

The SAFEhouse Guide to Luminaires

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Introduction

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.



Pendant luminaire.

- **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.



Interior fluorescent luminaire.

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



Industrial luminaire.

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



Floodlight.

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.

(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 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 lighting, luminaires, lamps and lighting components are available. Information can be obtained from suppliers.

While every care has been taken in compiling the information contained in this guide, neither the SAFEhouse Association nor the publisher can accept any responsibility for any errors or omissions herein.

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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Luminaire safety

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:



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 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.

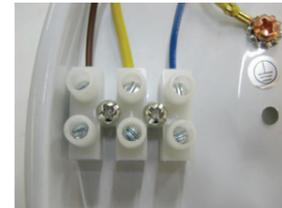
Flammable materials: Covers, shades and similar parts not having an insulation function shall be adequately spaced from any heated part in the luminaire that could raise the material to its ignition temperature.

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.
- 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:



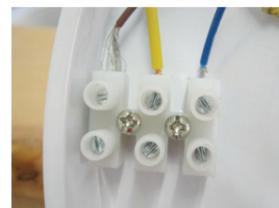
No grommet on the inside of the nipple.



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

Thermal control

- 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.
- 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.

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, however, there are no compulsory local standards for LED lamps.
- There are two standards that may be applied voluntarily by suppliers and specifiers:
 - > SANS 62560: South African National Standards.
 - > IEC 62560: International Electrotechnical Commission.There appear to be very few products that are certified against these standards.
- The 'CE' mark appears on many products. This is a manufacturer's claim to a certain quality standard. It is not an indication of independent, third party, testing.
- The nature of LED performance claims being made cannot usually be validated by buyers, whether they are resellers, electrical contractors or users – until it's too late.

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.

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

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