, or in ducts.

These ‘standard’ current ratings must be modified for each unique installation by taking into account the actual conditions of installation, in particular: ambient air temperature; presence of solar radiation; number of cables and their spacing from each other; depth of cable laying; ground thermal resistivity; etc.

Standard conductor sizes are: 1,5 mm²; 2,5 mm²; 4 mm²; 6 mm²; 10 mm²; 16 mm²; 25 mm²; 35 mm²; 50 mm²; 70 mm²; 95 mm²; 120 mm²; 150 mm²; 185 mm²; 240 mm²; 300 mm²; 400 mm²; 500 mm²; 630 mm²; 800 mm²; 1 000 mm²; 1 600 mm²; 2 000 mm²; and 2 500 mm².

**Short circuit rating**

The short circuit rating of any conductor can be calculated by referencing manufacturers’ brochures. Alternatively, the value can be calculated by multiplying the cross-sectional area of the conductor by the appropriate factor, which yields the one second short circuit rating.

1. The factors for MV cross-linked polyethylene (XLPE) cable are:
   - Copper conductor: 143 A/mm².
   - Aluminium conductor: 92 A/mm².

2. The factors for paper insulated lead covered (PILC) MV cables and LV polyvinyl chloride (PVC) insulated cables are:
   - Copper conductor: 115 A/mm².
   - Aluminium conductors: 76 A/mm².

Actual figures for any particular conductor size and fault duration are available from manufacturers’ brochures.

**Earth fault rating**

The earth fault rating of an electrical cable may also be obtained from manufacturers’ brochures or calculated. When calculated, the value is obtained by multiplying the cross-sectional area of the earth path by the appropriate factor. The factors are

24 A/mm² for lead sheath on PILC cables and 143 A/mm² for copper tape screen on MV XLPE cables.

Actual figures are available from manufacturers’ brochures.
The SAFEhouse Guide

Electric Cables

Electric cable components

Conductor
The conductor carries the current, and must be of a sufficiently large cross-sectional area to avoid the conductor overheating. The conductor may be solid circular, stranded circular, solid shaped or stranded shaped, depending on the cable specification to which it was manufactured. Copper and aluminium are metals with good electrical conductivity and this, together with other favourable attributes, makes them ideal for use in electric cables. These are the only materials specified for conductors in South African cable specifications. The conductors are critical components within the cable. Conductors are available with water blocking.

Insulation
The insulation around the conductors must exhibit high resistivity to withstand the applied voltage. It must also be able to withstand relatively high conductor temperatures before becoming soft or melting. In addition, it must be capable of being applied to the conductors using extrusion technology (paper cables are lapped not extruded). Insulation is an important component of electric cable and determines the cable’s lifetime.

Bedding
Certain cable constructions require a layer of bedding under the armour layer. Its purpose is to protect the underlying components during the armouring application by providing a soft layer on which the armour can be applied without damaging the underlying cable components. It is probably the least important component within the cable, but its thickness and material quality are nevertheless stipulated in the cable specifications. Normally PVC with fire retardant properties are used.

Armouring
Armouring may consist of steel wire armour (SWA), aluminium wire armour (AWA), or steel tape armour. Galvanised steel wire has many advantages over steel tape and is most commonly used. The armour minimises damage to and protects the underlying components from external impact. Importantly, SWA provides the cable with better tensile strength, which is important if ground movement is likely to occur.

Outer sheath
The cable outer sheath protects it from ingress of moisture and provides overall mechanical protection: weather, chemical and electrical. PVC is commonly used and is satisfactory for most applications. Where the cable is to be installed underwater or in marshy land, medium density polyethylene (MDPE) is often specified because of its superior radial water blocking advantages and its toughness.

Marking
All national and international electric cable specifications call for certain markings on the cable outer sheath. At the very least, this should include the manufacturer’s name; the specification to which the cable is manufactured; a description that includes the number of cores; and the voltage rating of the cable. Where large orders are negotiated with the manufacturer, it is possible to include conductor size and even metre-by-metre marking along the length of the cable. Sometimes the cable marking may include ‘Property of …’ or a contact number to assist in the event of the cable being stolen. On request, unique conductor markings can be printed on cables that carry a risk of theft.

In many respects, the outer sheath is the most important component of the cable. It keeps water out of the cable, thereby assuring a longer life span and fewer problems during operation.
The SAFEhouse Guide

Electric Cables

Different types of low voltage electric cable

- Low friction single-core general cable/housewire.
- PVC single-core flexible panel wiring cable.
- HRQ high temperature insulated wire (105 °C) cable.
- Cabtyre flexible cable.
- Audio flexible cable (ripcord).
- Illumination flexible wiring cable (Maconite).
- PVC single-core general purpose housewire.
- Flat twin and earth.
- Surfix.
- Submersible pump cable green (four-core)
- Submersible pump cable blue (three-core)
- Nitrile trailing cable.
- PVC nitrile welding cable.
- EPM/CM or EPM/CR welding cable.
- Low voltage three- and four-core SWA cable.

Who polices the electric cable industry in South Africa?

The Association of Electric Cable Manufacturers of South Africa (AECMSA) represents the interests of consumers and manufacturers.

The South African Bureau of Standards (SABS) and sets the National Standards and also operates a voluntary product certification scheme for these products, which ensures continued compliance of SABS certified products. The National Regulator for Compulsory Specifications (NRCS) sets local compulsory specifications for some cable types and carries out market surveillance inspections to monitor compliance.

The policing of standards was not being carried out effectively and this led to the formation of SAFEhouse to ensure that products supplied in South Africa comply with applicable standards.
SANS 1507: Low voltage PVC and XLPE insulated cables (includes armoured cables).
SANS 1574: Flexible cores, cords and cables, including panel wire, cabtyre and ripcord.
SANS 1418: LV aerial bundled conductors.
SANS 1520: Rubber insulated cables. Parts 1 and 2 cover LV and MV respectively.
SANS 97: Paper-insulated metal sheathed cables up to 33 kV.
SANS 1339: XLPE insulated cables up to 33 kV.
SANS 182: Overhead line conductors.
There are many other specifications, however the above are most commonly used.
SANS 1576: Welding cable (voltage rating 100 V) is not compulsory.

Other locally manufactured electric cable products

This brochure covers only some of the low voltage electric cable products. Reputable local manufacturers make a full range of low voltage, medium voltage and high voltage cables and accessories, which include:

- 1.9/3.3 kV three-phase four-wire low cost cable.
- House service connection cable.
- Silicone rubber insulated cabtyre and other cables.
- Ranges of fire performance cables.
- Aerial bundled conductors (ABC) rated from 600/1000 V up to 19/33 kV.
- Rubber insulated flexible trailing cables from 300/500 V up to 19/33 kV.
- Overhead lines, including ACSR, AAC, AAAC.
- Medium voltage paper insulated and lead covered cables (PILC).
- Medium voltage cross-linked polyethylene (XLPE) insulated cables.
- High voltage XLPE cables (44 kV to 275 kV up to 2 500 m²).
- Renewable energy (Solarflex) cables.
- Locomotive and rolling stock rail cables.
- Anti-theft cable solutions.

What to look for when buying cable

- Does the cable carry the SABS mark? Is a SANS standard indicated on the cable?
- Is the manufacturer’s name on the cable? Do you recognise the manufacturer’s name?
- Is the SAFEhouse logo on the packaging?
- Does a visual inspection of the cable reveal defects such as inconsistent radials, rough surfaces, bulges on the sheath, and other irregularities that are a cause for concern?
- Does the cable contain copper coated steel in the conductor? As copper is not magnetic, a simple test using a magnet can reveal the presence of steel.
- Does the cable feel too light for its diameter or does the price of the cable seem ‘too good to be true’? This is more common in cabtyre (extension leads) when copper clad aluminium has been used.

Examples of substandard cables being sold in South Africa

Copper coated aluminium and steel passed off as pure copper: Typically cable size corresponds approximately to the measured physical cross-sectional area, but the resistance would be much higher. The cross-sectional area is only nominal and the important property associated with a particular size is its electrical resistance, on which its current rating is based. For example, it is not necessary for a 2.5 mm² cable to have a physical cross-sectional area of 2.5 mm², but it is essential that its electrical resistance does not exceed 13.3 Ω/km at 20 °C.

Alloys, such as brass, used instead of pure copper: This is important for the same reasons as above. Also the cables can end up being much stiffer, making some domestic jointing practices in common use in South Africa quite dangerous.

Incorrect size: This has not yet been seen in South Africa but we should be aware of it. In countries where there is little control, it has been found that cables are marked one size bigger than they actually are. The sting in the tail is that any supplier who chooses to actually supply the correct sized cable is priced out of the market, so the situation persists.

Undersized insulation radials: With low voltage cables, including flexible cables, the dielectric properties of the insulation are not as important as the physical separation they create between live conductors and their surroundings. This is because the electrical stress that the insulation is subjected to is usually much lower than the material is capable of withstanding. However, a thinner
radial is more likely to be damaged during normal domestic use, exposing users to the possibility of electrocution or fire.

**Cheap insulation compounds:** Most small cables for domestic use are insulated with PVC-based compounds. PVC readily accepts fillers and additives required for properties such as flexibility, insulation resistance, UV-resistance, and colour. However, unscrupulous manufacturers cheapen products by increasing filler loadings, resulting in a loss of physical and electrical properties. Be aware of insulation that strips too easily or that becomes brittle when exposed to sunlight.

**Cable sheaths:** The sheaths of cables for domestic use are usually made from PVC compounds and physically protect the cable cores; however, as sheaths are made to slightly different standards, they can also be cheapened detrimentally.
The South African SAFEhouse Association is an independent, registered, non-profit organisation established by the electrical industry and committed to communicating with customers.

SAFEhouse has been established to combat the proliferation of dangerous products and services by making the market aware of the risks in using such products and services, exposing sub-standard products and services, and persuading specifiers, suppliers and distribution channels not to recommend or to offer such products and services for sale.

SAFEhouse members have signed a code of conduct that commits them to dealing only in safe electrical products and to responsible behaviour.

If you have doubts about a particular product or service, contact SAFEhouse for guidance.

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A good way to determine the requirements for a safe and effective electrical installation, is to look at the Certificate of Compliance. The CoC was introduced in South Africa in 1993, coinciding with the national registration of electrical contractors, which replaced annual registration at individual municipalities. In the same timeframe, municipal electrical bylaws were replaced with SANS 10142, the national code of practice for the wiring of premises (the ‘wiring code’).

The current legal framework, an act of Parliament that encompasses the CoC, is as follows:

- **Act No. 85 of 1993: Occupational Health and Safety Act (as amended)** Including regulations incorporated under section 44:
- **Regulation No. R. 242 – 6 March 2009: Electrical Installation Regulations** Which enacts several registrations and, under Annexure 1, the Certificate of Compliance (CoC)
- **Regulation No. R. 242** also incorporates the following safety standard:
  - **SANS 10142-1: The wiring of premises Part 1: Low voltage installations**
  - **The test report for all electrical installations**

The general purpose of the electrical regulatory framework is the allocation of responsibility under section 2 of R. 242:

‘... the user or lessor of an electrical installation, as the case may be, shall be responsible for the safety, safe use and maintenance of the electrical installation he or she uses or leases.’

To this end, the CoC and its test report are almost like a ‘birth certificate’, detailing the creation of a particular electrical installation on a particular and unique physical premises, and demonstrating compliance with certain safety features required in terms of the wiring code, SANS 10142. Several entities are allowed to issue blank CoC forms to contractors and registered persons; these are: The Department of Labour (DOL), the Electrical Contractors’ Association (ECA), the Electrical Conformance Board (ECB) and several electrical wholesalers.

The owner of the premises is responsible for the safe storage of the CoC. The completed and signed CoC is not required to be recorded on any system, other than storage by entities that do so on a voluntary basis.

It is important to note that SANS 10142 is a standard that is amended periodically and the CoC will follow suit. What follows here is illustrative and valid as at 1 March 2017. The reader is advised to examine an actual, current CoC document.

### Highlights and explanations

Page 1 of the document is the CoC. Pages 2 to 4 comprise the test report that permits the issuing of the CoC. The CoC, properly completed, is vital as an assurance of regulatory compliance and of protection of occupiers of premises against electrocution and damage to assets. A valid CoC is required to transfer ownership of buildings.
Page 2 of 4 – Test Report (as per SANS 10142-1: Sect 8.8):

SECTION 1 – LOCATION (Only required if not provided on CoC)

Physical address of premises. Not essential but always better to state it again.

SECTION 2 – DETAILS OF THE INSTALLATION

Type of electricity supply. This depends on how the earth conductor is provided. In general, a ‘TN-S’ system is favoured in South Africa, where the Neutral is earthed at the supply transformer and a separate earth conductor is provided at the consumer’s premises. Alternatively, in the case of a ‘TN-C-S’ system, the Neutral conductor is earthed at the consumer’s premises and the protective earth terminal is provided from this earthed connection.

The Prospective Short-circuit Current (PSC), which can be determined by measurement or calculation, has to be lower than the Short Circuit capacity of the main incoming circuit breaker (kA).

Where five or more units of premises are being reticulated, a competent person (such as a Pr.Eng.) has to be appointed to design and supervise the installation.
The details of the installation are entered on this page, together with the number of outlets and connection points.

It is recommended that, where possible, the model numbers of each fixed appliance (geyser, stove, air conditioner, etc.) be entered in order to subsequently determine the specifications of the original installation.

Check that all elements are filled in correctly.

Note that the CoC does not cover fixed appliances and light fittings; it applies only to the point of consumption, e.g. a socket outlet.

All these characteristics are to be checked in accordance with the requirements of the wiring code SANS 10142-1. Components installed are to be in accordance with the specifications listed in Table 4.1 of this standard.

Labelling of circuits should be checked so that the user has a clear view of what circuit is protected by which circuit breaker or disconnector at the distribution board.

In this section is the requirement that all products used in the installation comply with regulations; including, but not limited to, Compulsory Specifications. Refer to the SAFEhouse guide to the Regulation of Electrical Products. NB: See comment under 5.3 of section 5.

The importance of these tests cannot be over-stressed:

**Items 1, 2, 3 and 4:** deal with the integrity of earthing, which is vital if the earth leakage protection is to function correctly (together with 12 and 13). The earth leakage protection is aimed primarily at preventing electrocution at socket outlets, the tripping current of 30 mA (max) can only be achieved if the protective earth conductor has the lowest possible resistance. In terms of SANS 10142-1, Table 8.1, the maximum earth continuity resistance should not be more than 0.55 $\Omega$ for a 63 A (Ampere) supply and not more than 0.24 $\Omega$ for a 20 A socket outlet circuit.

**Item 6:** It is important that the Neutral conductor voltage be close to that of earth potential; According to SANS 10142-1, clause 8.7.6 a maximum of 25 V is allowed.

**Item 8:** Deals with the insulation integrity of the wiring and points of consumption.

**Item 14:** Deals with the correct polarity i.e. Neutral and Live connections to socket outlets.
This section (above) details sections or parts of the installation that have not been covered; items such as alarm systems, standalone power supplies of extra low voltage, solar installations, etc.

**SECTION 5 – RESPONSIBILITY**

The description at the top of the section is self-explanatory. Basically, for new installations with less than five units (premises) connected to the same supply, only section 5.4 need be completed. The registered person is responsible for the work being carried out to the relevant legislation and accepts liability for the work as described under section 3 of the CoC.

In the case of large premises, such as office complexes, the sections on design and procurement are to be filled in and signed by the professional persons who have executed the design and procured the relevant electrical components, thus taking responsibility for the correct application of all requirements of the legislation.

**Section 5.3** certifies that the construction of the electrical installation has been carried out in accordance with all the legislated requirements, including products used and installation practice.

It is important to note that certain components such as light dimmers, home automation and other electronic communication devices are covered by legislation in terms of Electromagnetic Emissions (EMC) and Electromagnetic Interference (EMI) certification, which is issued by the Independent Communications Authority of SA (ICASA). Compliance with these characteristics is vital for the safe functioning of other sensitive equipment.

**Section 5.4** is signed by the registered person under whose supervision the electrical testing was carried out, stating his/her qualification and registration certificate number.

**Section 5.5** is signed by the responsible person for installations where five or more units (premises) are connected to the same supply.

In both cases, the signatory certifies that the work was carried out in accordance with SANS 10142-1

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**Comment on the efficacy of the CoC control system**

For this system to work, registration of blank CoCs, bona fide contractors and other responsible persons must take place and be maintained on a national database and controlled by the Department of Labour. For a number of reasons, the system may not always be effective.

Reference to the Electrical Contractors’ Association (ECA) is recommended. The ECA is nationally represented and has a list of registered contractors and responsible persons. It also provides some protection to customers of their members.

On a voluntary basis, registrations that have been lodged with the DOL may have been submitted to the Electrical Conformance Board (ECB) which records these on its data base so an additional resource can be available to users and administrators for the tracking of registrations and CoCs.

A safe electrical installation is vital. What precautions can users take?

- Use contractors that have registered with the DOL and are in good standing with the ECA.
- Consult a qualified electrical engineer for comfort or if the installation’s complexity or size demands it.
- Get references of other work done by contractors you employ. Take the time to consult the references.
- Beware of contract and product prices that are substantially lower than what seem to be the going rates.
- Understand the essence of the CoC. Discuss it with your contractor. Ask questions to justify confidence in the quality of your installation.
- Ensure that a supplementary CoC covers any alteration or addition to an electrical installation.
- Get satisfactory assurance that only electrical products approved for sale by the National Regulator for Compulsory Specifications (NRCS) are used by your contractor.
- Satisfy yourself that a proper inspection and testing of the installation has taken place. Do not rely solely on a signature on the CoC.
- Be wary of a CoC that has been issued too easily.
- Do not be party to a fraudulent CoC in order to save money; that would be grossly irresponsible, illegal and dangerous.
- Do not tamper with your electrical installation. Always use a qualified, registered contractor.
- If in doubt, contact the SAFEhouse Association. It may be able to help you.
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Make a **commitment to safety.**

The SAFEhouse Guide

**LED Lighting**

**Introduction**

With the rapid change from traditional lamp types to more efficient LED (light emitting diode) lighting and the large variety of lighting products available, the selection of suitable LED light sources (lamps) and LED luminaires (light fittings) for lighting interior and exterior areas, offers the consumer many choices.

Product branding, where importers have the ability to mark products with the brand names of their choice, complicates the issue as it is difficult to evaluate such brands based on past experience with products from the same manufacturer. Although products from leading lighting companies are readily available and are supported by extensive research and product development programmes, the market offers a multitude of LED product brands. The suppliers of many of these products make optimistic claims of light output and product life expectancy.

While product safety is very important, the reliable performance of the LED light source and luminaire are essential for a good lighting installation; one that will allow occupants to move around safely and perform tasks efficiently. The safety requirements for LED lamps and luminaires are fairly clearly defined in standards and specifications and can be determined through suitable testing and inspection. The luminaire and light source performance and lifetime reliability are more difficult to determine and require extensive and costly testing.

**Product design basics**

Owing to the high energy efficiency, extended life expectancy, and colour variation available in LED light sources, designs of all shapes and sizes with standard lamp-cap configurations have become available to replace existing 'traditional' lamps. In South Africa, this changeover has gained impetus due to the energy crisis.

LED modules are extensively used in the manufacture of luminaires and are available in various configurations. The design of the luminaires should be such that temperature limitations, as specified by the LED module manufacturer, are maintained and insulation between the primary mains voltage circuit and the low voltage circuits are ensured, to prevent accessible luminaire parts from becoming live.

The replacement of other lamps with LED lamps in existing luminaires therefore requires omni-directional LEDs, which are readily available with most of the standard lamp-cap configurations. This has been achieved by mounting the LED chips in the required directions and, in some instances by covering the entire lamp with diffusers or lenses to disperse the light. It is therefore possible to retain a luminaire’s photometric distribution characteristics and light output, through the careful selection of LED lamps with omni-directional light distribution and equivalent light output (lumen) provided the LED lamp has a similar shape and similar dimensions as the original lamp for which the luminaire was designed.

Because of the construction of LEDs, the LED chip emits directional light in a fairly narrow beam, where light from most traditional sources is omni-directional (emitting light in all directions in space) and most luminaires are designed for these light sources.
LED Lighting

Life expectancy

LEDs emit visible light when electricity is passed through a semiconductor. In this process, heat is generated that needs to be dissipated effectively to prevent overheating of the LED, which could result in reduced light output and lamp life.

Some manufacturers make optimistic claims about their LED lamps’ life expectancy (25 000 to 50 000 hours are common claims). Because actual life testing is extremely costly and impractical, these claims are projections based on the life of the LED chip, when operating under temperature conditions as specified by the LED chip manufacturer. The design of the LED lamps or LED luminaires should therefore ensure that these conditions are not exceeded. Users should also understand that their operating environment may affect the life expectancy of the product.

LED lamp dimming

Incompatibility between dimmers and LED lamps is often experienced by users. Where the following marking is displayed on LED lamp packaging, the dimming of such lamps is not allowed. Suppliers should be approached for technical advice on dimming.

- **Light output, lumen:** the total amount of light emitted from a light source or luminaire, (lm).
- **Lumen maintenance, %:** the rate of deterioration of light output of a lamp over time.
- **Lamp efficacy, lumen/Watt:** The amount of light emitted from a bare lamp (lm) divided by the input electrical power (W).
- **Lamp life, hours:** The rated lamp life of lamps is generally based on the average life of a sample of lamps burning under controlled conditions. It gives the number of burning hours at which the sample of lamps maintains its claimed light output.

Colour characteristics

The colour characteristics of light emitted from light sources are described in various ways.

- **Correlated Colour Temperature (CCT)** is a measure of the emitted light’s colour. This classification is commonly seen on LED lamp packaging and gives the user a choice of some lamp colours to suit different applications.

There are currently a large number of LED products on the South African market that do not comply with this standard and that, when installed, become a distributed source of high emissions.

**Basic lighting concepts**

To make the correct choice, it is essential that some basic concepts of lamps and lighting are understood. Specifically in the case of LED lamps, aspects such as light output, colour and colour rendering, lamp efficacy and life expectancy should be considered to justify the higher expense of LED lighting when compared with traditional lamps.

**EMI (electromagnetic interference)**

LED lamps emit electromagnetic energy and there are very clear local and international specifications as to the maximum levels of these conducted and radiated emissions. Exposure to high frequency electromagnetic fields, even as low as 100 kHz, may have health consequences. High EMI can also interfere with electronic devices such as audio visual equipment, communication systems and pacemakers, amongst others. For these reasons, all lighting-related products must comply with international compulsory standards – part of the European EMC directive – or the South African SANS 215 standard of which ICASA is the regulatory authority.

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The SAFEhouse Guide
LED Lighting

than 75. Where the recognition of colour is important the LED lamps with the highest Ra value should be selected.

The colour rendering index depends on the spectral emission of light from the source over the visible range. A typical spectral emission curve for a white LED is given below. From the curve it is clear that the blue component is dominant and that there is lower emission in the green/yellow/red areas. This would lead to lower colour rendering of these colours.

Colour characteristics continued ...

The colour rendering index depends on the spectral emission of light from the source over the visible range. A typical spectral emission curve for a white LED is given below. From the curve it is clear that the blue component is dominant and that there is lower emission in the green/yellow/red areas. This would lead to lower colour rendering of these colours.

While there are many LEDs with different emission curves available, LEDs with good colour rendering index values should be selected where colour matching is important.

Luminaire and lamp suppliers/manufacturers should be contacted for technical advice.

LEDs can fail due to overheating if they are made from poor quality materials and if the heat from the LEDs is not dissipated efficiently. LED lamps with a greater light output are particularly prone to this problem.

Compulsory standards/specifications for LED luminaires

VC8055:
Electrical and electronic apparatus.

A new compulsory specification, VC9012- Electric luminaires, will shortly be implemented to distinguish LED luminaires from the present version of VC8055.

The following safety standards are compulsory by reference in VC8055 and VC9012 to the following safety standards:

SANS 60598-1:
Luminaires Part 1: General requirements and tests.

SANS 60598-2-1:
Fixed general purpose luminaires.

SANS 60598-2-2:
Recessed luminaires.

SANS 60598-2-4:
Portable general purpose luminaires.

SANS 60598-2-7:
Portable luminaires for garden use.

SANS 60598-2-8:
Hand lamps.

SANS 60598-2-9:
Photo and film luminaires (non-professional).

SANS 60598-2-10:
Portable luminaires for children.

SANS 60598-2-11:
Aquarium luminaires.

SANS 60598-2-12:
Mains socket-outlet mounted nightlights.

SANS 60598-2-13:
Ground recessed luminaires.

SANS 60598-2-18:
Luminaires for swimming pools and similar applications.

SANS 60598-2-19:
Air-handling luminaires.

SANS 60598-2-20:
Lighting chains.

SANS 60598-2-23:
Extra low voltage lighting systems for filament lamps.

SANS 60598-2-24:
Luminaires with limited surface temperatures.

SANS 60598-2-25:
Luminaires for use in clinical areas of hospitals and health care buildings.

SANS 1464:
Luminaires for emergency lighting.

SANS 60570:
Electrical supply track systems for luminaires. Various other standards for luminaires, lamps and lighting components are available. Information can be obtained from suppliers, the NRCS or the SABS.

Standards for LED lamps and control gear

- These are voluntary standards as LED lamps are not regulated by the National Regulator for Compulsory Standards in terms of compulsory specification. Further information can be obtained from the SABS.
Class 0 – Luminaires in which protection against electric shock relies upon basic insulation only, are not permitted in South Africa.

**Provision for earthing:** Class I luminaires shall be provided with an earth terminal to which all accessible metal parts, which may become live in the event of an insulation failure, are permanently and reliably electrically connected. The earth connection shall be locked against accidental loosening.

**Protection against electric shock:** Luminaires shall be so constructed that their live parts are not accessible when the luminaire has been installed and wired as in normal use, and when it is opened as necessary for replacing lamps.

**LED lamp safety**

For LED lamps with externally accessible metal parts, these parts must be effectively insulated with reinforced or double insulation to ensure protection against accidental contact with live parts.

(SANS 62560: Some LED lamps have been found not to comply with this requirement, resulting in a safety risk.)

Compliance with this requirement can only be determined through testing.

**SANS 60598-2-5 Floodlights:**

The basic requirement is that no single failure can result in dangerous voltage becoming exposed so that it might cause an electric shock and that this is achieved without relying on an earthed metal casing. This is usually achieved at least in part by having two layers of insulating material surrounding live parts or by using reinforced insulation such as insulating sleeves, grommets and bushings.
The IES South Africa (IESA) represents the interests of the South African lighting industry.

The South African Bureau of Standards (SABS) sets the national standards.

The National Regulator for Compulsory Specifications (NRCS) is mandated to set compulsory specifications and carry out surveillance and compliance monitoring against these specifications.

Visible workmanship is usually an indication of product quality and reliability.

For lamps with accessible metal parts, such as cooling fins and heat sinks, establish whether the product complies with the relevant safety standard.

If a product is materially cheaper than other, similar products on offer, be wary.

Be suspicious of excessive life expectancy claims compared with products from reputable brands.

Consult a qualified, registered electrician or electrical engineer for extensive installations, especially renovations and retro-fits.

Do not buy products with poor earthing of accessible metal parts or inadequate protection of wiring of double insulated luminaires.

Third party product certification, such as an SABS mark, provides some comfort in the event of premature product failure. (‘CE’ marking is not a third party certification).

Choose products from reputable, established suppliers and look for brand names from known manufacturers who have proven design and manufacturing capabilities.

If in doubt, contact the SAFEhouse Association for assistance.

The non-compliant LED luminaire’s driver (above) is marked with the double insulated marking, but the supply leads only have basic insulation and are not marked.
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SAFEhouse has been established to combat the proliferation of dangerous products and services by making the market aware of the risks in using such products and services, exposing sub-standard products and services, and persuading specifiers, suppliers and distribution channels not to recommend or to offer such products and services for sale.

SAFEhouse members have signed a code of conduct that commits them to dealing only in safe electrical products and to responsible behaviour.

If you have doubts about a particular product or service, contact SAFEhouse for guidance.

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For a list of reputable local manufacturers or for technical information on these products, please contact:

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Users have an endless choice of suitable luminaires (light fittings) for lighting interior and exterior areas. While product safety is important, so is the creation of a safe and attractive lighting installation that allows occupants to move around safely and perform their tasks efficiently.

Since the safety of products and their reliability are fairly clearly defined in standards and specifications, these can be determined through suitable testing and inspection. Although a luminaire’s photometric performance, its utilisation of light, its energy efficiency and lamp efficacy are often more difficult to determine, these are also important aspects to consider.

Choice of decorative luminaires is frequently based on the aesthetic appearance of the luminaire without any consideration of the light distribution and effectiveness of the light emitted from the luminaire. Light distribution and luminaire appearance should fit the environment and the application and these are based on personal preference, however, the advice of professional lighting designers is often required.

The user needs to understand some basic concepts to assist in making a thoroughly considered choice. This is of great importance, especially in luminaire retro-fit projects where the end result can prove to be a disastrous and costly exercise for the user or owner.

Basic lighting concepts

**Light output, lumen (lm):** The total amount of light emitted from a luminaire or light source.

**Illumination, lux (lx):** The amount of light incident on a surface per unit surface area.

**Lamp efficacy, lumen/Watt (W):** The amount of light emitted from a bare lamp (lm) divided by the input electrical power (W).

**Luminaire efficiency, percent or lm/input W:** This is the light emitted from the luminaire divided by the light emitted from the bare lamp(s) used in the luminaire. For luminaires with non-replaceable light sources, for example, LED modules, the efficiency of the luminaire is expressed in lm/input W.

When comparing luminaires, their efficiency values could be misleading as these depend on the light distribution of each luminaire. Efficiency values should only be used to compare luminaires with similar light intensity distributions.

**Note:** Where efficiency values for luminaires of 100% are claimed, the concept of replaceable light source was used for the calculation, which gives the incorrect value. In this instance the lm/input W value should be used for comparison purposes.

**Light utilisation, percent:** This is the percentage of light emitted from the luminaire that illuminates a specified area. Light utilisation of luminaires needs to be calculated for each application by the lighting installation designer to ensure optimum selection of luminaires. (Photometric data for luminaires can be obtained from the manufacturer.)

**Lamp life, hours:** The rated lamp life of lamps is generally based on the average life of a sample of lamps burning under controlled conditions. It gives the number of burning hours at which 50% of the lamps in the sample have burnt out.

**Glare:** A condition of vision that is caused by luminance (brightness) that sufficiently exceeds the luminance to which the eyes are adapted and that causes annoyance or discomfort or reduction in visual performance and vision.

**Note:** Lighting installations that appear to be ‘bright and sparkling’ could be an indication of excessive glare and may be detrimental to the performance and comfort of occupants.

Luminaire categories

Some of the main luminaire categories are:

- **Domestic/decorative luminaires:** For general and task lighting in homes, hotels, etc, where the aesthetic appearance of the lamp should blend with the interior décor to create an appealing environment.
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- **Commercial luminaires:** For lighting in shops, offices, factories and other work places where the light distribution needs to enable occupants to perform their tasks effectively.

- **Industrial luminaires:** For lighting in industrial plants, manufacturing areas and mines where adverse conditions may occur.

- **Outdoor luminaires:** Street lights, flood lights, garden lights, security lights, etc.

(A new compulsory specification, VC9012 - Electric luminaires, will shortly be implemented to separate luminaires from the present version of VC8055.)

The following safety standards are compulsory by reference in VC8055 and VC9012 to the following safety standards:

- **SANS 60598-1:** Luminaires Part 1: General requirements and tests.
- **SANS 60598-2-1:** Fixed general purpose luminaires.
- **SANS 60598-2-2:** Recessed luminaires.
- **SANS 60598-2-4:** Portable general purpose luminaires.
- **SANS 60598-2-5:** Floodlights.
- **SANS 60598-2-6:** Luminaires with built-in transformers for tungsten filament lamps.
- **SANS 60598-2-7:** Portable luminaires for garden use.
- **SANS 60598-2-8:** Hand lamps.
- **SANS 60598-2-9:** Photo and film luminaires. (non-professional)
- **SANS 60598-2-10:** Portable luminaires for children.
- **SANS 60598-2-11:** Aquarium luminaires.
- **SANS 60598-2-12:** Mains socket-outlet mounted nightlights.
- **SANS 60598-2-13:** Ground recessed luminaires.
- **SANS 60598-2-18:** Luminaires for swimmingpools and similar applications.
- **SANS 60598-2-19:** Air-handling luminaires.
- **SANS 60598-2-20:** Lighting chains.
- **SANS 60598-2-23:** Extra low voltage lighting systems for filament lamps.
- **SANS 60598-2-24:** Luminaires with limited surface temperatures.
- **SANS 60598-2-25:** Luminaires for use in clinical areas of hospitals and health care buildings.

**SANS 1464:** Luminaires for emergency lighting.

**SANS 60570:** Electrical supply track systems for luminaires.

Various other standards for lighting, luminaires, lamps and lighting components are available. Information can be obtained from suppliers.

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**Luminaire performance**

The lighting performance of luminaires is of utmost importance for energy efficient operation and the creation of optimum lighting conditions in their specific applications. The effective utilisation of luminaires can only be determined through appropriate lighting installation design for the luminaires on offer. Suppliers and lighting specialists should be consulted for such designs.

**Retro-fit of existing installations**

In recent times, energy-saving has been the main driver to retro-fit existing installations with lamps of higher efficacy. For luminaires with reflector systems and/or diffusers or lenses, any lamp-type change will significantly affect the resulting light distribution and may not meet light levels, uniformity and glare requirements. For more information, see the requirements of SANS 10114-1 Interior Lighting – Part 1: Artificial lighting of interiors.

It is strongly recommended that retro-fit proposals are tested for performance and safety requirements and that luminaires and components are purchased from reputable suppliers. Modifications to existing luminaires render all previous approvals invalid and retro-fit luminaires should comply with the relevant compulsory specification. This has become the responsibility of the electrical contractor doing the modification.

**Compulsory specifications for luminaires and lighting products**

- **VC8055:** Electrical and Electronic apparatus.
Luminaire safety requirements are set to prevent harm to persons or damage to property mainly through fire, electric shock or burning. Users should be aware of important safety aspects in selecting luminaires, some of which are listed below:

**Marking**

Luminaires shall be marked with at least the following:
- Manufacturer’s name, mark of origin.
- Lamp type and maximum wattage.
- Rated supply voltage.
- Any precautions for installation and maintenance.

**Insulation classification**

Luminaires shall be one of the following classes:
- **Class I**: Protection relies on basic insulation only and must be provided with a protective earth conductor (line, neutral and earth).
- **Class II**: Protection relies on basic insulation with additional double insulation or reinforced insulation. No provision for protective earthing (line and neutral). Luminaires shall be clearly marked with the symbol:

  ![Class II symbol]

  The basic requirement is that no single failure can result in dangerous voltage becoming exposed so that it might cause an electric shock and that this is achieved without relying on an earthed metal casing. This is usually accomplished, at least in part, by having two layers of insulating material surrounding live parts or by using reinforced insulation such as insulating sleeves, grommets and bushings.
- **Class III**: Luminaires in which protection against electric shock relies on supply at safety extra-low voltage (SELV) and in which voltages higher than those of SELV (<50V) are not generated. Such luminaires shall be clearly marked with the symbol:

  ![Class III symbol]

  • **Class O**: Luminaires in which protection against electric shock relies upon basic insulation only are not permitted in South Africa.

**Construction**

- **Mechanical strength**: Luminaires shall be so constructed that they adequately protect lamps and internal wiring from impacts and handling during normal use for their application.
- **Flammable materials**: Covers, shades and similar parts not having an insulation function shall be adequately spaced from any heated part in the luminaire that could raise the material to its ignition temperature.
- **Adjustment devices**: Joints, hoisting devices and adjusting brackets shall be so constructed that cords or cables are not pressed, clamped or excessively twisted during operation to cause damage.
- **Terminals and supply connections**: In portable luminaires of Class I and II and in fixed luminaires of Class I and II that are frequently adjusted, adequate precautions shall be taken to prevent metal parts from becoming live due to a detached wire or screw. This requirement applies to all terminals (including supply terminals).
- **Insulating linings and sleeves**: These shall be so designed that they are reliably retained in position when switches, lampholders, terminals, wires or similar parts have been mounted.

**Examples of poor quality**:

- No insulating plate under the terminal block.
- No insulating plate under the terminal block. Wire insulation stripped back too far.

**Components of luminaires**

- Replaceable components, such as lamp holders, control gear, capacitors, wiring and terminals, etc, shall comply with the requirements of the relevant IEC standards, if any.
- Ratings should be checked to establish that they suit the conditions that may occur in use.

**Internal and external wiring**

- Conductor size shall be compatible with the electrical current experienced in normal use.
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- Wiring shall be routed in such a way that damage to insulation because of high temperatures or chafing against sharp edges, and screws or rivets is prevented. Where wiring passes through joints, raising and lowering devices, telescopic tubes and similar parts, additional protection may be required.
- Adequate anchorages shall be provided for flexible supply cables or cords.

Examples of poor quality:

No grommet on the inside of the nipple.

No grommet on the base of the fitting.

No gland used to secure cable to fitting.

Wires not connected correctly; will short on base.

Provision for earthing

- Class I luminaires shall be provided with an earth terminal to which all accessible metal parts, which may become live in the event of an insulation failure, are permanently and reliably electrically connected.
- The earth connection shall be locked against accidental loosening.
- Earthing terminals shall be of brass or a non-corrosive suitable metal.
- Contact surfaces shall be bare metal.

Protection against electric shock

- Luminaires shall be so constructed that their live parts are not accessible when the luminaires have been installed and wired as in normal use, and when they are opened as necessary for replacing lamps or (replaceable) starters even if the operation cannot be achieved by hand.

Thermal control

- Basic insulated parts shall not be used on the outer surface of the luminaire without appropriate protection against accidental contact.

- Under conditions representing normal service, no part of a luminaire (including the lamp), the supply wiring within the luminaire, or the mounting surface shall attain a temperature that would impair safety.
- Parts intended to be touched, handled, adjusted or gripped by hand while the luminaire is at operating temperature, shall not be too hot for the purpose.
- Luminaires shall not cause excessive heating of lighted objects.

Who polices the lighting industry in South Africa?

- The Illumination Engineering Society of South Africa (IESSA) represents the interests of the South African lighting industry.
- The South African Bureau of Standards (SABS) sets the national standards.
- The National Regulator for Compulsory Specifications (NRCS) is mandated to set compulsory specifications and carry out surveillance and compliance monitoring against these specifications.

Locally manufactured luminaires

This guide covers luminaires in general. Most decorative luminaires are imported but a wide range of decorative, commercial, industrial and luminaires for outdoor lighting are manufactured in South Africa. Reputable local manufacturers make a full range of luminaires and many manufacturers specialise in photometric design to provide optimal light distribution options for various applications.

Examples of substandard luminaires being sold in South Africa

- For commercial, industrial, floodlights and road lighting luminaires, reliable photometric data should be available. If data cannot be provided, one can almost assume substandard performance. This particularly applies to retro-fitted luminaires.
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LED Lighting: A brief overview
A relatively new technology, LED lighting is fertile ground for unscrupulous and opportunistic suppliers to capitalise on the absence of a compulsory local standard for LED lamps and to make performance claims – mostly around lifespan and power-consumption – that will not be met.

Some facts:
LED Luminaires are subject to the same standards as described in this guide.
Compulsory specifications for the safety and performance of general service LED lamps are under preparation and will shortly be published by the NRCS as VC9018 and VC9110. The safety requirements will be based on SANS/IEC 62560 – Self-ballasted LED lamps for general lighting services by voltage >50V-Safety specification.

Some consequences:
The absence of compulsory standards can result in incompatible dimensions between fittings and lamps from different suppliers – a performance and safety risk to users.
The technology of an LED lamp and its heat-generation encourage shortcuts that compromise insulation in favour of heat dissipation – a safety risk to users.
Plastic parts are a manufacturer’s cost-saving opportunity. Inferior material will affect heat- and flame-resistance.
The low volume of certified testing of LED lamps in South Africa does not allow much credible reference to be made to local testing and regulatory authorities that will comfort buyers and specifiers.

- Inferior quality of luminaire construction such as floppy luminaire bodies and poor finishing.
- Flammable materials used in construction, and terminal blocks.
- Inadequate protection against electric shock.
- Poor earthing of accessible metal parts.
- Inadequate protection of wiring in double-insulated luminaires.
- Use of substandard components in luminaires.
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In South Africa, miniature circuit breakers (MCBs) have become commoditised over the past 20 years or so to the extent that their all-important function has been blurred and, in most cases, largely misunderstood. From around the 1960s, the MCB has replaced the fuse in incoming distribution boards, thereby increasing the safety standard of the incoming protection by making it impossible to replace a blown fuse with a nail or a piece of wire – a frequent and dangerous practice.

A MCB is a ‘mechanical switching device, capable of making, carrying and breaking currents under normal circuit conditions and also making, carrying for a specified time and breaking currents under specified abnormal circuit conditions, such as those of overload and short circuit’.

In all cases the MCB should operate:
- **With safety** for the user and the environment; and
- **Without damage** to the electrical and physical installation.

**What does a MCB consist of and how does it work?**

There are two technologies used in the construction of a MCB, which will be described in detail. However, irrespective of the technology, three main elements are found in the internal construction:
- A switching mechanism;
- A mechanical trip mechanism; and
- An overload control mechanism.

**Typical internal construction of a thermal magnetic type MCB**

- **The switching mechanism** forms the main current path from the line terminal connection to the load terminal connection. It includes special contact tip materials to handle the arc energy on make-and-break operations. The arc runners lead the arc away from the contacts and into an arc grid arrangement designed to split the arc between the iron plates, thereby increasing the arc voltage – generally 10 V per arc foot – to a point where the system voltage is too low to sustain it and would cause the arc’s collapse.

  This chamber also plays an important role in exhausting the hot gases away from the incoming line and the delicate trip mechanism.

- **The mechanical trip mechanism** is a delicate set of spring-loaded levers connecting the moving contact through a latch to the operating handle, allowing the MCB to be switched on and off manually. However, when acted upon, the latch automatically disconnects the moving contact from the incoming supply.

- **The overload control mechanism** determines at what current and for what period of time the MCB will disconnect from the incoming supply in the case where the rated current of the MCB is exceeded. In this aspect, there are two different technologies available.
The two technologies are: thermal magnetic and hydraulic magnetic. Here is a brief overview of what makes them work and why:

**Thermal magnetic principle of operation**

The main element in a thermal magnetic MCB is a bi-metallic strip, which is heated by the passage of current through it, causing it to bend and bias onto the main latch. At a pre-defined temperature, the latch is released – causing the main contacts to separate.

**Hydraulic magnetic principle of operation**

In this design, the bi-metallic strip is replaced by a ‘dashpot’, which is an oil-filled tube containing a spring-loaded iron core. The current is passed through a coil placed around the tube. A spring-loaded armature, an iron frame and an iron pole piece complete the magnetic circuit. As the current increases past the rated value of the MCB, the core is attracted towards the pole. Once the core reaches the pole, the armature is attracted towards it and this causes the latch to trip and the contacts to separate.

**Comparison between the two technologies:**

<table>
<thead>
<tr>
<th>Technology</th>
<th>PROS</th>
<th>CONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thermal magnetic</td>
<td>compact, simple design.</td>
<td>Sensitive to ambient temperature.</td>
</tr>
<tr>
<td></td>
<td>Can perform current limiting.</td>
<td>Minimum width of single module = 18 mm width.</td>
</tr>
<tr>
<td></td>
<td>Minimum width of single module = 13 mm width.</td>
<td>Complicated dashpot design.</td>
</tr>
</tbody>
</table>
What are the MCBs electrical characteristics?

In the standard wiring of domestic, commercial and light industrial installations, electrical characteristics of both technologies comprise:

**Voltage rating:** 230/400 V (+/- 10%) – 50 Hz.

**Current ratings:** From 1 A to 100 A (1, 6, 10, 16, 20, 25, 32, 40, 50 and 63 A being the most used).

**Overload characteristics:** Curves B, C and D.

**Breaking capacity:** 3, 6 and 10 kA alternating current (one- and three-phase).

**Time delay curves**

The function of an ‘inverse time delay curve’ is essential for the principle that the time to ‘trip’ or disconnect the breaker needs to be progressively less as the overload increases. This ties in with the principle that the installation wiring and/or appliances at increasing fault levels can tolerate a limited amount of overload energy. In addition, many appliances demonstrate a current ‘inrush’ when switched on – electric motors, in particular, have an inrush of around 10 to 15 times the rated current for a short duration of time; the MCB must be able to allow this without tripping.

The essence of these curves is to demonstrate the ‘instantaneous tripping’ point – the current beyond which the MCB offers no practical time delay and is said to trip instantaneously. The lower this value, the more likely the MCB will trip on start-up of any electric motor.

**Typical thermal magnetic time delay curves:**

- Fast acting response for normal household applications.
- Slow acting for normal applications that include motors.
- Very slow acting for industrial applications that include motors and pumps.

**As mentioned previously, the thermal MCB is affected by ambient temperature and the proponents of this technology argue that this is beneficial since, at higher temperatures, damage is more likely to occur to the installed cables and therefore, a reduced trip characteristic is desirable.**
Breaking capacity

Another subtle technical differentiator is the MCB’s inherent design, which enables it to limit the let-through current during short circuit conditions. The design of the tripping mechanism is enhanced to accelerate the moving contact opening speed and the effective dissipation of the arc into the arc chamber – and this is referred to as either a current-limiting or zero-point extinguishing breaker.

Marking and information required on the MCB

Every MCB is required to have the following marking:

In the product’s technical literature – visible on purchasing the MCB

- Rated short circuit making capacity (Icm) if higher than Icu.
- Rated insulation voltage (Ui) if higher than Ue, i.e. 500 V.
- Pollution degree, if higher than three.
- Conventional enclosed thermal current (Ithe) if different from the rated current.
- IP code where applicable.
- Further items for large frame MCBs.
- Further items for opening and closing devices for large frame MCBs.

On the body – not visible to the user when installed

- Type designation or serial number.
- IEC 60947-2 (or SANS 60947-2) or VC8036.
- Selectivity category, i.e. ‘Category A’.

On the front – visible to the user – MCB is installed in the distribution board:

- Rated current (In) in Amperes, i.e. 20 A. In some instances this is coupled to the DIN time delay curve designation, i.e. for curve Type C: C 20 A.
- Suitability for isolation, by way of the symbol:
- Indication of the open and closed positions with the symbols ‘I’ and ‘O’.
- Manufacturer’s name or trade mark – this is usually on the front and is visible to the user.

Typical MCB front marking. The look-alike aspect of MCBs emphasises the need for scrutiny of the detail.
In order to legally distribute the product, the manufacturer or importer of a MCB up to 10kA / 125A will require a Letter of Authority (LoA) issued by the National Regulator for Compulsory Specifications (NRCS) on the strength of a Type Test report, issued by an accredited laboratory, proving that the product complies with the requirements of VC8036.

**What are the applicable standards?**

<table>
<thead>
<tr>
<th>Standard</th>
<th>Description</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>SANS 10142-1</td>
<td>The SA National Standard for The Wiring of Premises.</td>
<td>Specifies the types of circuit breakers, the safety standards and their application in LV installations.</td>
</tr>
<tr>
<td>VC8036</td>
<td>The SA Compulsory Specification for Circuit Breakers.</td>
<td>Legislation issued under Government Gazette No. 29265 of 6 October 2006, makes the compliance with SANS 556-1 a mandatory requirement for the selling and distribution of these products.</td>
</tr>
<tr>
<td>SANS 556-1</td>
<td>The SA National Standard for Circuit Breakers.</td>
<td>SA ‘front-end’ specification, referring to SANS 60947-2; with the three national deviations; covering all aspects of the performance requirements of circuit breakers.</td>
</tr>
</tbody>
</table>

**What should a purchaser look for to help ensure the product is compliant and safe?**

The MCB is a vital safety device and the choice of MCB is a complex issue that is often best left to qualified persons who will know what characteristics are required for a particular installation and network. However, the purchaser will best be served by following these guidelines:

- Insist on being informed by the supplier about the origin of the product and, where applicable, by the consulting engineer or electrical contractor about available choices.
- Be critical about their choice if you have any doubts.
- Ask for proof of compliance with regulations.
- Deal with a supplier and brand that you know and can trust.
- Look for the markings and information details above – if absent or deficient, be suspicious.
- Look for certification marks such as SABS or VDE marks.
- Look for the test specification marking: ‘Tested to SANS or IEC 60947-1’ or ‘VC8036’.
- Try to validate ‘sales talk’ about quality and performance.
- Make contact with the original supplier in South Africa.
- Beware of copies of prominent brands.
- Beware of products at substantially lower prices than other products on offer.
- Look for the SAFEhouse logo on any packaging.
- Check with the SAFEhouse Association for information it may have on products.
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Please note that this is not an exhaustive guide. While every care has been taken in compiling the content, neither the SAFEhouse Association nor the publisher can accept responsibility for any errors or omissions herein.

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For a list of reputable local manufacturers or for technical information on these products, please contact:

+27 11 396-8140
info@safehousesa.co.za
www.safehousesa.co.za
The National Regulator for Compulsory Specifications (NRCS) came about in May 2008 with the introduction of the NRCS Act of 2008.

At its inception in 1965, the Regulator was part of the South African Bureau of Standards (SABS) and shared all the skills and expertise that the Bureau had at its disposal. Many aspects of this compulsory regulatory function have changed since 2008, when the NRCS was effectively ‘stripped away’ from the SABS.

The SABS was then reconstituted as a commercial undertaking with limited funding from Government while the NRCS, on the other hand, became a ‘non-profit’ Government agency reporting to the DTI, and separate from the SABS.

The following are some of the more visible consequences, as seen from the point of view of clients of these institutions:

**OUT**

| Regular interaction with industry and relatively easy access to the Regulator. |
| A LOA (Letter of Authority) system with long lead times and more-restricted access to the NRCS. |
| The Authorisation Committee process. |
| Web-based applications for approvals. |
| ‘In-house’ testing of products. |
| Rejection of the SABS mark as a qualification for compliance with regulations. |
| Regular inspections at outlets for non-compliant products. |
| Focus on the ports of entry of goods (and an implication that locally-produced products deserve no – or much less – policing). |

**IN**

| Provide a product certification scheme – such as the SABS mark scheme. |
| Provide ISO listing and auditing facilities. |
| Provide and manage laboratory facilities, such as NETFA (National Electro-technical Testing Facility and Accreditation). |
| Manage the standards division and produce national standards. |
| Sell standards documentation. |
| Report to the DTI via the SABS board. |

The changes caused some confusion in the market as many entities were, and still are, under the impression – due to years of SABS visibility – that they are protected by the SABS mark of approval. On the other hand, the different (and lesser known) profile of the NRCS is one of policing, funded by fees levied on suppliers.

The NRCS has the mandate to impound, confiscate and destroy non-compliant regulated products, and regularly demonstrates where they are destroyed.

The roles of the SANS and the NRCS

<table>
<thead>
<tr>
<th>SABS</th>
<th>NRCS</th>
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</thead>
<tbody>
<tr>
<td>Provide a product certification scheme – such as the SABS mark scheme.</td>
<td>Manage the National Compulsory Safety Regulations.</td>
</tr>
<tr>
<td>Provide ISO listing and auditing facilities.</td>
<td>Collect levies for regulated products.</td>
</tr>
<tr>
<td>Provide and manage laboratory facilities, such as NETFA (National Electro-technical Testing Facility and Accreditation).</td>
<td>Develop and implement national safety specifications*.</td>
</tr>
<tr>
<td>Manage the standards division and produce national standards.</td>
<td>Issue directives for the removal and disposal of non-compliant products.</td>
</tr>
<tr>
<td>Sell standards documentation.</td>
<td>Conduct market surveillance on regulated products.</td>
</tr>
<tr>
<td>Report to the DTI via the SABS board.</td>
<td>Report to the DTI via the NRCS board.</td>
</tr>
</tbody>
</table>

*NRCS specifications include reference to standards and administrative requirements.

Products that are regulated in terms of compulsory specifications

The NRCS has an informative, although not well-known website which, amongst other useful information (dealt with in this guide), lists and publishes Compulsory Specifications under the VC series of documents. A visit to the NRCS Website is recommended: www.nrcs.org.za. Follow the ‘Electrotechnical’ selections.

The table overleaf contains a consolidated list of products that are regulated in terms of the Compulsory Specifications. The list has been updated to the latest issued amendments as at June 2016, with the applicable standards referred to in the VC documents.

These specifications are available on the NRCS website and can be downloaded at no charge. Each specification covers the procedural and technical requirements, such as the applicable standard. Affected entities are urged to read these carefully and to purchase the referenced product standard(s) in order that the correct test report is obtained from an accredited test laboratory.
The Conformité Européenne or CE mark is generally a ‘self-certification’ mark, which was introduced in Europe to serve as a common certification within the European Economic Area.

### Certification Systems

<table>
<thead>
<tr>
<th>Elements of product certification systems</th>
<th>Product certification system types</th>
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<tbody>
<tr>
<td>1 Selection or sampling as applicable</td>
<td>1a 1b 2 3 4 5 6</td>
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<tr>
<td>2 Determination as applicable by:</td>
<td></td>
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<tr>
<td>Testing: (ISO/IEC 17025)</td>
<td></td>
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<tr>
<td>Inspection, design appraisal or assessment of service: (ISO/IEC 17020)</td>
<td></td>
</tr>
<tr>
<td>3 Review or evaluation</td>
<td></td>
</tr>
<tr>
<td>4 Decision on certification, which includes granting, maintaining, suspending and withdrawing</td>
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<tr>
<td>5 Licensing or attestation</td>
<td></td>
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<tr>
<td>6 Surveillance:</td>
<td></td>
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<tr>
<td>a) Testing or inspection of samples from the open market</td>
<td></td>
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<tr>
<td>b) Testing or inspection of samples from the factory</td>
<td></td>
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<tr>
<td>c) Quality system audits combined with random tests or inspections</td>
<td></td>
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<tr>
<td>d) Assessment of the production process or service</td>
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</tbody>
</table>

<table>
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<tr>
<th>1a</th>
<th>1b</th>
<th>2</th>
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</table>

Products are listed in EU directives/regulations and these cover the specific requirements of the CE certification process together with the specific duties and responsibilities of manufacturers and distributors of products.

The CE certification process is based on standard ISO/IEC 17050 – Parts 1 and 2 “Supplier’s Declaration of Conformity”. This standard has also been adopted as a South African National Standard - SANS 17050.

![CE mark](image)

**Correct CE mark.**

**Examples of fake CE marks.**

6.2: Levels of conformity assessment that can be applied to a product (simplified for this guide).

As can be seen from the table above, the Type 5 certification scheme includes market surveillance and regular audits of the manufacturer’s process and quality management systems, whereas the CE mark is only effective where regular third party audits/surveillance of the implementation of ISO/IEC 17050 requirements are conducted.

It is important to note that some of the latest amendments of VC specifications require that the manufacturer demonstrates compliance to a Type 5 certification scheme as part of the process for an LOA approval, for example, VC8036 – 2015: Circuit breakers.

**Governing legislation for electrical products and installations**

The sale and installation of electrical products are governed in South Africa by the following:

**THE NATIONAL REGULATOR FOR COMPULSORY SPECIFICATIONS ACT NO 5 OF 2008:**

- Refers to product standards and administrative requirements in VC documents relating to electrical products.
- Is managed by the NRCS (National Regulator for Compulsory Specifications), reporting to the Department of Trade and Industry.
- Covers the sale of products.
- Applies to electrical products, including those for fixed installations such as sockets, as well as plugs, adaptors and cord extension sets.
- Sets out the process for LOA, RCC and SP approvals.
THE OCCUPATIONAL HEALTH AND SAFETY ACT NO 85 OF 1993:
• Refers to the Electrical Installation Regulations of 2009 and the Code of Practice for Wiring of Premises SANS 10142-1.
• Is managed by the Department of Labour in terms of the Occupational Health and Safety Act.
• Covers the use of products in electrical installations, generally applicable to products for fixed installations such as socket outlets, wall switches, stove isolators and circuit breakers.
• Prescribes the Wiring Code (SANS 10142-1) for the wiring of fixed installations in the work environment.

THE ELECTRICAL INSTALLATION REGULATIONS: GOVERNMENT NOTICE R242 MARCH 2009:

These regulations are in the custody of the Department of Labour.
• Sets out the regulations applicable to domestic, commercial and industrial installations. All the components used therein must comply with the Code of Practice for Wiring of Premises, SANS 10142-1, which also covers the installation approval process for the issuing of Certificates of Compliance (CoCs) for new and existing installations. Incidentally, a CoC is required for the sale and registering of properties.

THE ELECTRICAL INSTALLATION REGULATIONS CONTINUED
• This regulation also sets out the Registration of Electrical Contractors. This registration was, for many years, in the hands of the Electrical Contractors’ Board (ECB), which no longer exists in its original form. Consequently, some of the previous control functions are now significantly reduced.
• This regulation also includes the Notice of Commencement of Installation Work provision, whereby all electrical installations are registered at Department of Labour with particulars such as location, type of installation and the identity of the registered contractor.
• It also has provisions for the appointment of Approved Inspection Authorities (AIAs) whose tasks are not unlike the original municipal ‘electrical inspectors’ but more complex now in terms of their function and duties under the Department of Labour.

THE CONSUMER PROTECTION ACT NO. 68 OF 2008 (CPA):
• This deals with consumer products and states, under Section 55 (d) regarding consumers’ rights to safe, good-quality goods: “…every consumer has the right to receive goods that … comply with any applicable standards set under the Standards Act, 1993 (Act No. 29 of 1993), or any other public regulation”.

INDEPENDENT COMMUNICATIONS AUTHORITY OF SOUTH AFRICA (ICASA):
• Electro-magnetic interference (EMI) and electro-magnetic compatibility (EMC) are applicable to a number of electrical products.
products such as certain lighting products and electronic switches, dimmers and sensors.

- Such products require compliance with certain standards in respect of electromagnetic emissions and compatibility which, if left without any control and suppression, could interfere with specific broadcasting and essential signalling systems, such as in air traffic control, security communication systems and pacemakers in healthcare applications.
- These standards are in accordance with international standards under the CISPR series of documents and broadly within the jurisdiction of ICASA.

### LOA, RCC and SP applications

All applications for NRCS approvals are made on-line and require the following steps:

**Step 1 – Application for registration:** The LOA administration procedure, downloaded from the NRCS website, explains the registration process and first time applicants are required to complete the form under Annexure 2. This application must be submitted by fax or email under a covering letter where a ‘username’ is proposed for the responsible person acting on behalf of the applying entity.

**Step 2 – Applicant on-line registration:** After about three days, the account is activated, on-line applications are available to the newly registered client, and a password is issued online. To make this easier, it is recommended that this is done at the NRCS in Pretoria, in the recently established client centre.

**Step 3 – Register the product:** By selecting the appropriate tab, the product is registered. One should include every possible version of the product in terms of ‘model numbers’ and descriptions. Failing this, subsequent variants of the product will necessitate additional approval applications.

**Step 4 – Application:** As a general guide, all listed products require an LOA. There are, however, some exceptions (see table on previous page).

**RCC (Regulatory Certificate of Compliance):** This applies to those VC specifications that have not been amended to include the LOA process and products not entirely covered by a single standard (such as new and innovative product types).

**SP (sales permit):** Where there are products that deviate from one or more standards, it would be necessary to apply for a SP. This may or may not be granted at the discretion of the NRCS, depending on the seriousness of the non-compliance.

The type of service request (SR) is selected on the applicable tab and the following documents are uploaded:

- Completed application form Annexure 1 of the LOA procedure.
- Test report(s).
- Proof of payment of application fees.

**Step 5 – Application approval and lead time:** Until April 2016 the LOA process time was stated as 120 working days. At an information forum in April 2016 the NRCS announced that this would change to 120 calendar days. The actual experience of many organisations is that it could take longer.

One way to reduce the risk of lengthy delays is to understand the process and to ensure that all requirements to support the application are properly completed and submitted.

Amongst other measures, the current NRCS strategy is to concentrate its limited resources on the ports of entry, so containers will be held up by the Department of Customs if there is no LOA or other approval included with import documents.

Another aspect of the NRCS strategy is to profile suppliers into risk categories in terms of their knowledge of the regulations and their record of adherence to them. Understanding the regulations and building up a record of compliance would thus be helpful.

The fact that current NRCS resources are limited along with a move to more electronic automation of the approval process, makes personal intervention in the process much more difficult, if not impossible.

There is currently much lobbying to reduce the application processing time but it is recommended that ample time be allowed for the approval process.

### Test Report requirements by NRCS

Without exception, the approval process requires a full test report to the referenced standard for the regulated product and there are some specific clauses covering this aspect, these are:

- **Accredited laboratories:** The laboratory must be appropriately accredited and internationally recognised by an accreditation body, which is a member of the IAF/ILAC/IECEE mutual recognition scheme.

- **Test reports:** A full test report, in the IEC format, is usually about a 30-page document covering every clause of the standard and, in some cases, covering more than one standard. For example, cord extension sets are covered under VC 8029, SANS 60884-2-7, SANS 1661 and SANS 164-0. It also requires photographs of the product.
  - On first application, the test report may not be older than three years.
  - On renewal of the LOA, the test report may not be older than five years.

- **Product families:** In certain products, characteristics may be grouped together and tested as a ‘family’ provided that the structure and design is consistent across the group. For example, miniature circuit breakers (MCBs) may, under the same design and characteristics, have several nominal current ratings (6, 10, 16, 20, 25, 32, 40, 50 and 63 A). The test report may encompass all these ratings.

The applicant must ensure that the test report reflects all the ‘type numbers’ for each of these ratings, which may then be transferred to the LOA application. Check that the issued LOA reflects all the types listed.
Electrical products are required to meet strict safety standards for the simple reason that, without extensive safety precautions, they may injure or kill users. Assets, such as buildings and other possessions, are also at risk but the purpose of the regulations is to protect users.

These precautions are embodied in the various clauses of Technical Standards and conforming to these standards often requires specialised materials: specially selected metals and metal coatings; strict manufacturing processes including testing; and ongoing proof of conformance. All in all, these measures add to the cost, even for a relatively simple product, such as a plug, for example.

Significant differences between prices of products offered should be a warning sign. Low prices might mean compromised quality and reduced safety and this has often proved to be the case. The location where the products are sold, combined with low prices may also be a warning of possible sub-standard quality.

What can end-users do?

- Buy known and trusted brands.
- Buy from reputable suppliers and outlets.
- Beware of copies of prominent brands.
- Be suspicious of prices substantially lower than other, similar products or services on offer.
- Try to make contact with the seller’s supplier and judge responses critically.
- Be suspicious of lack of information on or with the product packaging and on the product itself. Specifications require certain minimum markings and packaging should describe the electrical capacities and the correct application of the product. Look out for contradictions between data provided, for example, different voltage ratings for the same product.
- If the purchase is substantial enough, ask the supplier for references to other users and contact them.
- When dealing with an electrical contractor, ask about membership of the ECA(SA) (Electrical Contractors’ Association of South Africa) and/or call the ECA(SA) in your region to check credentials.
- Be wary of suspect installations or of Certificates of Compliance (CoCs) that are issued too easily.
- Ask the supplier to prove compliance with regulations and NRCS approval.
- Look for certification marks such as SABS, VDE and UL.
- Beware of fraudulent use of well-known marks, such as the SABS mark.
- A CE mark in its own is not proof of conformity or of independent testing – be careful.
- Report any electrical product failure to the dealer, manufacturer, the NRCS and, if applicable, the National Consumer Commission.
- If in doubt, check with the SAFEhouse Association for possible information it may have to help you.
The South African SAFEhouse Association is an independent, registered, non-profit organisation established by the electrical industry and committed to communicating with customers.

SAFEhouse has been established to combat the proliferation of dangerous products and services by making the market aware of the risks in using such products and services, exposing sub-standard products and services, and persuading specifiers, suppliers and distribution channels not to recommend or to offer such products and services for sale.

SAFEhouse members have signed a code of conduct that commits them to dealing only in safe electrical products and to responsible behaviour.

If you have doubts about a particular product or service, contact SAFEhouse for guidance.

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The history of standards for sockets in South Africa goes back 80 years, starting with the British System and continuing through to the IEC standards that followed in the 1990s. We now have nine standard configurations with an additional 12 dedicated versions to complete a range of products legally available in South African Electrical Installations. This guide does not cover industrial sockets, which fall under a separate standard and, although referred to in the Wiring Code, are not normally used in household and light commercial applications and are not covered by compulsory safety specifications.

Socket outlets are, of course, a reflection of PLUG configurations which are applied to any type of socket outlet, whether part of a fixed installation or of products such as cord extension sets and adaptors. It is important to note that plugs, socket outlets, cord extension sets and socket-outlet adaptors are covered by compulsory safety specifications (see applicable standards further on in this guide).

What do socket outlets do?

- Make and break current supply to an appliance by means of a plug.
- In the case of switched outlets, provide power On/Off functions and indication.
- Provide other functions such as USB-connection.
- Provide aesthetics to complement room decor.

What does a socket-outlet consist of and how does it work?

A typical view of the internal structure of a switched socket outlet, complying with SANS 164-1 (16 A, 250 V~), shows the components and their functions:

- Operating handle
- Spring-loaded plunger to operate moving contact
- Plug pin entry spouts
- Spring-loaded safety shutters, closing live and neutral plug entry holes when plug is not inserted
- Plug pin contacts
- Plastic base housing
- Plastic cover housing
- Moving contact
- Moving contact pivot
- Fixed contact
- Wiring terminals - box and screw type

Socket safety features

Socket outlets are the ultimate ‘point of consumption’ of electricity and at the front line of a user’s electrical connection. Consequently, wherever they may be installed, several safety precautions are required. These are:

- **Earth leakage protection:** According to the Wiring Code, all socket outlets are to be protected by sensitive earth leakage protection. With a nominal tripping current of 30 mA, this is an effective way of preventing electrocution if touching live and earth simultaneously.

- **Safety shutters:** It is compulsory that all socket outlets in SA are shuttered. In this way it is very difficult, if not impossible, to insert a single pin or metal rod into a live socket-entry spout, thereby reducing the likelihood of electrocution.

- **Socket entry well:** In certain socket configurations; such as SANS 164-2 and SANS 164-6, a 10 to 12 mm well is required so that, as the plug is inserted into the socket, the plug pins cannot be touched, even by a small child’s fingers, thereby eliminating the possibility of electric shock.
**Socket outlet combinations and features**

**Switched socket-outlets:**
For general purpose in building reticulation.

**Adaptors & Extension cords:**
Convenient accommodation of different plug standards and provision of power where needed, particularly for domestic use.

**Switched socket-outlets:**
For general purpose in building reticulation.

**Adaptors & Extension cords:**
Convenient accommodation of different plug standards and provision of power where needed, particularly for domestic use.

**Socket outlet modules:**
For modular trunking and office-type applications.

**Illuminated:**
On/Off indication and location in the dark.

**Multiple outlet configurations:**
For convenient use of different plugs.

**Additional functions:**
Surge protection and USB outlets.

**Automation:**
Programmable electronic functions.

**Robust applications:**
Special housings for outdoor use and other weatherproof applications.

**As part of assemblies:**
For example, inverters and portable generators. Whether in building installations or as part of other products, the same standards are applicable.

**What are the applicable standards?**
In the early 1990s, SABS adopted many IEC standards to replace those developed in South Africa. The only one remaining from the previous era is the plug and socket outlet configuration, SANS 164-1, -3 and -4. The SANS 164 series of documents, which over the years has grown to seven standards, is listed from SANS 164-0 through to SANS 164-6.
<table>
<thead>
<tr>
<th>Standard</th>
<th>Description</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>SANS 60884-1</td>
<td>Plugs and socket outlets for households and similar purposes.</td>
<td>SA National standard for plugs and socket outlets, fixed and portable, and also general requirements for plug-in adaptors. This standard, which is applied in most IEC countries, does not include ‘standard sheets’, which are specified by the different countries’ National Committees.</td>
</tr>
<tr>
<td>SANS 60884-2-3</td>
<td>Plugs and socket outlets for households and similar purposes.</td>
<td>As for switched socket outlets. This standard is read in conjunction with SANS 60884-1.</td>
</tr>
<tr>
<td>SANS 164-0</td>
<td>Plugs and socket outlets for households and similar purposes for use in South Africa.</td>
<td>The first part of the SANS 164 series of standards where the ‘standard sheets’ for the different plug and socket outlet configurations are listed. Part 0 covers aspects common to all configurations, i.e. shutters, surge protection and USB outlets.</td>
</tr>
<tr>
<td>SANS 164-1</td>
<td>Plugs and socket outlets for households and similar purposes for use in South Africa.</td>
<td>See configuration chart. <strong>Applied to general household, commercial and light industrial installations up to 16 A.</strong></td>
</tr>
<tr>
<td>SANS 164-2</td>
<td>Plugs and socket outlets for households and similar purposes for use in South Africa.</td>
<td>See configuration chart. <strong>New configuration, replacing SANS 164-1:</strong> <strong>Applied to general household, commercial and light industrial installations up to 16 A.</strong></td>
</tr>
<tr>
<td>SANS 164-2-1</td>
<td>Plugs and socket outlets for households and similar purposes for use in South Africa.</td>
<td>SANS 164-2-1, consisting of six different configurations. The partially dedicated version, which is a NEW configuration, replacing SANS 164-4: <strong>Applied to partially dedicated circuits for general household, commercial and light industrial installations up to 16 A.</strong></td>
</tr>
<tr>
<td>SANS 164-2-2</td>
<td>Plugs and socket outlets for households and similar purposes for use in South Africa.</td>
<td>SANS 164-2-2, consisting of six configurations. The partially dedicated version, which is a NEW configuration, replaces SANS 164-4: <strong>Applied to partially dedicated circuits for general household, commercial and light industrial installations up to 16 A.</strong></td>
</tr>
<tr>
<td>SANS 164-3</td>
<td>Plugs and socket outlets for households and similar purposes for use in South Africa.</td>
<td>See configuration chart. <strong>Applied to lighting circuits for general household, commercial and light industrial installations up to 6 A.</strong></td>
</tr>
<tr>
<td>SANS 164-4</td>
<td>Plugs and socket outlets for households and similar purposes for use in South Africa.</td>
<td>See configuration chart. The dedicated system based on SANS 164-1 comprises three variations (RED, BLUE and BLACK) considered partially dedicated. <strong>Applied to partially dedicated circuits for general household, commercial and light industrial installations up to 16 A.</strong></td>
</tr>
</tbody>
</table>
SANS 164-5

<table>
<thead>
<tr>
<th>Sockets</th>
<th>Plugs and socket outlets for households and similar purposes for use in South Africa.</th>
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</thead>
<tbody>
<tr>
<td><strong>Part 5:</strong> Two-pole, non-rewireable plugs, 2.5 A 250 V ac, with cord, for connection of class II equipment.</td>
<td></td>
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<tr>
<td><strong>SANS 164-6:</strong></td>
<td>Plugs and socket outlets for households and similar purposes for use in South Africa.</td>
</tr>
<tr>
<td><strong>Part 6:</strong> Two-pole systems, 16 A 250 V ac, for connection of class II equipment.</td>
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</tbody>
</table>

This standard covers the ‘Europlug’ or EN50075 standard, and only describes the plug. The socket version is unnecessary since the plug is compatible with both SANS 164-2 and SANS 164-6.

**Applied to small appliances and plug-in chargers, up to 2.5 A.**

**SANS 164-6**

<table>
<thead>
<tr>
<th>Sockets</th>
<th>Plugs and socket outlets for households and similar purposes for use in South Africa.</th>
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<td><strong>Part 6:</strong> Two-pole systems, 16 A 250 V ac, for connection of class II equipment.</td>
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</table>

What is commonly referred to as the ‘Unearthed Schuko’.

**Applied to power tools and small appliances, up to 16 A.**

**VC8008**

<table>
<thead>
<tr>
<th>Sockets</th>
<th>The SA Compulsory Specification for plugs, socket outlets, and socket outlet adaptors.</th>
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<tbody>
<tr>
<td>Legislation issued under Government Gazette Nr 33763 of 19 November 2010: making compliance with SANS 164-0 a mandatory requirement for the selling and distribution of these products.</td>
<td></td>
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</table>

**SANS 10142-1**

<table>
<thead>
<tr>
<th>Sockets</th>
<th>Wiring of premises.</th>
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<tbody>
<tr>
<td><strong>Table 4.1</strong> specifies VC8008 as the mandatory safety specification for socket outlets, including the various parts of SANS 164 (and the dedicated versions of SANS 164-2-1 and 164-2-2).</td>
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</tbody>
</table>

**Dedicated plugs and socket outlets**

The system of dedicated plugs and socket outlets for the SANS 164-2 configuration was recently added to replace the SANS 164-4 range. It includes fully-dedicated versions that were not previously available. Products made to the latter standard will, in the foreseeable future, be replaced by the SANS 164-2 series. Although the SANS 164-4 range will not be banned from use in installations, its use will decline, as will be the case with the SANS 164-1 plug and socket.

**SANS 164-2-1 and SANS 164-2-2 dedicated system**

The standards, published in 2014, are not widely in use at present. Twelve dedicated configurations are specified to allow for non-standard circuits for defined and special applications.

Note: The following clause in SANS 10142: Wiring of premises: makes it mandatory for new installations to install SANS 164-2 socket outlets:

To suit the interior design, the purchaser has a wide variety of aesthetics from which to choose, including colours and finishes of wall plates.

Example of a partially-dedicated SANS 164-2-1 socket and plug: Type PD-A (Red), one of six variations. Partially-dedicated means the plug does not only plug into the corresponding dedicated socket, but also into the non-dedicated or standard SANS 164-2 socket outlet.

Example of a fully-dedicated SANS 164-2-1 socket and plug: Type FD-A (Red), one of six variations: Fully-dedicated means the plug can only plug into the corresponding dedicated socket and no other socket outlet.
Note: The following clause in SANS 10142: Wiring of premises: makes it mandatory for new installations to install SANS 164-2 socket outlets:

6.15.1.1 Except where otherwise specified in this part of SANS 10142, single-phase socket-outlets for general use (see also 6.14.1.4) shall

a) be of the two-pole and earthing contact type,

b) comply with SANS 164-0,

c) effective from January 2018 all socket-outlet points for new electrical installations shall include at least one socket-outlet complying with the dimensions of SANS 164-2. Socket-outlet points may also include socket-outlets complying with the dimensions of SANS 164-1.

To suit the interior design, the purchaser has a wide variety of aesthetics from which to choose, including colours and finishes of wall plates.

Examples of typical socket outlets

Industrial plugs and sockets: compulsory standards

The image below depicts industrial sockets which are not covered in this guide. Although referred to in the ‘Wiring Code’, they are not normally used in household and light commercial applications.

Because the National Regulator for Compulsory Specifications (NRCS) has not issued a Compulsory Specification for industrial plugs and sockets, these products are not required to have a Letter of Authority (LOA) for sale in SA. However, there are applicable safety standards referred to in SANS 10142-1: The wiring of premises (commonly referred to as the ‘Wiring Code’),

Part 1: Low voltage installations, Clause 4: Compliance, and in particular Clause 4.1.1, which states: ‘Table 4.1 gives a list of commodities and the applicable standards. The commodities given in column 1 shall comply with the applicable standards given in column 3’

Table 4.1 lists the safety standard of socket outlets (industrial type) rated ≤690 V, ≤250 A: as SANS 60906-1 and SANS 60906-3

In terms of the EIR and the Occupational Health & Safety Act, compliance with SANS 10142-1 is mandatory and each electrical installation (within the specified parameters) shall be issued with a COC by the registered electrical contractor who carried out the installation work.

Compliance of the industrial products to the standard (SANS 60906-1) is demonstrated by the manufacturer, importer or retailer by producing a test report, issued by an ILAC accredited laboratory, for the particular product or range of products. The report should in all cases not be older than five years.

There are many sub-standard, unsafe electrical products being distributed in South Africa. What can a purchaser do to help ensure a product is compliant and safe?:

Some guidelines

- Determining the required product specification for the desired function is best left to qualified persons.
- Buy brands you know and can trust.
- Buy from reputable distributors and outlets.
- Beware of copies of prominent brands.
- Be suspicious of prices substantially lower than for other, similar products or services on offer.
- Make contact with the seller’s supplier and judge responses critically.
- Be suspicious of lack of information on or with the product packaging and on the product itself. Specifications require certain minimum markings. Packaging should describe the electrical capacities and the correct application of the product. Look out for contradictions between data provided e.g. different voltage ratings for the same product.
- If the purchase warrants it, ask the supplier for references to other users – and make the effort to contact them.
- When dealing with an electrical contractor, ask about membership of the ECA and call the ECA in your region to check credentials. Be critical of a suspect installation or a COC that is issued too easily.
- Ask the supplier to prove compliance with regulations: NRCS approval in the form of a LOA for the products used that are subject to regulations (see above and the SAFEhouse Guide to the Regulation of Electrical Products in South Africa for a list of other products subject to compulsory specifications).
- Look for the test specification marking: ‘Tested to SANS 60884-1 and/or SANS 164-0’ or ‘VC8008’.
- Look for certification marks such as SABS and VDE (note the SABS mark is not necessarily a substitute for the LOA).
- Beware of fraudulent use of well-known certification emblems, such as the SABS mark.
- Be careful - A ‘CE’ mark is not necessarily proof of conformity or of independent testing.
- Report any electrical product failure to the dealer, manufacturer, the NRCS and, if applicable, the National Consumer Commission.

If in doubt, check with the SAFEhouse Association for information it may possibly have to help you.

List of abbreviations used in this guide

CE: European Conformity (Self certification)  
COC: Certificate of Compliance  
ECA: Electrical Contractors Association  
EIR: Electrical Installation Regulation  
ILAC: International Laboratory Accreditation  
L&N: Live and Neutral  
LOA: Letter of Authority  
NRCS: National Regulator for Compulsory Specifications  
SABS: South African Bureau of Standards  
SANS: South African National Standards  
VC: SA Compulsory Specification  
VDE: International Certification Body
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For a list of reputable local manufacturers or for technical information on these products, please contact:

SAFE™
Suppliers you can trust

+27 11 396-8140 info@safehousesa.co.za www.safehousesa.co.za
**Introduction**

Increasingly, more products can be found on stores’ DIY shelves that display ‘lightning bolts’ and claim, in bright red letters: ‘surge protected’. What does this really mean, and what are the standards that apply to this type of product? This brochure offers an easy to follow explanation: Introduction:

---

**What is our electrical supply about?**

Our electrical supply – or power – is delivered to each installation by way of a voltage, which drives current in an electrical circuit. The product of these two parameters is called the wattage or power consumed by the appliance connected into the electrical circuit. Simply put: voltage (volts – V) multiplied by current (amperes – I) is equal to power (watt – W). In South Africa, our national nominal voltage is fixed at 230 V +/- 10%. Another important characteristic of our voltage supply is that it is alternating and referred to as alternating current (ac) and fixed at 50 Hertz (Hz) or cycles per second. This alternating voltage waveform completes a full cycle of between 0 and +230 V to 0 and -230 V and back to 0, fifty times in one second, or every 20 milliseconds (ms).

This type of waveform is obtained in a typical generator such as those used in Eskom power stations and the choice of alternating current instead of direct current (dc) is largely due to the fact that ac can be easily transformed into different voltages using the changing magnetic field that ac produces. In this simple example, the rotational speed of the magnet will determine the frequency of the alternating current and every time the north pole of the magnet passes the coil, it produces a positive voltage. When the south pole passes the coil, it produces a negative voltage.

---

**What are surges, transients and impulses and what causes them?**

The inseparable phenomenon between electricity and magnetism is that whenever there is a change in current, a magnetic field is created and vice versa. Simply put, a fast and sudden change in current in one circuit can cause a fast and sudden change in voltage in another circuit adjacent to it.

A surge is when the voltage or current increases suddenly to a value exceeding the rated value by a few percent (typically 10 to 20%) and falls back to normal in a few milliseconds (typically 20 to 30 ms). This is also referred to as a ‘transient’ and can be caused by switching power ON to un-energised transmission lines, during short circuits and arcing faults to earth. In the case shown, the voltage gradient between the front and back legs of the cow is high enough to electrocute the animal.

Spikes and impulses, however, are of high voltages (typically 1 to 5 kV) and of extremely short duration. These are usually caused by lightning strikes – in some cases, direct strikes onto the overhead lines (although this is quite rare) or to earth, and also cloud-to-cloud strikes where the spikes are caused in the overhead lines by the electromagnetic...
Switching of loads ON and OFF, depending on which point on the voltage wave, also produces short duration spikes and these are the most common occurrences in our installations.

A typical voltage surge or spike has a peak of 2.5 kV with a 1.2 micro-second (1.2/1 000 000 of a second) rise time and a fall to 50% of the peak value in 50 microseconds.

This spike, superimposed on our power frequency waveform, looks like a very thin needle rising to a peak more than 10 times the peak of our mains voltage. **These are the types of spikes that damage electronic equipment such as computers, printers and television sets.**

**What is surge suppression all about?**

Surge suppression is about diverting the surge spikes – either between the neutral and live conductors or between live and the protective earth conductor. However, this must be done in such a way that the mains voltage is not affected during this process and it must be done safely.

Typical components that do this are ‘gapped arrestors’ and ‘metal oxide varistors’ (MOV).

Gapped arrestors are generally used in Type I arrestors for HV power lines. Because of the air gap there is almost no current flow between the terminals. The breakdown voltage across an air gap is around 3 kV per mm (under specified conditions), at which point an arc is struck in the air gap. The resistive disc then controls the current flow through the arc, till the voltage drops to a value below the breakdown level.

MOV arrestors are used in Type II and Type III arrestors and since this varistor is connected directly to the terminals, a small current flows continuously between them. As the voltage increases, the current also increases slightly until, at breakdown, a sudden and high current flows through the disc and persists until the voltage drops to a value below the breakdown level.
this delicate diversion of unwanted surges. It is this 50 Hz current that can damage the line or installation as it has to pass through the overcurrent protection circuits, thereby increasing the risk, under extreme conditions, of damage or failure.

**What are the applicable standards for surge protected products?**

Three standards and one compulsory specification are applicable and interlinked for both the installation and the products. These are:

<table>
<thead>
<tr>
<th>Standard</th>
<th>Description</th>
<th>Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>SANS 10142-1</td>
<td>The SA National Standard for the wiring of premises</td>
<td>Specifies the types of surge protection products and circuits for the wiring of fixed installations.</td>
</tr>
<tr>
<td>SANS 164-0</td>
<td>The SA National Standard for plug and socket outlet systems for household and similar purposes for use in South Africa Part 0: General and safety requirements</td>
<td>The first of seven parts that specify national plug and socket outlet configurations legally applied in South Africa. Part 0 covers the requirements for surge protected plugs and socket outlets.</td>
</tr>
<tr>
<td>VC8008</td>
<td>The SA Compulsory Specification for plugs, socket-outlets and socket-outlet adaptors</td>
<td>Legislation issued under Government Gazette No 33763 of 19 November 2010: making the compliance with SANS 164-0 a mandatory requirement for the selling and distribution of these products.</td>
</tr>
</tbody>
</table>

For SANS 164 products, which include all the commonly known plugs and sockets, cord extension sets and plug-in adaptors in use in South Africa; SANS 164-0 has the following applicable clause …

4.1.6 – Surge protective devices (SPDs) incorporated in a plug, in an adaptor or in a portable socket outlet shall comply with the requirements of SANS 61643-11. The SPD shall be a Class III device (a metal-oxide varistor or a silicon device) and shall incorporate a thermal disconnector that functions in series with its live connection. The internal connection of SPDs within a plug, an adaptor or a portable socket-outlet shall be such that the SPDs will provide both common mode and differential mode surge protection. An indicator shall be provided to indicate whether the SPD is operational.

… and is accompanied by the following circuit diagrams:

![Circuit Diagrams](image)

**F = thermal disconnector**

**Common mode:**
The MOV connected between L & E and/or between N & E.

**Differential mode:**
MOV connected between L & N.

The most appropriate connection is that shown in ‘Connection B’ of the standard.

**Why the thermal disconnector?**

The thermal disconnector is a crucial component in the surge protection circuit as it prevents a fire developing within the MOV assembly after it has absorbed repetitive surges over its lifetime.

The zinc oxide material in the MOV acts as a diode and, under normal voltages, it conducts a very small current of a few microamperes. However, after many surges,
small ‘holes’ develop within the structure and the current gradually increases where at around 1 milliampere, the heating effect raises the temperature of the device to levels where the epoxy coating can ignite. The thermal fuse, which is assembled in intimate contact with the MOV, protects it by interrupting the current when a temperature of 100 ºC has been exceeded. Usually, a neon or LED indicator lamp is connected in the protection circuit in order to show whether the MOV is functional or not. Once the indicator is OFF, the surge protection function has been disabled.

What required markings should be shown on a surge protected product and what do they mean?

According to the standard SANS 61643, there are several markings specified for the MOV itself, which are generally applied to the MOV components, usually in the form of a catalogue number and the MOV operating voltage. However, as far as SANS 164-0 is concerned, there are three items of information that are required to be visible to the user:

- **Surge category: Type III or the symbol**
  - Type III: As explained above, these devices are installed to reduce the overvoltage at the terminals of sensitive equipment. Their current discharge capacity is very limited. Consequently, they should be used in conjunction with Type II devices fitted to the main distribution board. A Type III device is tested with a combined high voltage and high current wave.

- **Open circuit voltage (surge):** \( U_{oc} = \text{Value in kV} \)
  - \( U_{oc} \): The open circuit voltage of the combined (surge) wave denotes the high voltage level of the surge that can be safely absorbed by the protection circuit. The higher this value the greater the capacity of the protection circuit’s ability to handle surges. Generally, a level of 2.5 kV or more is recommended.

- **Voltage protection level:** \( U_{p} = \text{Value in kV} \)
  - \( U_{p} \): Denotes the voltage protection level or the residual voltage that the equipment connected to it is exposed to, after having diverted the surge pulse.

  - The lower this value, the better protection is offered to the equipment being protected. Generally, a level of 1 kV or less is recommended.
  
  - In addition, at the indicator lamp, the legend: ‘If lit – surge protection on’ (or words to that effect).

What should a user look for to ensure the product is compliant and safe?

- Look for the markings as listed above.
- Look for certification marks such as the SABS mark or VDE.
- Look for the test specification marking: ‘Tested to SANS or IE 61643-11’.
- Look for the SAFEhouse logo. It is a supplier’s commitment to providing only safe products and services.
- If the product does not display ‘Tested to SANS 61643-11’ be cautious. Try to determine when the Letter of Authority (LOA) was issued by the National Regulator for Compulsory Specifications (NRCS)
- If the approval was issued before 2012, the product may not be fitted with a thermal fuse and can become a fire hazard.
- Read any product information and/or instruction leaflet carefully to understand the product’s capability and possible limitations. Surge protection products limit the surges but cannot eliminate all of them. If there is no literature with the product or if such information appears to be sketchy – be very careful.

What should purchasers look for to ensure adequate protection for the entire installation?

- Check whether the distribution board is fitted with surge suppression.
- If not, ask an electrician for a quote to fit Type II surge arrestors and get them installed before the seasonal storms.
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Make a commitment to safety.

The SAFEhouse Guide
Switches

Introduction

In the South African electrical industry, it is often said that “a switch is a switch is a switch!” Nothing could be further from the truth; switches and sockets are not only functional devices, they are also elements of interior design. They must have the technical requirements essential for modern household and office appliances and equipment, but should not detract from the aesthetic of their environment.

The following guide is applicable to alternating current (ac), whilst any direct current (dc) applications require confirmation with the relevant supplier regarding applicable ratings.

What does a switch do?

- Make and break current
- Indicate whether power supply is ON or OFF
- Provide aesthetic appeal.

What does a switch consist of and how does it work?

These are usually alloyed with small amounts of Nickel or Tin-oxide to ensure they do not weld together at the point of current inrush when switched on. High inrush currents are present where fluorescent lights are installed. The more light fittings, the higher the inrush.

Basic construction of a switch.

Contact ‘snap-over’ is a fundamental design characteristic, which prevents the user from ‘teasing’ the contacts by changing the switch-on speed and thereby allowing the moving contact to hover around the fixed contact – this causes arcing and eventual fritting away of the conductive parts, producing a risk of overheating and fire.

Switching surges (inrush currents)

Depending on the nature of the load, which may include fluorescent lights with transformer-type ballasts or a small electric motor, an inrush current will flow into that circuit at the point where the switch is switched on.

This inrush is generally of a short duration but there could be currents of a few hundred amperes. For this reason certain tests are included in the switch standard (SANS 60669-1) to determine that the switch can withstand such currents. If it cannot, in general, a switch would fail by developing an open circuit i.e. the contacts burning off, or the contacts could remain closed, known as ‘contact welding’.

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

This is the IEC symbol for a switch: Single pole, single throw and double pole, single throw. These are typically used in lighting circuits in electrical installations. There are other configurations such as change-over (two way) and intermediate switching.
The SAFEhouse Guide

Switches

SANS 60669-1 Clause 19.2 - Test circuit

The switch standard provides a test to determine the suitability of the switch to handle inrush current, normally present in fluorescent lighting loads. The test circuit consists of the following:

![Test circuit diagram]

Typical inrush current:

<table>
<thead>
<tr>
<th>A</th>
<th>Current in amperes</th>
</tr>
</thead>
<tbody>
<tr>
<td>RMS</td>
<td>Root Mean Square - measured value of alternating current</td>
</tr>
<tr>
<td>V</td>
<td>Voltage in volts</td>
</tr>
<tr>
<td>ms</td>
<td>Milliseconds or 1/1000th of a second</td>
</tr>
</tbody>
</table>

NB: Switches suitable for fluorescent loads are marked with the letters ‘AX’ behind the current rating, i.e. 10AX or 20AX. **Where the rating is marked only 10A or 20A, this switch is not suitable for fluorescent loads** and should therefore not be installed in such circuits.

### Switch functions and combinations

**Illumination:** Find it in the dark

**Two-way switching:** For corridors and multiple entries and exits

**Dimmer:** Alter light levels

**Sensor:** Detect presence and daylight

**Timer:** Select time-of-day switching

**Automation:** Programmable switching of loads

### What are the applicable standards?

The principal purpose of standards and compulsory specifications is to protect the user against unsafe products.

In the early 1990s, the SABS adopted many IEC standards to replace those developed in South Africa. Switches, which were covered under SANS 152, were then required to meet **SANS (IEC) 60669-1**. The applicable standards are tabulated below:

The wording below referring to ‘household’ installations is quoted from the regulations. These standards are **equally applicable to commercial and industrial installations** containing this equipment.

| SANS 60669-1 | Switches for household and similar fixed-electrical installations.  
|---------------|------------------------------------------------------------------|
| Which also refers to several parts listed below | Part 1: General requirements.  
| | (See switch configurations below). |

| SANS 60669-2-1 | Switches for household and similar fixed-electrical installations.  
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Part 2-1: Particular requirements – Electronic switches.</td>
<td>Includes: Touch switches, light dimmers, speed controllers (such as those for fans) with or without electronic switching devices, switches incorporating light sensors (daylight switches) and switches incorporating heat sensors (under-floor heating control units).</td>
</tr>
</tbody>
</table>

| SANS 60669-2-2 | Switches for household and similar fixed-electrical installations.  
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Part 2-2: Particular requirements – Electromagnetic remote-control switches.</td>
<td>Remotely activated switches making use of a relay or a stepping relay, which can be operated remotely by the application of an electrical signal.</td>
</tr>
</tbody>
</table>
### SANS 60669-2-3

**Switches for household and similar fixed-electrical installations.**


Time delay ON or time delay OFF, adjustable and operated by any means. Generally, these devices are not in use in SA but are quite common in Europe for stairways and corridors. When switched on, they remain on for a limited period of time only.

### SANS 60669-2-5

**Switches for household and similar fixed-electrical installations.**

Part 2-5: Particular requirements – Switches and related accessories for use in home and building electronic systems (HBES).

Switches for home and building automation. Programmable switches and associated accessories such as electronic relays and switching modules.

### VC8003

Which refers to the standards listed above and additional administrative requirements

The SA compulsory specification for switches for fixed installations.

This includes administrative requirements.

Legislation issued under Government Gazette No. 38441 of 6 February 2015, making the compliance with SANS 60669 series of standards a mandatory requirement for the selling, distribution and installation of these products.

### SANS 10142-1

Wiring of premises.

Refer to the SAFEhouse Guide to Electrical Installations.

Table 4.1 of this standard specifies VC8003 as the mandatory safety specification for manually operated switches.

### Switch configurations (Patterns according to the standard)

SANS 60669-1 lists several switch ‘patterns’, each of which is tested to a defined protocol depending on the contact configurations. Here are the standard patterns, together with a brief description of their applications:

<table>
<thead>
<tr>
<th>PATTERN No.</th>
<th>No. OF POLES</th>
<th>DIAGRAM</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td><img src="image" alt="Single-pole switch" /></td>
<td>Single-pole switch: Most commonly used for wall switches for lights, which disconnect only the live conductor.</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td><img src="image" alt="Two-pole switch" /></td>
<td>Two-pole switch: Used where the disconnection of both Live and Neutral conductors is required for full isolation of the load circuit.</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td><img src="image" alt="Three-pole switch" /></td>
<td>Three-pole switch: Used for three-phase circuits, disconnecting only the three live conductors.</td>
</tr>
<tr>
<td>03</td>
<td>4</td>
<td><img src="image" alt="Three-pole plus switched neutral switch" /></td>
<td>Three-pole plus switched neutral switch: Used for three-phase, four-wire circuits, where all the live and neutral conductors are disconnected.</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td><img src="image" alt="Two-way switch with OFF position" /></td>
<td>Two-way switch with OFF position: Used to control two stage circuits (high/low) with an off position.</td>
</tr>
<tr>
<td>5</td>
<td>1</td>
<td><img src="image" alt="Two-circuit switch with a common incoming line" /></td>
<td>Two-circuit switch with a common incoming line: Used mainly for multiple light circuits, disconnecting only the live conductor.</td>
</tr>
<tr>
<td>6</td>
<td>1</td>
<td><img src="image" alt="Two-way switch" /></td>
<td>Two-way switch: Used where the light circuit can be switched on and off in two separate locations, disconnecting the live conductor only.</td>
</tr>
<tr>
<td>6/2</td>
<td>2</td>
<td><img src="image" alt="Two-way, double pole switch" /></td>
<td>Two-way, double pole switch: Used as above but where the live and neutral conductors are disconnected.</td>
</tr>
<tr>
<td>7</td>
<td>1</td>
<td><img src="image" alt="Intermediate switch" /></td>
<td>Intermediate switch: Used for multiple control of a light circuit, where several points are used to switch the light circuit on and off.</td>
</tr>
</tbody>
</table>

The choice of switch configurations and patterns is determined by the required functions, which is best left to qualified persons.
The SAFEhouse Guide
Switches

Two common examples of the use of different pattern type switches are as follows:

**Typical two-way switching arrangement:**

- Two entries: Where the single light circuit is to be switched at each entry, two-way switches (pattern No. 6) are fitted at each entry and wired according to the diagram. In this case, irrespective of whether the light is on or off, it can be switched at either entry / exit.

**Typical intermediate switching arrangement:**

- Multiple entries: Where the single light circuit is to be switched at each entry, intermediate switches (pattern No. 7) are fitted at each entry between the first and last two-way switch (pattern No. 6) and wired according to the diagram. In this case, irrespective of whether the light is on or off, it can be switched at any of the entry/exit points.

**EMC and EMI compliance**

Electronic switches, including various products for home automation, require compliance with the Electromagnetic Compatibility (EMC) and Electromagnetic Interference (EMI) characteristics that are part of the standards. Broadly, these important aspects cover the following:

**EMC:** The switch’s emission of high frequency wavelengths is limited to certain prescribed levels – to prevent it from interfering with various other signal transmissions.

**EMI:** The switch is not acted upon by spurious signals imposed on it from outside sources.

The custodian of these requirements is the Independent Communications Authority of South Africa (ICASA) in terms of the Electronics Communications Act No. 36 of 2005.

**SUBSTANDARD PRODUCTS:**

Typical shortcuts taken by unscrupulous manufacturers

Safety of a switch is compromised by unscrupulous manufacturers in order to reduce costs. Some suppliers may do so out of ignorance or negligence. Typical compromises and failings are:

- Avoiding the product testing and regulatory requirements altogether.
- Using inferior plastics that are not heat-resistant.
- Avoiding the use of silver contacts, which would lead to abnormal heat rise.
- Providing inadequate contact pressure, leading to overheating.
- Providing inadequate thickness of copper/brass contacts, leading to overheating.
- Poor contact mechanism design, leading to contact freezing and/or an open circuit.

**Some guidelines as to what users can do to avoid using unsafe products:**

- Buy brands you know and can trust.
- Buy from reputable distributors, outlets and installers.
- Beware of copies of prominent brands.
- Be suspicious of prices substantially lower than for...
other, similar products or services on offer.

- Try to make contact with the seller’s supplier and judge responses critically.
- Be suspicious of lack of information on, or with, the product packaging and on the product itself. Specifications require certain minimum markings. Packaging should describe the electrical capacities and the correct application of the product. Look out for contradictions between data provided e.g. different voltage ratings for the same product.
- If the purchase warrants it, ask the supplier for references to other users – and make the effort to contact them.
- When dealing with an electrical contractor, ask about its membership of the ECA (Electrical Contractors Association) and call the ECA in your region to check credentials. Be critical of a suspect installation or a Certificate of Compliance (COC) that is issued too easily.
- Ask the supplier to prove compliance with regulations: A National Regulator for Compulsory Specifications (NRCS) approval in the form of a Letter of Authority (LOA) for the products used that are subject to regulations (See the SAFEhouse Guide to the Regulation of Electrical Products).
- Look for the test specification marking: ‘Tested to SANS 60669’ or ‘VC8003’.
- Look for certification marks such as SABS, VDE and UL. (Note that the SABS mark is not necessarily a substitute for the LOA).
- Beware of fraudulent use of well-known certification emblems, such as the SABS mark.
- Be careful - A ‘CE’ mark is not necessarily proof of conformity or of independent testing.
- Report any electrical product failure to the dealer, manufacturer, the NRCS and, if applicable, the National Consumer Commission.

If in doubt, check with the SAFEhouse Association for information it may possibly have to help you.

<table>
<thead>
<tr>
<th>Examples of switches to illustrate differences in aesthetics</th>
</tr>
</thead>
</table>

The purchaser has a wide variety of aesthetics to choose from, including colours and finishes of wall plates to suit any interior design.
The South African SAFEhouse Association is an independent, registered, non-profit organisation established by the electrical industry and committed to communicating with customers.

SAFEhouse has been established to combat the proliferation of dangerous products and services by making the market aware of the risks in using such products and services, exposing sub-standard products and services, and persuading specifiers, suppliers and distribution channels not to recommend or to offer such products and services for sale.

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If you have doubts about a particular product or service, contact SAFEhouse for guidance.

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For a list of reputable local manufacturers or for technical information on these products, please contact: