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Knowledge Base

CORRELATED COLOUR TEMPERATURE (CCT)

Correlated Colour Temperature (CCT) is a measurement of the colour appearance of a light source, expressed in degrees Kelvin (K). It is used to describe the "warmth" or "coolness" of the light, with lower numbers (2700-3000K) being considered "warm" or "soft" and higher numbers (5000-6500K) being considered "cool" or "daylight." . CCT is commonly used as a specification for lighting products. CCT is a way of standardizing the colour appearance of different light sources so that they can be compared and specified for various applications, such as lighting design, photography, and video production.

The appropriate Correlated Colour Temperature (CCT) for different lighting applications is based on the application, desired mood, ambiance, personal preferences and other external factors..

Correlated Colour Temperature (CCT) for mining and industrial lighting applications should be based on the specific task and environment. As a rule of thumb CCT for underground and industrial lighting is between 4000K-6500K.

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CHEMICAL RESISTANCE OF A LUMINAIRE MATERIALS HOUSING AND LENS

The chemical resistance of a luminaire housing and lens materials is an important factor to consider when selecting lighting fixtures for industrial or harsh environment applications. The housing and lens materials must be able to withstand exposure to chemicals, fuels, and other potentially corrosive substances without deteriorating or becoming damaged.

The most common materials used for luminaire housing and lenses are: -

- Aluminium: Highly resistant to corrosion and commonly used for lighting fixture.
- Stainless Steel: Resistant to corrosion, ideal for harsh environments and harsh chemicals, and commonly used for industrial lighting fixtures.
- Polycarbonate (PC): Resistant to impact, UV rays, and certain chemicals, and hence PC is commonly used for both indoor and outdoor lighting fixtures.
- Acrylic: Resistant to impact and UV rays, but not as resistant to chemicals as polycarbonate or glass.
- Glass: Resistant to impact, UV rays, and certain chemicals, but can be brittle and prone to breaking.

When selecting housing and lens material careful consideration must be given to the specific operating environment, as some materials may be more suitable for certain applications. By way of example in the food and beverage industry, glass cannot be used in many applications, which results in a need to utilize other alternatives. Finding alternatives is sometimes a complex process as many of the commonly used materials may not comply with the SANS standards due to heat resistance, IP ratings and other factors, hence choosing a correct luminaire for an application often requires specialized knowledge.

While the manufacturer's datasheet should provide information on the chemical resistance of the specific material used in the luminaires, care

should be taken, and expert advice sought to ensure the appropriateness of the product in the desired application.

Our R&D specialists can assist you with product specifications for your applications.

(Download Table) Eben to find.

THE TEMPERATURE RESISTANCE OF LUMINAIRE HOUSING AND LENS MATERIALS

Temperature resistance is a critical consideration when selecting luminaires for use in high-temperature environments. The housing and lens materials must be able to withstand high temperatures without degrading, melting, or becoming damaged, as this can significantly impact the longevity and functionality of the lighting fixtures.

A common issue in luminaire design is inadequate heat sinking, resulting in reduced lifetimes of the chips and drivers. Therefore, choosing materials with excellent thermal conductivity and heat dissipation properties is crucial in ensuring the longevity and optimal performance of the luminaire. In the petrochemical industry, the selection of housing and lens materials is crucial due to the harsh exposure to chemicals, fuels, and high temperatures. The materials must be able to withstand exposure to these conditions without compromising their structural integrity.

Generally, materials such as aluminum and stainless steel are highly resistant to high temperatures and are commonly used in industrial and outdoor lighting fixtures. On the other hand, polycarbonate and acrylic are also high-temperature resistant but can become brittle at low temperatures.

It's important to note that the manufacturer's datasheet should provide information on the temperature resistance of the specific material used in the luminaire. Therefore, selecting materials with excellent temperature resistance, thermal conductivity, and heat dissipation properties will help ensure optimal performance and longevity in high-temperature environments.

The most common materials used for luminaire housing and lenses and their temperature resistance are:

- Aluminium: Resistant to high temperatures and commonly used for outdoor and industrial lighting fixture.
- Stainless Steel: Resistant to high temperatures and commonly used for industrial lighting fixtures.
- Polycarbonate (PC): Resistant to high temperatures but can become brittle at low temperatures.
- Acrylic: Resistant to high temperatures but can become brittle at low temperatures.
- Polyethylene (PE): Resistant to chemicals, fuels, and impacts, making it ideal for harsh industrial environments.
- Glass: Resistant to impact, UV rays, and certain chemicals, but can be brittle and prone to breaking.

It should be noted that where the materials noted above cannot meet the requirements,, there are specialised materials designed to withstand unique situations, particularly in specialised chemical environments.

Special care should be taken, and expert advice sought to ensure the appropriateness of the materials to be used in the desired application.

Our R&D specialists can assist you with product specifications and or lighting solutions specific to your applications.

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Specialised applications

Hazardous

Oil and gas

Mining

Food and Beverage Luminaires

Luminaires used in the food and beverage industry in South Africa must comply with various standards to ensure their safety and suitability for use in food processing and preparation areas. The South African National Standards (SANS) is the national standardization body responsible for developing and publishing national standards that such luminaires must comply with. Additionally, HACCP, a food safety management system, mandates that luminaires used in food and beverage processing areas comply with relevant standards to prevent contamination and ensure food safety.

Ingress Protection (IP) ratings, such as IP65 or IP66, define the degree of protection against the ingress of solid and liquid objects into the luminaire, making them crucial for food safety. Luminaires must have a high IP rating to prevent moisture ingress and enable easy cleaning. It is critical to select a luminaire that complies with relevant standards for the food and beverage industry in South Africa to guarantee the safety and suitability of lighting for use in food processing and preparation areas.

The manufacturer's datasheet should provide information on the standards that the luminaire complies with, including its temperature resistance, IP rating, and chemical resistance to ensure its suitability for the specific environment.

It is imperative when selecting a luminaire, that it complies with relevant standards for the food and beverage industry in South Africa, as this

helps ensure the safety and suitability of the lighting for use in food processing and preparation areas.

If you require assistance on finding a solution to your application our specialist Engineering and R&D team ready to assist you

HAZARDOUS AREA LIGHTING

NOTE-Hazardous area classification and zoning are complex and technical subjects, and it is advisable to seek the assistance of a hazardous area specialist to ensure compliance with the relevant standards and regulations.

Our team of specialists can assist you with your zoning requirement.

A hazardous area is a location where flammable gases, liquids, dusts, or fibers are present, and there is a risk of fire or explosion. Hazardous areas are commonly found in industries such as petrochemical, oil and gas, mining, chemical processing, and others where flammable gases, liquids, dusts, or fibers are present. Specific examples of hazardous areas include oil and gas production facilities, refineries, chemical plants, gas processing plants, loading docks, pump rooms, grain storage facilities, flour mills, woodworking plants, and more. Hazardous areas can also be found in certain types of manufacturing facilities, laboratories, and other settings where hazardous materials are present..

For lighting in hazardous areas, the following factors must be considered to ensure the safety of the area.

- Gas and Dust Group: In hazardous areas, gases and dusts are classified into different groups based on their properties, such as flammability and explosive potential. These classifications are used to determine the appropriate lighting fixtures, electrical equipment, and other devices that can be used safely in these areas.

- Temperature Classification: In hazardous areas, temperature rating refers to the maximum temperature that a particular piece of

electrical equipment or instrumentation can reach without causing the surrounding flammable material to ignite or explode. The temperature rating of a hazardous area is important because it helps to determine the type of equipment that can be safely used in that area.

- Ignition Protection: Ignition protection refers to the methods and techniques used to prevent the ignition of transfer of energy of flammable gases, vapors, or dust in hazardous areas. In the context of lighting fixtures used in hazardous areas, ignition protection is necessary to prevent sparks or arcs that could ignite the flammable substances in the surrounding atmosphere.
- Area Classification: Area classification is the process of identifying and defining hazardous areas in a facility where flammable gases, liquids, dusts, or fibers may be present, and assessing the likelihood of a hazardous event occurring. The area classification is based on the type and quantity of the flammable substances present, the ventilation in the area, and the frequency and duration of their presence. The area classification is used to determine the appropriate type of equipment that can be safely used in each classified area. In hazardous areas, it is important to ensure that all equipment, including lighting fixtures, are designed and tested to meet the requirements of the specific area classification.

Lighting fixtures are specifically designed for use in hazardous areas and to comply with relevant standards and regulations to ensure the safety of the area. In order to be compliant these lighting fixtures are subjected to extensive testing by accredited certification laboratories and are issued with certifications for the specific hazardous area that they can be utilized in.

In South Africa, the hazardous area zoning standards are based on the SANS 10108 and SANS 60079-10-1/2 standards, which is part of the South African National Standards (SANS) system. This standard classifies

hazardous areas into zones based on the likelihood and duration of the presence of an explosive atmosphere.

Zone 0: This is the most hazardous area, where an explosive atmosphere is present continuously or for long periods. This might include locations where highly volatile substances, such as gases or vapours, are handled or processed.

Zone 1: This is an area where an explosive atmosphere is likely to occur occasionally during normal operations. For example, this could include the area surrounding the opening of a tank containing flammable liquids.

Zone 2: This is an area where an explosive atmosphere is not likely to occur during normal operations, but where it may still occur infrequently or for short periods. For example, this could include areas where flammable dust is generated during material handling processes.

Zone 20: This is an area where a cloud of flammable dust is present continuously or for long periods. This might include areas such as grain silos, where dust is generated as a by-product of the stored material.

Zone 21: This is an area where a cloud of flammable dust is likely to occur occasionally during normal operations. For example, this could include areas around the opening of a container containing flammable powders.

Zone 22: This is an area where a cloud of flammable dust is not likely to occur during normal operations, but where it may still occur infrequently or for short periods. For example, this could include areas where fine powders are produced or handled during manufacturing processes.

In all Zoned areas, electrical equipment, including lighting fixtures, must be specifically designed and certified for use in said hazardous areas, and must meet specific requirements to ensure that they do not pose a risk of ignition.

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HAZARDOUS AREAS ZONING SERVICES

Hazardous area classification is typically carried out by trained professionals with expertise in the specific industry or environment in question.. However, in general, hazardous area classification should be carried out by individuals who have a solid understanding of the properties of hazardous materials and the risks associated with their presence in different environments.

In some cases, hazardous area classification may be carried out by internal staff, such as health and safety professionals, engineers, or maintenance personnel, who have received appropriate training and certification. However, in most applications, it is recommended to engage external consultants or specialized hazardous area classification services to ensure that the classification is performed correctly and in compliance with relevant regulations.

In general, hazardous area classification involves a thorough assessment of the potential risks associated with the presence of hazardous materials in a given environment. This may include the analysis of factors such as the types and quantities of hazardous substances present, the ventilation and confinement of the area, and the likelihood and duration of hazardous conditions. Based on this assessment, zoned areas are then designated, and appropriate safety measures are identified and implemented to mitigate the identified risks.

Nordland has a team of accredited Zoning specialists ready to assist you with your area zoning requirements.

Our team of specialists are not only accredited zoning specialists but also have extensive experience in the development and manufacture of Ex products and solutions for numerous applications and environments. Hence, they will also be able to assist you in assessing any specialized

characteristics of the operating environment which may require unique product features to be incorporated into the luminaire design.

When doing an area zoning exercise, particularly in older application areas, we recommend that the team should also carry out a lighting survey and review the existing lighting infrastructure. We tend to find that over a period of time the older installed lighting has become a mixture of different technologies and products and hence standardizing the lighting in a retrofit program can add significant benefits.

The significant performance enhancement and longevity of well manufactured LED luminaires has created the opportunity to do retrofit programs that are both cost effective, provide better lighting, and reduced maintenance.

Please contact our team of certified zoning specialists for assistance

LIGHTING SURVEYS

A lighting survey is a valuable tool for business owners who want to ensure that their premises are operating at peak efficiency. Not only can it identify any potential lighting problems, such as compliance with OHS or other applicable standards, improper zoning of hazardous areas and placement of emergency lighting, but it can also help to determine the best types of lighting systems to install in order to maximize energy savings. Furthermore, a lighting survey can help identify potential safety issues, such as glare or other hazardous conditions, and can provide guidance on how to improve the overall lighting system. A lighting survey is an important step in creating a safer, more efficient operating environment, and it is essential for any business owner who wants to ensure their premises are running effectively.

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With the significant improvement in LED lighting performance over the last three years combined with the dire need to reduce power usage in cost a lighting survey has become key to every business operation

Please contact us for specialist assistance.

LIGHTING SURVEYS (Technical section)

A lighting survey is an evaluation of a building or space's current lighting system and conditions. It involves measurement of lighting levels, assessment of lighting quality, and identification of potential issues or areas for improvement. The purpose of a lighting survey is to determine the adequacy and efficiency of the existing lighting system and to provide recommendations for upgrades or changes to meet current lighting standards and the specific needs of the space.

A lighting survey typically involves using specialized equipment to measure light levels and involves gathering information about the type and age of lighting fixtures, electrical systems, and control systems. The data collected during the survey is analyzed and used to develop recommendations for improving the lighting system, such as upgrading fixtures, increasing energy efficiency, or adding lighting controls.

The primary focus of a hazardous area lighting survey is to ensure that the lighting system meets the relevant safety and regulatory standards. This includes evaluating the type of fixtures and electrical systems used, the level and distribution of light, and the availability of backup power sources. The survey may also assess the suitability of lighting controls, such as dimming or emergency lighting systems, to ensure they meet the necessary safety requirements.

The results of the lighting survey are used to identify any potential risks and make recommendations for improvements to meet the required safety standards. A well-designed lighting system in a hazardous area

should provide adequate illumination, minimize the risk of ignition, and provide reliable backup lighting in case of power failure.

Lighting surveys are conducted by lighting professionals, such as lighting designers, engineers, or certified lighting experts, to ensure accurate and comprehensive results.

Nordland has a team of experts to cover all types of lighting surveys with particular emphasis on the Mining, Oil and gas, and Industrial sectors where more complex surveys are required.

Note that in doing a lighting survey our team will also be in a position to assessing the hazardous zoning of a facility.

Please contact us for specialist assistance

LIGHTING DESIGN AND PHOTOMETRY (Technical)

Photometry

Photometry refers to the science of measuring light and its properties, such as its intensity, distribution, and colour. In the context of lighting design, photometry is used to determine the amount and distribution of light produced by a lighting fixture, and how it will impact the surrounding environment. This information is used to create lighting systems that are energy-efficient, visually appealing, and meet specific requirements such as safety and visibility standards.

A photometric lighting design is essential for any industrial plant that wants to ensure maximum efficiency and safety. With a photometric lighting design, the level and distribution of light can be precisely tailored to the specific needs of the industrial plant. Typically, an optimised lighting design will include a provision for lumen losses over a forecast period to ensure that the placement of luminaires in a facility are designed to meet all regulated standards and an effective operating

environment over an extended forecast period in order to ensure sustainability of a lighting project.

A well-planned lighting design involves considering factors such as energy efficiency, maintenance, and cost. This will result in a lighting system which provides adequate illumination for workers and machinery, minimize shadows and glare, and improve overall productivity while optimising on the CAPEX and future maintenance costs.

Additionally, a photometric lighting design can enhance the overall aesthetic of the plant and create a more comfortable working environment. For any industrial plant looking to maximize efficiency and safety, a photometric lighting design is an essential part of the process.

Nordlands team of accredited IESSA lighting designers can assist you with all types of design work.

RELUX LIGHTING DESIGN SOFTWARE

"Relux" is a lighting simulation software used to create virtual visualizations of indoor and outdoor lighting schemes. It is commonly used in the architectural, engineering and construction (AEC) industry to calculate the amount of light present in a space, predict the energy consumption and to design lighting systems. The program allows the user to import floor plans, insert light fixtures and run simulations to see how light will be distributed in a space, including shadows and reflections.

Nordland's highly experienced team of IESSA accredited lighting designers can assist you with any design requirements.

PHOTOMETRY

Photometry refers to the science of measuring light and its properties, such as its intensity, distribution, and colour. In the context of lighting design, photometry is used to determine the amount and distribution of light produced by a lighting fixture, and how it will impact the surrounding environment. This information is used to create lighting systems that are energy-efficient, visually appealing, and meet specific requirements such as safety and visibility standards. Photometric data is usually presented in the form of photometric diagrams and luminance maps, which can be generated using specialized simulation software such as Relux.

IES FILES

The term "IES" is most commonly used in the context of lighting and stands for "Illuminating Engineering Society". An IES file is a file format that provides information about the light distribution of a lighting device, such as a luminaire or lamp. It contains data on how light is emitted from the device, including the intensity and direction of light at various angles. This information can be used by lighting designers and engineers to simulate the light output of a device and predict its performance in a given environment.

In architectural and interior design, IES files are used to predict the light levels and distribution in a space, and to evaluate the performance of different lighting fixtures. The IES format has become a standard in the lighting industry, and many lighting manufacturers provide IES files for their products.

The IES file format is based on the photometric data collected by lighting manufacturers through laboratory testing. This data is then processed and stored in a standard format, which can be easily read by lighting design software, such as Relux, Dialup or AGi32,

LUX AND LUX LEVELS

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Lux is a unit of measurement for light intensity that is used in lighting design and analysis. It is defined as the amount of luminous flux per unit area and is commonly used to express the illuminance on a surface. The lux level is a measure of the amount of light that falls on a surface, and is used to assess the adequacy and quality of lighting in a space.

The lux level is an important factor in lighting design, as it determines the visibility, comfort, and safety of a space. A higher lux level results in better visibility and increased safety but can also lead to discomfort due to glare or high levels of illumination. A well-designed lighting system should aim to provide an appropriate and consistent lux level throughout the space, while also considering factors such as energy efficiency and visual comfort

The typical lux levels required for different applications vary based on the specific use and requirements of the space. Here are some general guidelines for common applications:

Office spaces: 400 to 500 lux
Residential spaces: 50 to 100 lux
Classrooms: 400 to 500 lux
Retail spaces: 100 to 1000 lux
Industrial spaces: 100 to 500 lux
Hospitals: 300 to 500 lux
Street lighting: 2 to 10 lux
Emergency lighting: 0.3to 3 lux
Museums and art galleries: 50 to 150 lux

It's important to note that these are very general guidelines and may vary depending on the specific requirements of each space.

The lux level required for a space may be influenced by several factors, including the size and layout of the space, the activities performed within the space, the colour and texture of surfaces, and the availability of natural light. A lighting designer or engineer will assess these factors and make recommendations for the appropriate lux level based on the specific needs of the space

For specific assistance with a workplace requirement please contact one of our IESSA accredited lighting specialists for assistance

Specialised

Lux levels for mining applications

The lux levels required in underground mining applications vary based on the specific use and conditions of the mine. In general, the lux level must be sufficient to ensure the safety and productivity of workers, while also meeting relevant health and safety regulations

According to international mining standards and regulations, such as the International Labour Organization (ILO) and the South African Department of Mineral Resources, the standard recommends a minimum illuminance of 20 lux for haulage roads, 50 lux for loading and tipping points, and 100 lux for work areas where visual tasks are performed. The standard also recommends higher levels of illuminance for emergency areas and areas where safety-related tasks are performed. Kindly note that these are general guidelines, and the actual lux level required in a mine may vary based on the size and layout of the mine, the type of ore and minerals being extracted, and the specific lighting fixtures and systems used.

A lighting designer or engineer will assess these factors and make recommendations for the appropriate lux level based on the specific needs of the mine.

LED LUMEN LOSS AS A RESULT OF HEAT

LED (Light Emitting Diode) lumen loss is the reduction in light output from an LED light source over time due to various factors, including heat

When an LED operates at higher temperatures, its internal components can degrade, leading to a decrease in light output and a corresponding decrease in luminous efficacy. Additionally, high temperatures can also affect the longevity of the LED and its ability to produce consistent light output over time.

To mitigate the impact of heat on LED lumen output, it is important to properly design and maintain the thermal management system, which helps dissipate heat away from the LED. This may involve the use of heat sinks, fans, or other cooling systems, as well as proper placement of the LED within a fixture or lamp to ensure proper air flow and ventilation. Proper thermal management can help extend the life of an LED and reduce the amount of lumen depreciation over time.

LED LUMEN DEPRECIATION

LED lumen depreciation refers to the reduction in light output from an LED light source over time. This can be caused by various factors, including heat, current fluctuation, and component degradation. As the LED ages, its components can degrade, leading to a decrease in light output and a corresponding decrease in luminous efficacy. This reduction in light output is referred to as lumen depreciation.

The rate of LED lumen depreciation varies depending on the quality of the LED components, the operating conditions (e.g. temperature, current), and the specific application. Generally, high-quality LED lights have a slower rate of lumen depreciation than lower-quality options. To minimize the impact of lumen depreciation, it is important to choose high-quality LED lights and to properly design and maintain the thermal management system, which helps dissipate heat away from the LED. Proper maintenance, such as regular cleaning and avoiding over-driving the LED, can also help extend the life of an LED and reduce the amount of lumen depreciation over time.

LED HEAT SINKING

LED heat sinking refers to the process of removing heat from the LED light source to prevent overheating and to maintain optimal operating conditions. Heat is generated during LED operation and must be dissipated to prevent damage to the LED and to ensure its consistent performance.

Heat impacts lumen depreciation in LED lighting because the increased heat causes the LED chips to become less efficient over time. The higher the temperature of the LED chips, the more quickly the light output (or "lumens") will degrade. This degradation can be accelerated by other factors, such as dust, dirt, and humidity. The lumen depreciation due to heat can be minimized by ensuring the LED chips are properly cooled and protected from dust, dirt, and humidity. Additionally, it is important to select LED lighting fixtures that are designed to withstand higher temperatures, as this will help to reduce lumen depreciation.

Heat sinking is typically accomplished using a heat sink, which is a passive component that is designed to dissipate heat away from the LED and into the surrounding environment. A heat sink may be integrated into the LED package or attached to the LED as a separate component. The heat sink may have fins or other features that increase its surface area and improve its ability to dissipate heat.

In addition to heat sinks, other cooling methods, such as fans or liquid cooling systems, may be used to manage heat in LED lighting applications. Proper thermal management is essential to extend the life of an LED and to maintain its consistent performance over time.

LED lifetime is rated in terms of the number of operating hours (or "L Rating") at which the LED reaches a certain % of its initial light output. This is typically measured on LED bulbs and LED fixtures and is expressed in hours. The higher the rating, the longer the LED is expected to last before it needs to be replaced. Generally, most LED bulbs and fixtures have a rated lifetime of 50,000 to 100,000 hours.

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LED LIFETIME

The lifetime of an LED (Light Emitting Diode) depends on various factors such as temperature, current, and manufacturing quality. On average, the lifetime of an LED is rated at 50,000 to 100,000 hours under normal operating conditions. This means that if an LED is operated at the manufacturer's specified current and temperature and is not subjected to external damage, it will continue to operate for the rated lifetime before it reaches the end of its useful life. However, it's important to note that actual LED lifetime can vary greatly based on specific conditions and the quality of the driver, the power it is driven by and the luminaire's heat sinking.

L-RATING

The L-rating of an LED (Light Emitting Diode) refers to its expected lifetime or longevity under specific conditions. The L-rating is usually expressed in terms of hours of operation, and it is an important parameter to consider when designing LED-based lighting systems.

Temperature is one of the most significant factors that affect the L-rating of LEDs.

The L Rating is an extrapolation of degradation at differing temperatures to provide an expected life expectancy.

TM-21 is a testing method that is used to determine the lumen maintenance or lifespan of an LED lighting product. The test involves running the LED product for a certain number of hours, typically 6,000 to 10,000, and then measuring the light output to see how much it has degraded. Based on this data, a projection can be made for how long the LED product will last before it reaches a certain percentage of light loss, typically 30%. This information is important for manufacturers, designers,

and end-users to make informed decisions about the reliability and maintenance requirements of LED lighting products.

Care should be taken reading data sheets ….

The relationship between L-rating and temperature can be described by an inverse exponential function, commonly known as the Arrhenius equation. The Arrhenius equation is based on the principle that chemical reactions, such as the degradation of LED materials, are temperature-dependent and increase exponentially with temperature.

From the Arrhenius equation, we can see that the L-rating of an LED decreases exponentially with increasing temperature. For example, if an LED has an L-rating of 50,000 hours at a temperature of 25°C, its L-rating will decrease to 25,000 hours at a temperature of 45°C (assuming an activation energy of 0.7 eV).

It's important to note that the Arrhenius equation is a model and that the actual L-rating of an LED under specific temperature conditions may deviate from the predicted values due to other factors such as current, humidity, and voltage. Therefore, it's essential to conduct reliability tests to verify the L-rating of LEDs under specific operating conditions.

LED lifetime is rated in terms of the number of operating hours (or "L-Rating") at which the LED reaches 70% (L70) of its initial light output. This is typically measured on LED lamps and is expressed in hours. The higher the rating, the longer the LED is expected to last before it needs to be replaced. Generally, most LED lamps and fixtures have a rated lifetime of 50,000 to 100,000 hours.

The L-rating is typically done at a specific temperature, such as 25°C. This is because the lifetime of an LED is affected by temperature, and the L-rating is intended to be a standardized measure of LED lifetime. As such, the L-rating is usually done at a specific temperature to ensure that the results are consistent and accurate.

Where ambient operating temperatures are higher than 25°C the lifetime of the LED will diminish at a rate faster than the L-rating prediction. In these instances, it is advisable to choose a luminaire with enhanced cooling systems.

LED COB (CHIP ON BOARD)

COB refers to a "chip on board "layout of LEDS.

COB LED systems are often more reliable than other LED luminaires because they contain multiple LED chips that are connected together in a single package, which helps to ensure that the overall system is more reliable and efficient than a single-chip LED luminaire. Additionally, COB LED systems are typically designed to be more durable and have a larger thermal footprint, which helps to ensure that they have a longer lifetime than other LED luminaires. It is also important to select LED lighting fixtures that are designed to withstand higher temperatures, as this will help to reduce lumen depreciation and ensure the LED light's performance is not compromised.

Many of the cheaper luminaires utilise a single high power chip system in there luminaires. This type of system will concentrate significantly more heat at the thermal junction which cannot be dissipated at an effective rate and will result in early degradation and or failure. In addition, if the driver is installed to close to the LED chips the electronic components will be prone to early failure.

LED NOMINAL LUMENS VS SYSTEM LUMENS

The difference between nominal lumens and system lumens in LED lighting refers to the amount of light that is produced by the LED light source, and the amount of light that is available for use after taking into account various losses and factors.

Nominal lumens refer to the amount of light that is produced by the LED light source when operated under ideal conditions, such as at a specific

current and temperature. This number is usually specified by the manufacturer and is based on laboratory testing.

System lumens, on the other hand, take into account the various losses and factors that can reduce the amount of light available for use in a real-world lighting application. These losses can include things like

- Optical efficiency
- Thermal losses
- Electrical losses
- Manufacturing variables

System lumens provide a more accurate representation of the amount of light that is available for use in a specific lighting application and is a useful metric for comparing different LED lighting options and determining the appropriate light level for a given space.

When comparing luminaires it is essential that a consumer understands the concept of Nominal vs system lumens together with the way in which the driver is delivering power to the LED Chips. An overdriven LED Chipset may produce more lumens but at a reduced lifetime of the LEDs if the thermal increases aren't managed.

LUMINOUS FLUX

Luminous flux is a measure of the total amount of visible light emitted by a light source. It is expressed in units of lumen (lm) and is used to quantify the overall brightness of a light source. The luminous flux of an LED light source is a key metric that is used to determine its performance and efficiency.

Luminous flux is calculated by measuring the amount of light emitted in all directions and integrating it over the solid angle of the light source. The luminous flux of an LED light source can be influenced by various

factors, including the LED chip efficiency, the type of phosphor used (for white LEDs), and the design of the LED package.

When selecting an LED light source, it is important to consider the luminous flux, along with other performance metrics, such as colour rendering index (CRI), colour temperature, and efficacy, in order to determine the best option for a specific application. The luminous flux of an LED light source can also be affected by its operating conditions, such as temperature and current, so it is important to maintain proper thermal management to ensure consistent performance over time.

CRI – (COLOUR RENDERING INDEX)

CRI (Colour Rendering Index) is a measure of the ability of a light source to accurately render the colour of objects compared to an ideal or natural light source. It is a scale that ranges from 0 to 100, with higher numbers indicating better colour rendering.

In LED lighting, the CRI is a critical factor that affects the perceived quality of light and the appearance of objects under the light. LED lights with high CRI produce light that is similar in quality to natural light and accurately render the colour of objects, while lights with lower CRI can produce a colour cast and make objects appear unnatural.

CRI is calculated by comparing the spectral power distribution of the light source to that of a reference light source and evaluating the colour shift of eight standard colour samples. The CRI of an LED light source can be influenced by various factors, including the LED chip efficiency, the type of phosphor used (for white LEDs), and the design of the LED package and optical components.

When selecting an LED light source, it is important to consider the CRI, along with other performance metrics, such as luminous flux, colour temperature, and efficiency, in order to determine the best option for a specific application. The CRI of an LED light source can also be affected by its operating conditions, such as temperature and current, so it is

important to maintain proper thermal management to ensure consistent performance over time.

INGRESS PROTECTION

Ingress Protection (IP) is a rating system used to describe the level of protection provided against the intrusion of solid objects (including body parts like hands and fingers), dust, accidental contact, and water in electrical enclosures. The IP code consists of two numbers, the first one indicating protection against solids and the second one against liquids. The higher the numbers, the higher the protection level. For example, IP68 means complete protection against dust and protection against long periods of immersion in water.

More detail to be provided via a table.

L70 AMBIENT TEMPERATURE MEASUREMENT

The standard for measuring ambient temperature for LED lighting is typically 25°C (77°F). This temperature is often used as a reference temperature in LED specifications and datasheets to define the maximum operating temperature and other performance parameters of the LED. It is also the standard temperature used in most laboratory tests to evaluate the performance of LED lighting products.

It's important to note that the ambient temperature in real-world LED lighting applications can vary greatly and may be much higher than 25°C. In these cases, LED manufacturers will often provide additional information and performance specifications for operating the LED at higher temperatures. This information can be used to estimate the expected LED lifetime and performance under different conditions.

If your operating environment is under abnormally high or low ambient temperatures we recommend that you consult our engineers to assist you with your luminaire selections. Failure to do so may end up in an unnecessary project failure.

Consider removing this entire paragraph, as L-Rating was already explained above in this document, and most L-ratings are tested at 25 and 80degrees.

Specialised & Technical

EMERGENCY LIGHTING

Emergency lighting is a type of lighting that provides illumination in the event of a power failure or other emergency situations. The primary purpose of emergency lighting is to ensure the safety of building occupants by providing a reliable source of light for evacuation.

Emergency lighting systems typically include a backup battery and a battery charger to ensure that the lights will continue to function even when the main power supply is disrupted. The lights may be connected to a control panel or other monitoring system that activates the lights automatically in the event of an emergency.

There are two types of emergency lighting: "central battery" and "self-contained." Central battery systems have a centralized battery that provides power to multiple emergency lights throughout a building. Self-contained systems have a battery and lighting unit integrated into each fixture, allowing the lights to operate independently.

In most jurisdictions, emergency lighting is regulated by building codes and safety standards that specify the required illumination levels, battery backup times, and testing requirements. These regulations help to ensure that emergency lighting systems are installed and maintained in a way that meets the needs of building occupants in the event of an emergency.

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Emergency lighting plays a critical role in ensuring the safety of building occupants in emergency situations. It is important for building owners and managers to understand the requirements for emergency lighting and to ensure that their systems are properly installed and maintained to provide reliable, safe, and efficient lighting in the event of a power failure or other emergency.

MAINTAINED VS NON-MAINTAINED EMERGENCY LIGHTING

Maintained and non-maintained lighting refer to two different types of emergency lighting systems.

Maintained lighting is an emergency lighting system that operates continuously, providing both normal and emergency lighting. In the event of a power failure, the emergency lighting will take over, providing illumination for the building's occupants to evacuate safely. Maintained lighting is typically used in public buildings, such as schools and office buildings, where the lights are always required to be on for normal use.

Non-maintained lighting, on the other hand, is an emergency lighting system that only operates during an emergency. These lights are normally turned off and are only activated in the event of a power failure. Non-maintained lighting is typically used in areas where there is limited use, such as stairwells, escape routes, and storage rooms.

In some jurisdictions, the type of emergency lighting required will be specified by building codes and safety regulations. In these cases, building owners and managers must ensure that their emergency lighting systems meet the required standards for their specific location.

Both maintained and non-maintained lighting serve important roles in ensuring the safety of building occupants in the event of a power failure or other emergency. The type of emergency lighting required will depend on the specific needs of the building and the requirements specified by building codes and safety regulations.

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MAINTAINED LIGHTING APPLICATIONS

Maintained emergency lighting is typically used in a variety of applications where a continuous source of light is required, both for normal use and emergency situations. Some common applications for maintained emergency lighting include.

Public buildings: Schools, offices, hospitals, and other public buildings typically require maintained emergency lighting to provide a reliable source of light for evacuation in the event of a power failure or other emergency.

Retail spaces: Maintained emergency lighting is often used in retail spaces to provide a safe and well-lit environment for customers, both during normal business hours and in the event of an emergency

Industrial facilities: Factories, warehouses, and other industrial facilities often require maintained emergency lighting to ensure the safety of workers and to provide a reliable source of light for evacuation.

Transportation facilities: Airports, train stations, and other transportation facilities typically use maintained emergency lighting to provide a safe and well-lit environment for travellers, both during normal operations and in the event of an emergency.

Residential buildings: Apartment buildings, dormitories, and other multi-residential buildings often use maintained emergency lighting to ensure the safety of residents in the event of a power failure or other emergency.

maintained emergency lighting is a versatile and reliable solution that can be used in a variety of applications to ensure the safety of building occupants and to provide a continuous source of light in emergency situations.

NON-MAINTAINED LIGHTING APPLICATIONS

Non-maintained lighting is typically used in applications where a continuous source of light is not required, but a reliable source of light is

necessary for emergency situations. Some common applications for non-maintained lighting include.

Stairwells and escape routes: Stairwells, fire escapes, and other escape routes often use non-maintained lighting to provide a reliable source of light in the event of a power failure or other emergency.

Storage rooms: Non-maintained lighting is often used in storage rooms, such as basements, attics, and closets, where a continuous source of light is not necessary but a reliable source of light is required in emergency situations.

Emergency exits: Emergency exits in public buildings, such as schools, offices, and hospitals, often use non-maintained lighting to provide a reliable source of light for occupants to evacuate safely in the event of a power failure or other emergency.

Unoccupied areas: Non-maintained lighting is often used in unoccupied areas, such as parking garages, service elevators, and mechanical rooms, to provide a reliable source of light in emergency situations.

Residential buildings: Non-maintained lighting is often used in residential buildings, such as single-family homes, to provide a reliable source of light in the event of a power failure or other emergency.

In conclusion, non-maintained lighting is an effective solution for applications where a continuous source of light is not necessary, but a reliable source of light is required for emergency situations. Non-maintained lighting can provide a cost-effective and reliable solution for building owners and managers to ensure the safety of their building occupants in the event of a power failure or other emergency.

SCOTOPIC AND PHOTOPIC

Scotopic and photopic refer to two different modes of vision in humans, which are optimized for different levels of light.

Photopic vision refers to the vision that occurs in high levels of light, such as during daylight or well-lit indoor environments. This type of vision is mediated by the cone cells in the retina of the eye, which are most sensitive to the colors green, blue, and red. Photopic vision provides us with high acuity and color vision and is responsible for our ability to see fine details and colors in our environment.

Scotopic vision, on the other hand, refers to the vision that occurs in low levels of light, such as during nighttime or in dimly lit indoor environments. This type of vision is mediated by the rod cells in the retina of the eye, which are more sensitive to the colorless light and provide us with low-light sensitivity but poor color vision and low acuity. In scotopic vision, objects may appear blurry or indistinct, and color discrimination is limited or absent.

In general, the transition from scotopic to photopic vision occurs gradually as the level of illumination increases or decreases.

One way that the eye reacts to different colors of light is through the process of color vision, which is mediated by the three types of cones in the retina that are most sensitive to different ranges of wavelengths of light. Cones that are most sensitive to shorter wavelengths of light (around 420-440 nm) respond most strongly to blue light, while cones that are most sensitive to longer wavelengths of light (around 535-565 nm) respond most strongly to green light. Cones that are most sensitive to medium wavelengths (around 450-490 nm) respond most strongly to yellow-green light.

In addition to color vision, the eye also has other mechanisms for responding to different colors of light. For example, the amount of light entering the eye (called "brightness") can also vary depending on the color of the light. Generally, the eye is most sensitive to light in the green-yellow range (around 555 nm), and less sensitive to light in the blue and red ranges. This means that light that appears "bright" to the

eye may not necessarily be the same as light that appears "intense" or "saturated" in terms of color.

The eye's reaction to different colors of light can also affect various aspects of visual perception, including depth perception, contrast sensitivity, and visual acuity. For example, blue light has been shown to increase visual acuity and reduce glare, which is why it is often used in outdoor lighting and computer screens. On the other hand, red light has been shown to have minimal effects on visual acuity and is often used in dark environments to preserve night vision.

Overall, the eye's reaction to different colors of light can depend on a complex interplay of factors, including the wavelength of the light, the intensity and duration of exposure, and individual differences in sensitivity and perception.

Research has shown that some people may be more sensitive to certain colour temperatures than others, and that certain colour temperatures can affect mood, alertness, and sleep patterns. However, these effects are largely individual and can vary greatly based on the person, their age and specific lighting conditions.

In general, it is recommended to use lighting that is comfortable to the eyes and avoid excessive exposure to bright light. This can be achieved by adjusting the brightness and colour temperature of the lighting, as well as reducing glare and reflection.

One way that the brain may react to different colors of light is through the process of circadian rhythm regulation. Light is a key environmental cue for regulating the body's internal clock, which controls the sleep-wake cycle and other physiological processes. Specifically, the brain's response to blue light (in the range of about 450-480 nanometers) has been shown to be particularly important for regulating circadian rhythms

and promoting alertness and cognitive performance during the day. Exposure to blue light in the evening, however, can disrupt sleep and cause other negative effects on mood and health.

As a rule of thumb, the guidelines for specific applications is as follows

- Industrial and mine lighting: 4000K-6500K dependant on the task
- Commercial lighting: 4000K-5000K is often used in commercial spaces such as offices, schools, and retail stores, as it provides bright, cool light that is easy on the eyes.
- Residential lighting: 2700K-3000K is generally used for living rooms, bedrooms, and other residential spaces to create a warm and cosy atmosphere, while in kitchens,workspaces and garages more neutral light may be more appropriate.
- Outdoor lighting: 4000K-6500K is commonly used for outdoor lighting, as it provides bright light that mimics daylight and enhances visibility.

Note that these are just general guidelines and that the best CCT for a specific application may vary depending on the specific needs and requirements of the environment.

It is recommended that you also read up on the scotopic and photopic affects on the human eye.

Please consult one of our lighting experts for any advice related to specific lighting applications.

PITFALLS IN PURCHASING LED LUMINAIRES

Consumers beware -LED luminaires are not all equal. There can be significant differences in quality, performance, and features between different LED luminaires, even while they appear similar at first glance there are very good reasons why the pricing of luminaires can vary

significantly. What you pay is what you get! LED luminaires can be a long term investment or a dismal failure.

While LED (Light Emitting Diode) luminaires have many advantages over traditional lighting technologies, including energy efficiency, long lifespan, and low maintenance costs. However, there are also some significant potential pitfalls to consider when purchasing LED luminaires.

- LED Chip Quality: The quality of the LED chips used in the luminaire can have a significant impact on its performance. High-quality LED chips are more efficient, last longer, and produce a more consistent light output than low-quality chips. The quality of LED lighting can vary greatly between manufacturers, and it is important to choose a reputable supplier and to carefully evaluate the specifications of the LED lights before purchasing.
  A good LED chip typically has a life expectancy of 50,000 hours or more, while a poor LED chip may have a life expectancy of just a few thousand hours. The difference in life expectancy between a good LED chip and a poor LED chip can be attributed to several factors, including:
  - Quality of Materials: The quality of materials used in the LED chip, such as the type of semiconductor material and the quality of the substrate, can greatly impact its life expectancy. Good LED chips are often made with high-quality materials that are able to withstand the thermal and electrical stress of long-term operation.
  - Manufacturing Process: The manufacturing process used to produce the LED chip can also have an impact on its life expectancy. Good LED chips are often produced using a strict quality control process that ensures consistent performance, while poor LED chips may be produced using lower-quality manufacturing processes that result in variability in performance.
- Driver Quality: The driver is the component that regulates the power supply to the LED chips. A high-quality driver will ensure a consistent, stable power supply to the LEDs, which will result in

improved performance and longer lifespan. The LED driver is as good as its weakest component and hence good quality luminaires use good quality drivers.

- Thermal Management: Effective thermal management is critical for the performance and longevity of LED lighting. Poorly designed luminaires may not properly dissipate heat, which can lead to reduced performance and shorter lifespan of the LED chips and electronic components. -
- Material Quality: The quality of materials used in the construction of the luminaire can impact its durability and performance. High quality materials, such as aluminium and tempered glass, will generally result in a more robust and long-lasting luminaire,
- Manufacturing Quality: The manufacturing quality of a LED luminaire can also have a significant impact on its performance and lifespan. Poorly manufactured luminaires may have issues with electrical connections, mechanical components, and other parts that can result in reduced performance and shorter lifespan.

Beware the golden sample: It is easy for unscrupulous manufacturers to utilise a golden sample as a means of passing luminaire standards and then supply a luminaire that is of a different quality.

NORDLAND MANUFACTURING ETHOS

Nordland prides itself on over half a century of manufacturing high quality luminaires. Our reputation in the market has been built on products that withstand the test of time. As a preferred supplier in the largest mining conglomerates and in the petrochemical and oil and gas sector we estimate that we have supplied in excess of a million luminaires many of which were installed and are still functioning more than 2 decades later.

Norland's key principles are based on: -

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Component procurement: - quality Control is crucial in LED luminaire manufacturing, this applies to LED Chips, Drivers and Housing materials. Proper QC ensures longevity of the product. As a result we only procure from the most reputable component suppliers.

Testing and Certification: Our LED luminaires are all rigorously tested internally for compliance before being sent to accredited EX testing facilities for full certification in compliance with the relevant industry standards. This includes Photometric performance, electrical safety, performance, EX, and energy efficiency testing.

Material Selection: It is important to use high-quality materials that are able to withstand the harsh environments in which LED luminaires are often used. Particular emphasis is placed on the thermal management of luminaires and the heat sinking design. We use the most durable housing materials applicable to the application and working environment.

Manufacturing Quality Control: Our manufacturing facility is ISO 9001/2015 accredited. We run a strict policy on QC to ensure that no products leave the premises without being fully tested.

Technical Support: Nordland has a full team of lighting engineers available to assist with all technical questions and assist in designing luminaires to meet the customer's specific requirements. Hence, we have the ability to adapt and engineer luminaires to meet your specific requirements.

Warranty and after sales service: As a result of the comprehensive attention to detail in the design, procurement of materials, manufacturing procedures and QC we are able to offer extended warranties.

After sales service: While warranty claims are extremely rare we pride ourselves on the reputation we have developed for our after sales service and backup. Whereas many Companies are dependent on overseas Companies backing up there warranties

and luminaires may need to be sent to suppliers for warranties to be honoured, we at Nordland pride ourselves in our backup service.