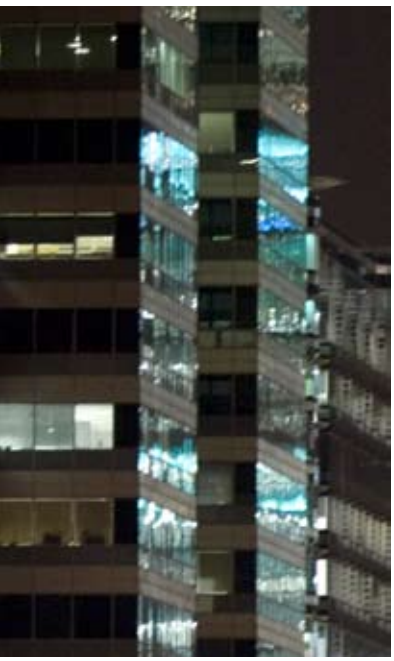
THORN

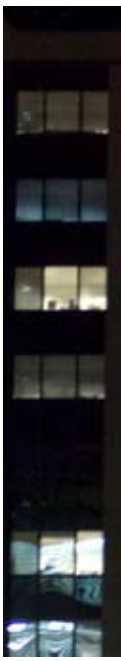
Thorn Lighting and Sustainability

Improving quality of life by lighting people and places



Thorn Lighting, part of the Zumtobel Group, is a highly recognised, global brand for professional indoor and outdoor lighting. Its mission is to improve quality of life by lighting people and places. As a contributor towards a healthy and comfortable society, Thorn has an important role to play in achieving this goal, sustainably.

Against a background of growing customer concern for the sustainable development of society the following pages outline the wide range of issues related to Thorn's sustainability performance. It explains the key issues identified as having the most material impact on the business. The Brochure also aims to encourage and assist all readers to adopt a more harmonious and sustainable approach to their lighting work.



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Interview with Andreas J Ludwig - CEO of the Zumtobel Group, President of CELMA and Vice Chairman of ZVEI

As a company how can the Zumtobel Group contribute to greater sustainability?

Some 20% of the electrical energy consumed worldwide is accounted for by artificial lighting. Against this backdrop, we aim to optimise the use of energy by supplying technically innovative, intelligently controlled luminaires, components and lighting solutions. As we develop these products and solutions, we are also concerned to take human needs into account. Within our company we adopt a responsible approach to the environment and natural resources. That applies, for example, to our use of materials as well as to our production processes. We have a programme to certify all our production facilities to ISO 14001 – the standard for environmentally compatible production.

And humanity?

When we make a commitment to sustainability, environmental protection and the responsible use of finite resources, the underlying aim is to contribute to the long-term conservation of our ecosystem and the human habitat. For me, that has two consequences: firstly we must strike a balance between the demand for energy savings and human needs. There are many situations in which energy consumption is essential to the well-being, health and safety of humankind, as well as promoting human performance. Secondly, in my view, the long-term conservation of the human habitat also involves social aspects of a more sweeping significance. Only if we find answers to the challenges posed by globalisation, if we lay the foundations for more equal opportunities and more equitable shares, do we have a real chance of making peaceful progress.

Why a sustainability report?

Increasingly sustainability and environmental performance is becoming a public process so that customers, employees and shareholders alike can ask to see the achievements or non-achievements, of companies. Following a formalisation of the reporting process within our business a structure is being developed for company wide compliance. We aim to publish our first Sustainability Report for the Group, along the lines of the Global Reporting Initiative (GRI) Guidelines, in September 2009. These Sustainability Reporting Guidelines are for voluntary use by organisations for reporting on the economic, environmental, and social dimensions of their activities, products, and services. This will show the transparency of our activities against stated objectives and targets, giving us the opportunity to fine-tune our business to reflect our intention of becoming a sustainable company in all respects.

How do you promote sustainability?

Firstly, it is one of the main focuses of our strategy and our investment policy. We seek to offer best-in-class products and services while remaining fully aware of our responsibility to the environment and society. The topic of energy efficiency is something that all our brands have been promoting for many years now. We can help reduce global energy consumption and at the same time improve the general quality of life. On the public stage we offer, amongst others, the Zumtobel Group Award that honours, biannually, outstanding international architectural and engineering innovations in the built environment pertaining to sustainability and humanity. In line with the company's vision, the award also challenges the Zumtobel Group itself- to boost the emphasis on sustainability and humanity in all its processes.

And will you succeed?

It's all too easy for a company to make a few cosmetic changes and then claim to be really green. It's much more difficult to face up to the real issues involved – the establishing, the monitoring, the implementation of improvements. The Zumtobel Group doesn't claim to have all the answers overnight, but it is increasingly asking itself the difficult questions as it seeks to ensure the sustainability of its operations. We will succeed because we recognise that sustainability is essential for the long term economic and social/cultural growth of our business.

What are the social and environmental impacts associated with your products?

Thorn products are designed to meet product safety and performance standards and conform to all relevant regulations covering environment, energy efficiency, restriction of hazardous substances and waste control.
We have invented a new dynamic design concept called PEC (Performance, Efficiency and Comfort) that embraces all criteria for vision, health and sustainability. This is used for lighting products and lighting schemes design.

Do you have a sustainability policy?

The Thorn brand has a Group Environmental, Health and Safety policy applied as a control on all our internal activities and this now includes sustainability, energy conservation and ecodesign elements.
Our vision is to be among the world's leading brands in demonstrating progress towards sustainability. We aim to do this by contributing to a better quality of life and by reducing our environmental footprint through innovative design and manufacturing, minimising resource and energy use. Our key aims are: to foster a responsible concern for the environment in all aspects of products, services and operations; to progressively improve the environmental impact of our brand's activities; to comply with regulations and pro-act with voluntary initiatives.

Do you have sustainability programmes or activities in place ?

In the current year the cost of energy is set to rise in the region of 30% and over the next two years it may double. Our customers and specifiers will be looking to our new products to deliver the best possible photometric performance, which will at least outperform future legislation.
Meanwhile we do not just develop new products, but we also have an ongoing photometric enhancement programme on existing products. They now exceed the minimum requirements of Part L of the Building Regulations of 45 luminaire lumens per circuit watt. These products are called Green Eco Liners.

Thorn has probably the largest team of lighting designers in the UK, many of whom are qualified with SLL and LIF, and are widely trained further under the Thorn Academy of Light umbrella to understand completely their responsibility in delivering energy effective, but fit-for-purpose, lighting schemes.

Whenever possible we exceed the minimum requirements set by EU directives. For instance, we are taking an industry leading step in using substitutes such as Nickel Metal Hydride (NiMH) as a cadmium free replacement for NiCd batteries in our emergency lighting products.

Do you adhere to, or have membership with any internationally recognised standards or principles promoting sustainability?

Thorn is a member of BSI, holds the BSI registered photometric laboratory and BSI registered SMT status. Our products fully meet EN 60598 product standard and conform to the ENEC mark licence requirements. We hold the ENEC licence "ENEC 25554" for many products. Our technical staffs are also very active in International standards ISO, IEC, CIE, European standards CEN, CENELEC and BSI standards development. Thorn is a member of the UK Lighting Industry Federation and, through its parent, of CELMA the European organisation to promote good practice in the use of luminaires and electro technical components. We help to create standards and directives to protect the environment.

Is sustainable lighting achievable?

Remember, we need light for modern life. Good lighting is achievable. Tackling climate change and providing light for a growing population, sustainably, is not impossible. In Thorn we have good practices, lighting products, solutions, techniques and competence to ensure a healthy living environment that provides, for people in all places, Performance, Efficiency and Comfort.

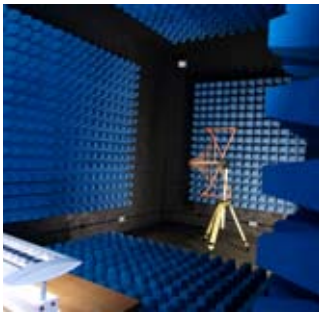
Let us enjoy the illuminated environment, responsibly.

Thorn Spennymoor - Be lean, Be green, Be clean

If there's a sustainability lesson that has come out of Thorn's move to a new factory in Spennymoor, North East England during early 2009, it would appear to be this; look at the problem, identify the obvious solution – and go and do the direct opposite.

Looking for better packaging? Take it out and use as little as possible. Looking for better lighting? Turn it off with daylight sensing. You want carbon neutral heating? Lose the conventional boiler. Want to improve material movements? Do away with most of the forklift trucks.

By challenging the status quo in this way Thorn's new plant is kinder to its people and kinder to the environment. The problem-solving and continuous improvement culture has led to some paradoxical decisions.



Packaging

The decision to improve packaging, for example. Packaging designers were informed that it was not their job to design packaging. Instead they should be looking to take packaging out, use as little as possible. For major projects the designers have replaced individual cartons with re-useable polypropylene trays with foam inserts that accept multiple fittings at a time. Additionally, a 90% reduction in polystyrene filler pads has been recorded thanks to air bags made on-site.

Biomass Boiler

Similarly, the conventional fossil fuel boiler has been replaced by a biomass boiler, fired on wood products, rather than gas or oil. Although biomass produces CO_2 it only releases the same amount that it absorbed whilst growing, which is why it is considered to be carbon neutral. The boiler ensures that 10% of the total energy consumption of the site is provided from renewable energy technologies and is one of the factors contributing to a 25% reduction in Carbon Footprint compared to the previous factory (7.7 million kg of CO_2 pa from 10.2 million).

Electric lighting has a major impact on sustainability and our new factory building combines energy efficient lighting and control combined with natural daylight

Daylight and Artificial Lighting

At Spennymoor natural sunlight streams in through generous windows (30% glazed on two sides) and skylights (20% glazed) to improve working conditions and reduce the reliance on artificial lighting. The light décor contributes to the bright, cheery, spaciousness of the interior, which is also amazingly clean and relatively quiet – a true 21st century workplace.

The main lighting is provided by low energy Primata II luminaires with twin 49W T5- 16mm lamps, slotted white reflector optics and DALI/ DSI controlled dimmable HF ballasts. Plus, of course, linked daylight detection and auto off control to save energy further.

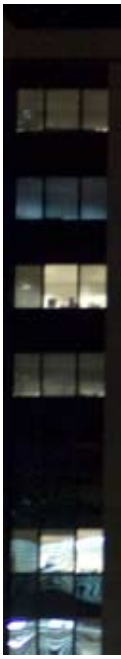
Material movements

With the move to a new building came the opportunity to make products flow through the factory with as few interruptions as possible. Aside from improved productivity, the distance travelled by materials has been cut by 42%, saving time, worker fatigue and halving the number of forklift trucks, and thus batteries.

Waste

The amount of potentially hazardous waste generated by factories has become a stress on the environment. Spennymoor's solution is to reduce or eliminate waste at source. Two such initiatives to improve production processes are paint-focused. Firstly, wherever possible the firm uses pre-coated steels for fitting bodies (<30micron as opposed to post paint with an average of 60 micron). Secondly a new powder-coating shop that controls polluting fumes and treats wastewater before it is discharged into the drain is a popular feature on the factory floor.

Waste reduction ideas are shared between the 22 sister factories worldwide, and environmental targets form part of the overall performance – and with some success. Over 95% of waste generated is recycled and Spennymoor aims to reduce energy consumption by 22% compared to the old site and become ISO 14001 compliant in May 2009.



Transport measures to minimise the impact of Thorn's distribution operation include the use of double deck demountable trailers, the integration of raw material supply chain into the delivery operation and consolidation of customer deliveries – saving 830 vehicle journeys per year

Transport

Finally Thorn Spenymoor has developed a range of transport measures to minimise the environmental impact of its distribution operation.

The UK transport operation delivers in excess of 100,000 pallets and parcels across the UK per annum. Delivery routes to 800 plus customers are consolidated, resulting in 44% less deliveries than a normal pick pack and despatch operation.

The company has improved the design of its trucks to reduce handling time and breakages in transport. The development of double decked, demountable trucks means that product is not re-handled at any point on its journey and the number of delivery nodes is reduced. Plus, there is the obvious advantage that the weight of the top pallets is not transferred onto the bottom pallets, as with conventional loading patterns.

Furthermore Thorn uses a system wherein trucks delivering products to wholesalers collect raw materials and parts from several UK suppliers on their return run - the fleet collects more than 9000 pallets per annum, including 2400 tonnes of steel and 600 tonnes of aluminium.

This increases the load efficiency and reduces the number of trucks that are required - saving 830 vehicle journeys per annum, which is equivalent to one truck driving around the world six times.

Underpinning these initiatives is a continuous driver training programme focussed on fuel efficient driving.

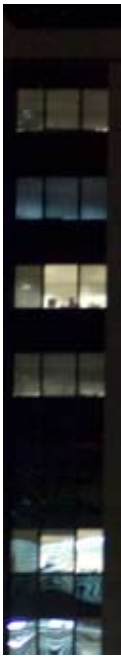
Thorn Spennymoor loads hundreds of containers per year to destinations across the world. Many of these leave from nearby Teesside, but some do travel to Southampton or Felixstowe. Therefore freight partners assist to make use of the Intermodal freight opportunity the railways can offer. Such options are also offered for major projects where customers can handle containers and are equally committed to reducing CO_2 emissions.

Thorn offers its employees unique opportunities to develop their full potential and show exceptional performance by providing training on products, applications and interpersonal skills

Thorn Academy of Light

In keeping with the its parent company's core values Thorn offers its employees unique opportunities to develop their full potential and show exceptional performance. To this end a new academy was founded during the 2006/7 financial year – the "Thorn Academy of Light". Experts from relevant specialised areas of the business provide sales employees with brand-specific training on products, applications, business processes and interpersonal skills. The Lighting Adviser courses are held at Spennymoor in North East England and Les Andelys in North West France. In order to ensure the high quality of teaching, minimum standards were established for content and a separate train-the-trainer course was developed for the lectures.

The subsequent development of these courses for partners and customers, suitably "de-Thorned", forms an integral part of the Academy. A 1.3 million Euro investment in the future is the newly built Competence Sharing Centre at Spennymoor. Complete with lighting application areas, indoor and outdoor product displays and state of the art facilities for training, events and presentations it will be a valuable tool for customer training where the Thorn brand can be experienced. The first customer-training programme – on sustainability – will be introduced during 2009 and preparations are underway to expand the programme.



When we talk about green issues and sustainability we have a mental image of what we mean. But do we really understand the issues or do we only think in terms of what we see in the news headlines?

Our world is at a crossroads. The growth in world population makes massive demands on our environment. This is combined with an increasing move by people into urban areas, producing ever bigger and more crowded cities.

More people results in the depletion of natural resources and raw materials, higher energy requirements, and increased waste in terms of materials and emissions. The outcome is a world unable to cope, and therefore a world out of balance. The visible signs of this are global warming and climate change.

Challenges	**Thorn solutions**
• global warming	• promote the practice of energy efficiency
• climate change	• participate in standards development
• depletion of raw materials	• limit the use of hazardous substances
• excess waste	• use recycled material
• pollution and light spill	• restrict obtrusive light emissions
• high energy usage	• provide energy efficient products

It is widely accepted that climate change is caused by burning fossil fuels and if we can reduce our emissions then there is every chance that the most catastrophic impacts of climate change can be avoided. This recognition was formalised in the Kyoto Agreement. This aims to regulate and limit the production of greenhouse gasses by setting targets for countries to achieve in limiting or reducing emissions by increased energy efficiency and the use of renewable energy sources.

Europe has set its own target to cut CO_2 emissions by 20% by 2020

Within the European Union additional targets were set to reduce carbon emissions by 20% from 1990 levels by 2020. To support this process a raft of directives and standards have been produced, promoting energy efficient and sustainable practices within the EU. For lighting these include:

Energy Directives

- Energy Efficiency Labelling of Products Directive (ELP)
  Has the aim to indicate on lamps and ballasts the energy efficiency of the product through an energy efficiency index label
- Energy use Products Directive (EuP)
  This encourages eco-design and energy efficiency during the life of an energy using product
- Energy Performance of Buildings Directive (EPB)
  The objective of this directive is to promote the improvement of the energy performance of buildings within the EU

Waste Directives

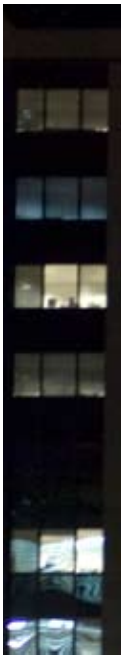
- Waste of Electrical and Electronic Equipment Directive (WEEE)
  This puts responsibility on the producer for end of life take back and recycling of products, prepaid for collection and processing costs
- Restriction of Hazardous Substances Directive (RoHS)
  This restricts the use of hazardous substances in products by designing out such materials
- Battery and Accumulators Directive (B&A)
  Aims to ban the use of heavy metals in batteries and accumulators
- Packaging of Products Directive (PoP)
  Aims to harmonise measures concerning the management of packaging and packaging waste to ensure a high level of environmental protection

The goal of sustainable development is to meet the needs of the present without compromising the ability of future generations to meet their own needs

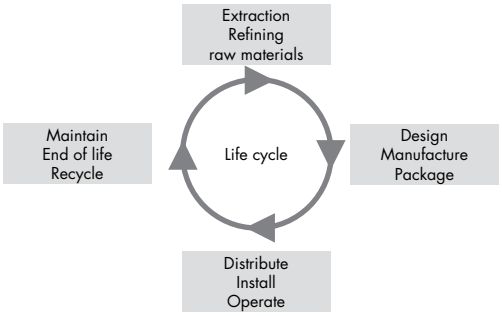
Eco-Design

Electric lighting has a major impact on sustainability. The key to sustainability in lighting is ecodesign, efficient operation and planned recycling at the end of the product life. These are fundamental considerations in the Thorn PEC - Performance, Efficiency and Comfort - programme. Thorn understands the green issues involved and acts to minimise the impact and find intelligent solutions to safeguard our environment and leave something worthwhile to our descendants. Eco-design is practiced in the creation of a lighting product, whilst operation is when the product is put into service in lighting schemes. End of life is when the product is no longer required or is unable to fulfil its function.

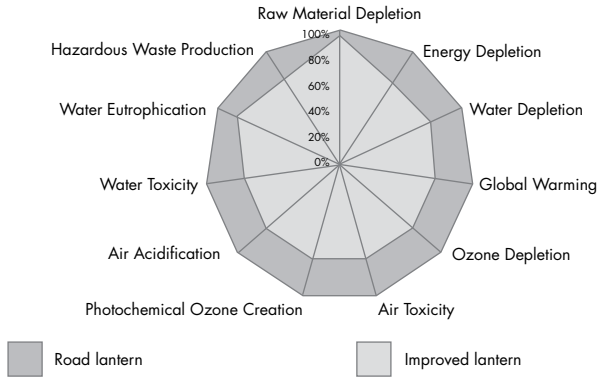
Eco-design is the design of a product with the entire life cycle in mind. The life cycle covers consideration of the product from extraction and refining of raw materials, through design, manufacture, installation, use and maintenance to the end of useful life, when dismantling and recycling of the materials commences. Employing life cycle assessments will check the environmental impact of the solution through life. It ensures that care is taken during design to employ absolutely the minimum amount of restricted hazardous substances and that the minimum amount of virgin materials, water and energy are used during manufacture. Consider also the energy efficiency during the operation phase and the need to dismantle the product quickly and without waste at the end of life.



Product life cycle analysis (LCA)



EIME Software aids Environmental Assessment



EIME (Environmental Impact and Mangement Explorer) is a user friendly application tool used in the design of eco-friendly products. It is used by Thorn to prepare environmental impact assessments for luminaires over their full life cycle and helps the designer in the choice of materials, components and processes.

Energy Consumption and Efficiency

The generation of electrical energy required for lighting is a major contributor to CO_2 emissions. For every kWh of energy 0.42 kg of CO_2 is liberated and added to the "greenhouse" gases in the atmosphere, increasing global warming. The proportion of energy demand by lighting products can be roughly split into three phases: creation (12%), use (80%) and disposal (8%). The most energy consumption by the product is clearly during operation and much of this can be influenced by prudent design and component selection.

No less than 14% of EU electricity consumption is today expended on artificial lighting and 19% globally. In domestic premises lighting isn't a large proportion of the electrical energy consumption, but in commercial buildings and offices it accounts for 43% and for cities, urban lighting accounts for 40% of the electricity bill.

Sadly about 60% of lighting in Europe today is energy inefficient. A third of road lighting lanterns use old, outdated and inefficient technology and with current change over rates of old equipment put at 3% per annum it will take a generation to improve. More importantly 75% of commercial and industrial lighting remains inefficient, although change over rates are somewhat more encouraging at 7% per annum. The widespread application of energy efficient professional (office, street and industry) lighting products/systems could, in overall terms reduce EU electricity demand by 53 KWh, cut the emission of CO_2 by 20 million tonnes and save over 5 billion euros per annum.

Many of the lighting technologies and innovations that could dramatically reduce our dependence on fossil fuels – renewable energy, energy efficient products and buildings already exist and work with the climate rather than against it. Here we outline some of these proven and ready-to-go products and systems.

The design of lighting installations to a given standard but with minimum energy use (maximum cost effectiveness) requires attention to five key factors:

- The adoption of the correct lighting standards both in terms of quality and quantity
- Selecting the correct type of lighting system
- Using the most suitable lighting equipment
- Controlling the hours of use
- Efficient installation and maintenance

Office Lighting example

Old T12/T8 System
Energy inefficient technology
High loss ballast
Halo-phosphate lamp
No control
Large luminaire

Modern T5-16mm System
Energy efficient technology. Higher LOR
Electronic ballast (highly efficient)
Tri-phosphor lamp
Fully controllable (daylight/presence)
Sleek luminaire due to better optics
Good Glare control (UGR)

Road Lighting example

Mercury Vapour System
Low efficacy typical 35-60 lm/W
Large source
Service lifetime 10,000 hr (70%)
Modest Ra: 40-50
Poor light distribution due to 3 part reflector

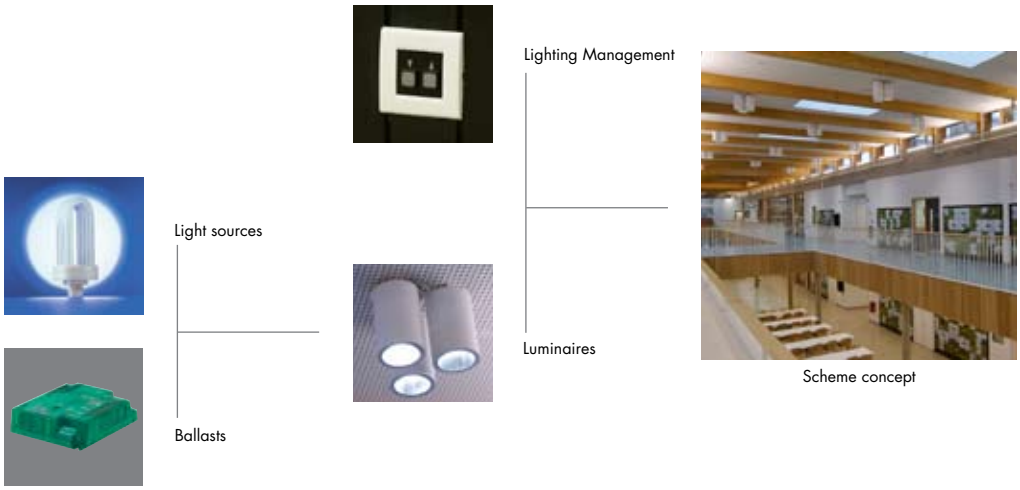
Low maintenance factor
Low IP-2X

Metal Halide System
High efficacy typical 65-120 lm/W
Small source
Service lifetime 10,000 hr (70%)
Better Ra: up to 95
Good light distribution and LOR due to facetted reflector
High maintenance factor
High IP-5X

The combination of state of the art LED light sources with advanced optical and luminaire design is providing better, more flexible lighting solutions while consuming less energy, materials and resources

Energy Consumption and Efficiency

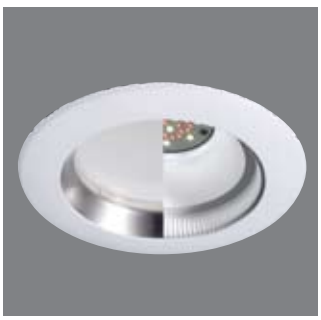
The key elements in selecting the most suitable equipment are light sources, the control circuit including ballast type and the luminaire optic.



Scheme concept

Today the most useful and efficacious light source is the fluorescent lamp. It can be linear or compact and employ poly-phosphor coatings yielding good colour and light output. The lamp requires a ballast to operate, which can be magnetic or electronic. Magnetic ballasts (copper and iron) have the advantage of being lower in cost. Electronic ballasts, however, can operate the lamp at high frequencies, in excess of 10 kHz thus eliminating flicker, are more efficacious, use less energy, and are lightweight one-piece control gear that can be dimmable and automatically controlled. Thorn is committed to the greater use of electronic ballasts, preferably dimmable.

Solid state LEDs are making significant progress as an energy saving light source. Aside from low energy there are a number of operational and environmental benefits of using LEDs. Their extraordinary long life means they need zero maintenance with no light source replacement, thus reducing costs and the amount of material going into landfills. In addition they emit neither UV nor IR radiation and contain no mercury.

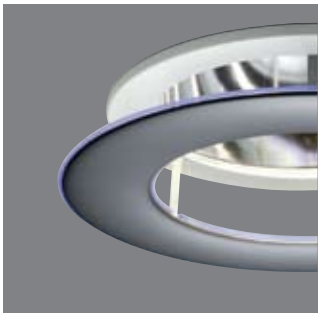


Among the next generation of LED engines is Base LED – a breakthrough in optics, electronics and thermal management. At 12W and with an output of 650 lumens, it saves up to 50% in energy consumption compared to conventional CFL downlights and is dimmable to 20 %. Using Cree LED technology it is available in 2700 and 3500K options and has a high CRI of 94.

Energy Consumption and Efficiency

By improving the Light Output Ratio (LOR) of a luminaire it is possible to save around 10-15% energy and material by reducing the number of luminaires required for the project.

Planor
Thorn didn't have to develop new material for the suspended Planor as the product already exceeded the demands of UK building regulations, but by using microprism optical (MPT) material LOR has been increased 31% from 0.76.



Cruz
The Cruz range of downlights has been engineered to improve lighting quality whilst save up to 30% of the power used by conventional downlights. Optimised for compact fluorescent lamps with amalgam the reflector ensures that fittings can be more widely spaced; therefore fewer downlights may be used to produce the same light level. The result: savings both in installation, running costs and raw material. As an example, a Cruz downlight with a single 42W TC-TELI lamp gives more light than a conventional fixture employing 2x26W TC-DEL lamps for less power.

Green Eco Liners

As part of the drive towards improving sustainability Thorn's laboratories have an ongoing photometric enhancement programme. Specific products within 14 Recessed and Direct/ Indirect fluorescent ranges have recently been enhanced to provide the best photometric solution in terms of sustainability. These products are marked in green and referred to as Green Eco Liners.

INDOOR COMMERCIAL LIGHTING

RECESSED LUMINAIRES

Dual colour lamp option

Materials/Finish
Body and reflectors: White painted steel
Suspended optic: micro-perforated white painted steel wings, aluminium reflectors and partially perforated white painted steel baffle
Louvre: aluminium in Satinbrite finish
Diffuser: polycarbonate in opal or prismatic finish
End caps: white polycarbonate

Installation/Mounting
Suitable for lay-in installation into 15mm or 24mm exposed tee. Unique "wedge" brackets (included) allow pull up installation into most exposed tee (max 70mm grid height), concealed fix and solid ceilings. MenloSoft SR is supplied as a complete luminaire and has been designed to be quick and easy to install. Simply install the body into the ceiling and electrically connect using the GST connector, before fitting the lamps and

Ordering Guide Lamps to be ordered separately.

Description	ILCOS Code	Socket	Wt (kg)	SAP Code
600x600 Versions				
Satinbrite Louvre				
MENLOSFT SR 3x24W HF DSB WL4	FDH	G5	8.4	96235246
MENLOSFT SR 3x24W HF E3TX DSB WL4/3	FDH	G5	9.3	96235245
MENLOSFT SR 3x24W HFD DSB WL6	FDH	G5	8.4	96235247
MENLOSFT SR 3x24W HFD E3TX DSB WL6/3	FDH	G5	9.3	96235248
MENLOSFT SR 4x14W HF DSB WL4	FDH	G5	8.4	96235256
MENLOSFT SR 4x14W HF E3TX DSB WL4/3	FDH	G5	9.3	96235261
MENLOSFT SR 4x14W HFD DSB WL6	FDH	G5	8.4	96235263
MENLOSFT SR 4x14W HFD E3TX DSB WL6/3	FDH	G5	9.3	96235265
Satinbrite Louvre Plus Versions				
MENLOSFT SR + 3x24W HF DSB WL4	**FDH**	**G5**	**8.4**	**96235249**
MENLOSFT SR + 3x24W HF E3TX DSB WL4/3	**FDH**	**G5**	**9.3**	**96235250**
MENLOSFT SR + 3x24W HFD DSB WL6	**FDH**	**G5**	**8.4**	**96235251**
MENLOSFT SR + 3x24W HFD E3TX DSB WL6/3	**FDH**	**G5**	**9.3**	**96235252**
MENLOSFT SR + 3x24W HFL DSB WL6	FDH	G5	8.4	96235253
MENLOSFT SR + 4x14W HF DSB WL4	**FDH**	**G5**	**8.4**	**96235266**
MENLOSFT SR + 4x14W HF E3TX DSB WL4/3	**FDH**	**G5**	**9.3**	**96235267**
MENLOSFT SR + 4x14W HFD DSB WL6	**FDH**	**G5**	**8.4**	**96235268**
MENLOSFT SR + 4x14W HFD E3TX DSB WL6/3	**FDH**	**G5**	**9.3**	**96235269**
MENLOSFT SR + 4x14W HFL DSB WL6	FDH	G5	8.4	96235270
Satinbrite Louvre with Air Handling				
MENLOSFT SR 3x24W HF DSB AH WL4	FDH	G5	8.8	96235271
MENLOSFT SR 3x24W HF E3TX DSB AH WL4/3	FDH	G5	9.7	96235272
MENLOSFT SR 3x24W HFD DSB AH WL6	FDH	G5	8.8	96235273
MENLOSFT SR 3x24W HFD E3TX DSB AH WL6/3	FDH	G5	9.7	96235274
MENLOSFT SR 4x14W HF DSB AH WL4	FDH	G5	8.8	96235275
MENLOSFT SR 4x14W HF E3TX DSB AH WL4/3	FDH	G5	9.7	96235276
MENLOSFT SR 4x14W HFD DSB AH WL6	FDH	G5	8.8	96235277
MENLOSFT SR 4x14W HFD E3TX DSB AH WL6/3	FDH	G5	9.7	96235278
300x1200 Versions				
Satinbrite Louvre				
MENLOSFT SR 3x28W HF DSB WL4	**FDH**	**G5**	**10.1**	**96235279**
MENLOSFT SR 3x28W HF E3TX DSB WL4/3	**FDH**	**G5**	**11.2**	**96235280**
MENLOSFT SR 3x28W HFD DSB WL6	**FDH**	**G5**	**10.1**	**96235281**
MENLOSFT SR 3x28W HFD E3TX DSB WL6/3	**FDH**	**G5**	**11.2**	**96235282**
MENLOSFT SR 3x28W HF DSB AH WL4	FDH	G5	10.9	96235283
MENLOSFT SR 3x28W HF E3TX DSB AH WL4/3	FDH	G5	12	96235284
MENLOSFT SR 3x28W HFD DSB AH WL6	FDH	G5	10.9	96235285
MENLOSFT SR 3x28W HFD E3TX DSB AH WL6/3	FDH	G5	12	96235286
Important - Female connectors (sockets) needed with each luminaire				
Connect S4	Socket for connecting HF			96200559
Connect S6 B	Socket for connecting HFD			96233052
Connect EM S3 R	Socket for connecting E3TX			96503766

Specification

For further connectors please see Connect Range on P161

Eco Liners
Page example from UK catalogue showing Green Eco Liners

From the early days of fluorescent tube manufacture, Thorn has worked to introduce energy saving products, systems and practices, including the world's first independent, intelligent lighting management luminaire

Lighting Controls

Lighting controls add much to operational efficiency and are mandatory in many EU member states. The controls maybe a simple on/off switch or a sophisticated computer programmed system. Controls save energy use by providing electric light only where and when needed. Controls can link up to respond to constant illuminance, daylight availability and presence of people. With efficient products, correct lighting scheme design and the use of control systems up to 80% energy savings can be made without jeopardising the quality of the required lighting condition.

Intelligent controls, innovative optics and new kinds of surface materials, as well as the latest electronic control gear or long lasting LEDs can all play a part in providing better lighting while consuming less material and energy. For Thorn, the challenge is to generate energy savings without compromising the quality of lighting, nor the visual environment. Many users have halved the electrical load, but achieved considerable gain in both illuminance and the quality of the lit environment.

Method	Savings Potential %
Daylight-based control	40-60
Presence detector	15-30
Time management	5-15

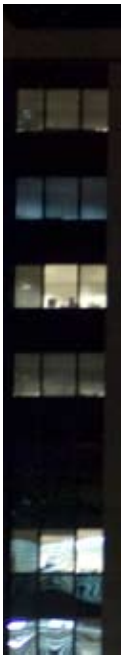
Potential energy savings using lighting management

Illumination Levels

Electricity demand is also affected by the levels of illumination provided by installations. Recommended lighting levels are now stable and no significant increase is anticipated in the next few years. There is also a move from general to task lighting. For instance with the working plane in an office at about 35% of the total area, why light the corridors and circulation areas to the same level as the workstation?

Luminaire Progress

Electric lighting has increased in efficiency and effectiveness by more than 5% per annum since luminaires were first introduced, with the greatest efficiency improvements occurring in the last 30/40 years. The gains made have resulted in substantial improvements in adequacy and quality of lighting and yet reduced the power demand for lighting by more than 10%. Today we provide twice as much light to a space for less than half the electric power used in the 1970's. This underlines that lighting is one of the most energy conservation sensitive services provided for mankind.

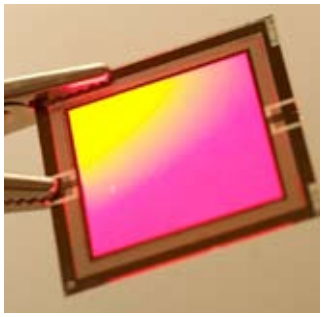


Thorn invented the world's first independent intelligent lighting management luminaire for offices "Sensa" in 1990. An upgraded version was voted a Millennium Product by the Design Council and progress continues today as shown here by the Sienna Sensa luminaire.

Thorn has recently focussed its attention on renewable raw materials as alternatives to fossil fuels. It has designed stand alone exterior products operated by alternative fuel sources, such as solar power and wind generation.

Renewable Energy Generation and Lighting

Monolit
A solar-powered LED concept luminaire, the Monolit is straight out of 2001: A Space Odyssey. It has two photovoltaic panels flanked top and bottom by a modified LED Band luminaire (a strip of 10 x 1W LEDs). The rows of 40 LEDs (4 x 10) are mounted at 3.2m and 0.9m above the ground for overall lighting and pavement illumination respectively. The unit operates independently of the mains supply via storage batteries within the base.



OLEDS
What of the future? Thorn is developing, in collaboration with Sumation UK and Durham University, the next generation of lighting technology. Organic Light-Emitting Diodes (OLEDs) are wafer thin panels of material that light up when electrically charged and are already found in mobile phone and MP3 displays. The team is developing the capability of printing a layer of conductible material – one two-thousandth the thickness of a human hair – on to a thin glass sheet that could transform walls and ceilings into lights. The sheets use minimal amounts of energy by comparison with traditional lighting and low volt power – 4 to 5 volt DC current. This will allow Third World hospitals to be lit using only battery or solar power. They also emit a far wider spectrum of light –more akin to natural daylight than current lighting methods – last longer and are more environmentally-friendly (due to the lack of mercury) than current light sources.

Smart Avenue
The renewable energy theme continues with Smart Avenue, which uses solar PV panels with twilight sensors and presence detectors to deliver illumination from 4 x 1.2W LEDs. Wind generation allows similar recharging of the 50 hour capacity batteries during the night.

Protecting against the depletion of raw materials

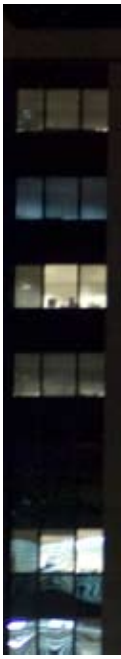
The next obvious step is to protect the rapid depletion of raw materials. In this process sustainable product designs must make use of source reduction or waste prevention techniques. These cover any changes in the design, manufacture, purchase, or use of materials or products (including their packaging) to reduce their amount or toxicity. Source reduction also includes the reuse of products or materials.

Thorn is achieving this in a number of ways:

- Marking products - for easy identification and removal
- Using fewer different materials and less material (lightweighting)
- Avoiding toxic substances
- Selecting better environmental or recycled/recyclable materials (e.g. pre-painted steel)
- Designing for disassembly and dematerialisation – making products simpler to take apart (e.g. using snap fit connections rather than screws and quick dismantling of batteries) and making parts multifunctional
- Cannibalising reuseable parts and recycling returned goods
- Minimising energy in production, use and disposal
- Finally, Thorn is certifying its manufacturing sites to ISO14001 (the standard for environmentally compatible production)

With such practice of good management of resource, increased energy efficiency, employment of new technologies and the drive for renewable energy generation will ensure a sustainable future for light and lighting.

At one time downlights consisted mainly of steel with a small portion of plastics and maybe an aluminium reflector and glass cover. Nowadays much of the downlight is made up of plastic and aluminium parts and hence offers greater possibilities for the use of recycled material. It is estimated that over 50% of the plastic used in Thorn downlights has been recycled.



Wherever possible we exceed the requirements of EU directives such as the Energy Performance of Buildings Directive which seeks to improve the energy efficiency of buildings

Energy Performance of Buildings Directive

The EU Directive on the Energy Performance of Buildings (EPB) contains a range of provisions aimed at improving energy performance of residential and non-residential buildings, both new-build and existing, taking into account the building type, outdoor climate and local conditions and the indoor climatic requirements and cost effectiveness. The directive, therefore, seeks a common methodology for the estimation of energy performance of buildings leading to numeric indicators as part of energy certification and to benchmarks for energy demands in new projects. The calculation framework takes into account the energy needs of the building services including heating, hot water supply, ventilation, air-conditioning and built-in lighting. The directive covers all building types, but concentrates on offices, educational buildings, hospitals, hotels and restaurants, sports facilities, manufacture, wholesale and retail buildings.

As mentioned a key underlying factor in the implementation of the EPBD is the establishment of an official methodology for the calculation of energy performance. Recognising this, the EU Commission undertook to support the European Standards Organisation (CEN) to prepare relevant standards. CEN Technical Committee 169 dealt with the lighting requirements and devised the European Standard EN 15193:2007 "Energy performance of buildings – Energy requirements for lighting" to establish conventions and procedures for the estimation of energy requirements of lighting in buildings.

Lighting Energy Numeric Indicator (LENI)

EN 15193 specifies the calculation methodology and introduces a Lighting Energy Numeric Indicator (LENI) for certification purposes. The document also provides guidance with notional limits derived from reference standards.

Note that whilst responsible use of energy is important it must not lead to inadequate lighting schemes being produced. A reduction in lighting standards to meet energy targets will be counter productive. Therefore, both the lighting requirements (EN 12464-1 Lighting of work places, currently being udpated, and EN 12193 Indoor sports lighting) and energy usage requirements should be fulfilled. Note also that the section on Energy Efficiency Requirements references of EN 15193 (LENI) is currently under review and should appear during 2009.

The basic requirements of LENI, complete with worksheets and an Application Performance Listing of the vast majority of Thorn Lighting products to help check system compliance are given on page 28. Although the EPBD must be implemented by each EU Member State, the method of implementation is up to individual countries, hence certain members do not use LENI, but have responded with other systems, such as the Part L of the UK Building Regulations. However, the power and LOR values in the table (page 34) are still applicable to these methods.

Implementation

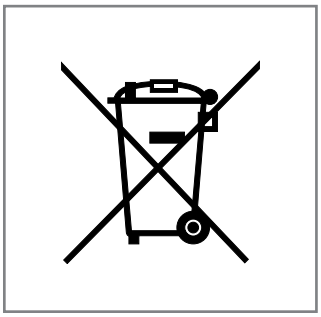
The EPB will force all designers not only to design lighting schemes to provide the correct lighting scheme for the place and tasks, but also to consider solutions that provide the right light to the right place at the right time. The energy efficient solutions can be found in the exploitation of new lighting technologies and techniques.

Through membership of compliance schemes we take responsibility for the collection, treatment, recycling and disposal of end of life products

WEEE Directive

The oil lamp tells the age-old story of recycling. In Roman times, the potters of Sagalassos in Turkey crafted ceramic oil lamps. When the kiln load misfired, the broken lamps were not thrown away, but were ground down, mixed with clay and re-used for building.

Until 2007 we used luminaires once, and then considered them landfill waste – and yet they are precious resources. The introduction of the WEEE directive has re-introduced the ancient art of recycling. Directive 2002/96/EC on waste electrical and electronic equipment (WEEE) is an Article 175 directive and defines requirements and responsibilities for the management of waste lighting equipment within the European Union. This places responsibility for managing waste on the producer, reseller (in cases of re-branded product) or importer of the product. To fulfil these obligations Thorn is funding authorised "producer compliance schemes" to recycle redundant lighting equipment. Irrespective of the method of waste management, Thorn marks its lighting products with the symbol shown to indicate that it may not be disposed of as unsorted waste.



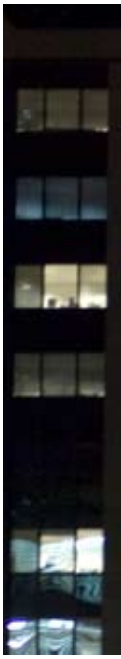
WEEE scheme stops lighting going to landfill

Gateshead Council's lighting replacement programme included swapping over 4,000 office lighting units with more modern units as part of the Council's energy saving strategy. Instead of being sent to landfill the old luminaires have been put straight into a skip provided by Lumicom, who operate a lighting fittings recycling scheme on behalf of Thorn and other lighting players.

Peter Udall, Head of Design for Gateshead Council, says "Collection and recycling of the redundant light fittings was a simple matter of registering on the Lumicom website and, within days, free collection skips were delivered to Gateshead Civic Centre. These were filled with the redundant lighting units which are destined for separation into the correct recycling channels by Lumicom's appointed recycler.

"Lumicom have implemented a simple-to-use, one-stop shop that allows us to dispose of these unwanted electrical units responsibly and help us to divert several tons of electrical waste from land fill."

The new lighting units have also been supplied by Thorn, who worked closely with Gateshead Council to design a purpose-made unit which is a perfect fit with the Civic Centre's ceiling panels, allowing replacements to be fitted quickly and with minimum disruption to employees. New "Daylight" lamps are employed to give near natural light and, more importantly, the new lighting units use only a third of the power of their predecessors.



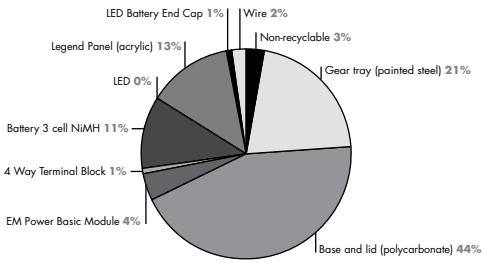
WEEE Directive

Aside from mandatory legislation the idea makes eco-sense; aluminum lanterns can be used to make new aluminum lanterns. Floodlight front glasses can be used to make new front glasses. Also, the energy saved can be significant - recycling aluminium scrap for example saves 95% of the energy costs of processing new aluminium. Lumicom, who manage end-of-life luminaires in the UK, estimate that 50,000 tonnes of professional lighting equipment is placed on the market each year. If all were processed in the spirit of the WEEE regulations, it would produce 25,000 tonnes of steel, 11,000 tonnes of aluminium, 3,500 tonnes of glass and 10,500 tonnes of plastic, all of which can be re-used in manufacturing.

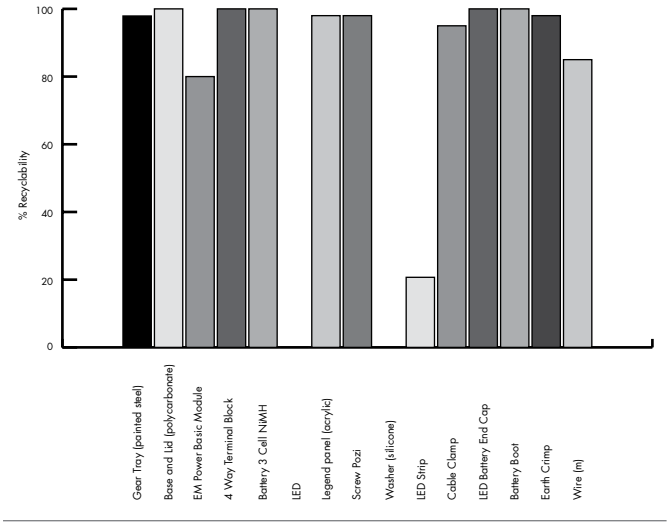
However, to be successful recycling must be cost effective and a complete view of the costs and benefits involved needs to be taken. For instance, aluminium is generally 100% recyclable, but where it is coated or anodised there will be some losses typically <2%. The same applies to plated steel parts or sheet such as precoated steel although Thorn's move away from painted zintec steel to plain precoated is environmentally friendly as previously the zinc coat would be either turned into dross or dissolved away. Likewise an LED, a fraction of a fitting by weight, is non-recyclable, but in theory the metal parts could be extracted from the small plastic lens and both then recycled. On the other hand you could argue that cardboard packaging, although more easily recycled than plastic, is heavier to transport and often has a higher waste rate due to spoilage.

The Voyager Sigma LED
A year ago this single sided exit box comprised of 15 components, mainly steel (80%), including an 8W fluorescent lamp and NiCd battery cells. At each design milestone 120 separate paper drawings were issued. As the name implies the new fitting, designed with electronic drawings and with 20% less components, uses a long life LED strip (8 x 1W) and a more eco-friendly NiMH battery which, like all batteries, should be recycled separately. The emergency exit sign weighs 1374 grams without packaging. It contains no substances prohibited by RoHS legislation and is produced at the Thorn Spennymoor factory, which aims to be certified in accordance with the environmental management standard ISO 14001 in May 2009. At the end of its life the product can be recycled to recover its constituent materials. The table opposite shows that the recycling potential is 97% compared with 78% previously.

Voyager Sigma LED E3M: % by weight of components recyclable



Voyager Sigma LED E3M: Recyclability of individual components

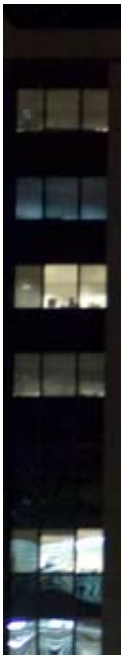


All our suppliers and service providers have to conform to the required national and international regulations and company standards which are defined and specified

Restriction of Hazardous Substances (RoHS) Directive

The RoHS Directive stands for "the restriction of the use of certain hazardous substances in electrical and electronic equipment". This directive bans the placing on the EU market of new electrical and electronic equipment containing more than agreed levels of hazardous substances (lead, cadmium, mercury, hexavalent chromium), plus two flame retardants often found in plastics, PBB and PBDE.
All standard catalogued Thorn products designed and manufactured since 1st July 2006 conform to the requirements.

Voyager LED
In the Voyager LED range the NiMH batteries are not encased in the LED gear, thus complying with regulations, avoiding any operational heat issues and allowing quick replacement without tools. As well as their long operating lives, the LEDs employed offer considerable energy savings. Voyager LED units typically consume only 15 percent of the power of a standard solution for the same light output. They enable designers to specify fittings that are more aesthetically pleasing, consume less power, require smaller power supplies, run for longer periods than before and give a better quality of life through a cleaner environment.



Promoting a cleaner environment by minimisising harmful substances in emergency lighting batteries

Following a new environmental focus the new EU Batteries and Accumulators (rechargeable batteries) Directive (2006/66/EC) came into force in September 2008 replacing the previous battery directive (91/157/EEC).

One of its key aims is to effectively ban the use of nickel cadmium (NiCd), other than for specific exemptions, including emergency lighting. Naturally, EU officials are concerned about the environmental and health hazards posed by used batteries which contain toxic metals such as cadmium, when they go to landfill. Additional aims include designing for "easy" removal of batteries at end-of-life, more efficient waste management and better labelling.

Realising that the directive is an important step towards a greener society, even though emergency lighting products are exempt, and appreciating that customers are more likely to chose products that pollute less, Thorn is taking the leading step of using substitutes such as Nickel Metal Hydride (NiMH) as a cadmium free replacement for NiCd batteries in its emergency lighting products. Against the slow response of most lighting manufacturers the company aims to change-over 50% of its emergency lighting portfolio by April 30, 2010.

The use of NiMH brings other benefits: they offer greater battery capacity per volume resulting in smaller units and have superior recharge characteristics in that they do not suffer from the "memory effect". This occurs when a NiCd battery is only partially discharged before its next recharge. The battery then "forgets" it has the capacity to further discharge and, although functional, remains stuck at the lower, partially discharged capacity.

Whilst conducting this conversion program Thorn is also designing emergency lighting products in such a way that the battery can be more easily removed.

Regent Street Project
With the aim to reduce waste, lower cost and increase efficiency a recent reusable packaging initiative was designed by Thorn Spennymoor for the W8 Project on Regent Street, London. By using reuseable polypropylene trays with foam inserts (for product location/separation) that accept eight modular fluorescent luminaires and then stretch wrapping them onto pallets packaging waste has been reduced, installation speeded up (the fittings were supplied with flying leads) and 20,000 euros saved.

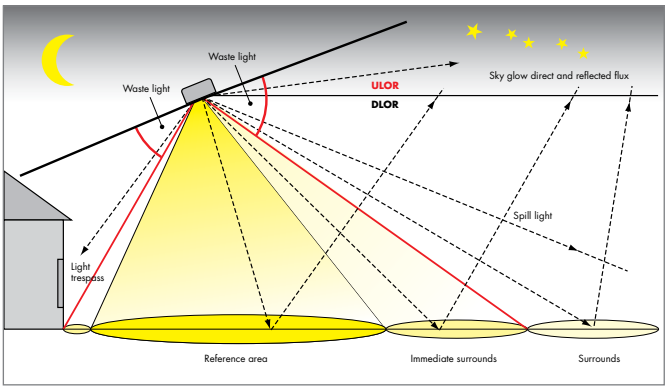
The Packaging Directive

Packaging legislation is driven by the Packaging & Packaging Waste Directive (94/62/EC) - which is concerned with minimising the creation of packaging waste material and promotes energy recovery, re-use and recycling of packaging. Thorn focusses particularly on packaging composition, reusability, recoverability, and the ability to recycle.

Upward light emissions, spill light and light trespass are major concerns and at Thorn we invest in the study of obtrusive light and in the development of solutions to minimise it in urban, road and sports lighting applications

Obtrusive light

Obtrusive light (upward emissions, spill light and light trespass) has emerged as a major concern in the past decade and there are demands and guides (CIE 150: "Guide on the limitation of the effects of obtrusive light from outdoor lighting installations") for making a reduction. Thorn invests in the study of obtrusive light and in the solutions to minimise it. Computer optimised luminaire optics and best practise in application design, coupled with good installation set-up, will all combine to limit as far as possible this harmful and wasteful effect and produce a result welcomed by users and local residents alike.



The components of obtrusive light

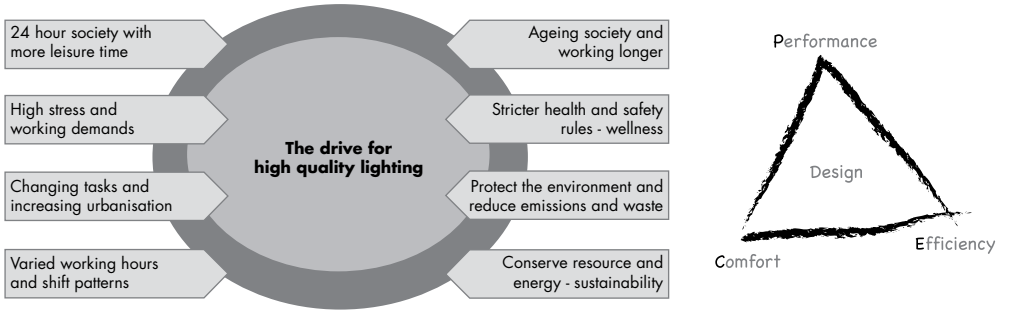
With such practice of good management of resource, increased energy efficiency, employment of new technologies and the drive for renewable energy generation will ensure good future for light and lighting.

Plurio
Sustainability and well-being are important factors in the Plurio range of lanterns, especially designed for urban and residential spaces. A multi-facetted rotational reflector improves visibility, minimises glare and directs the light down, thus avoiding any upward light (ULOR=0%).

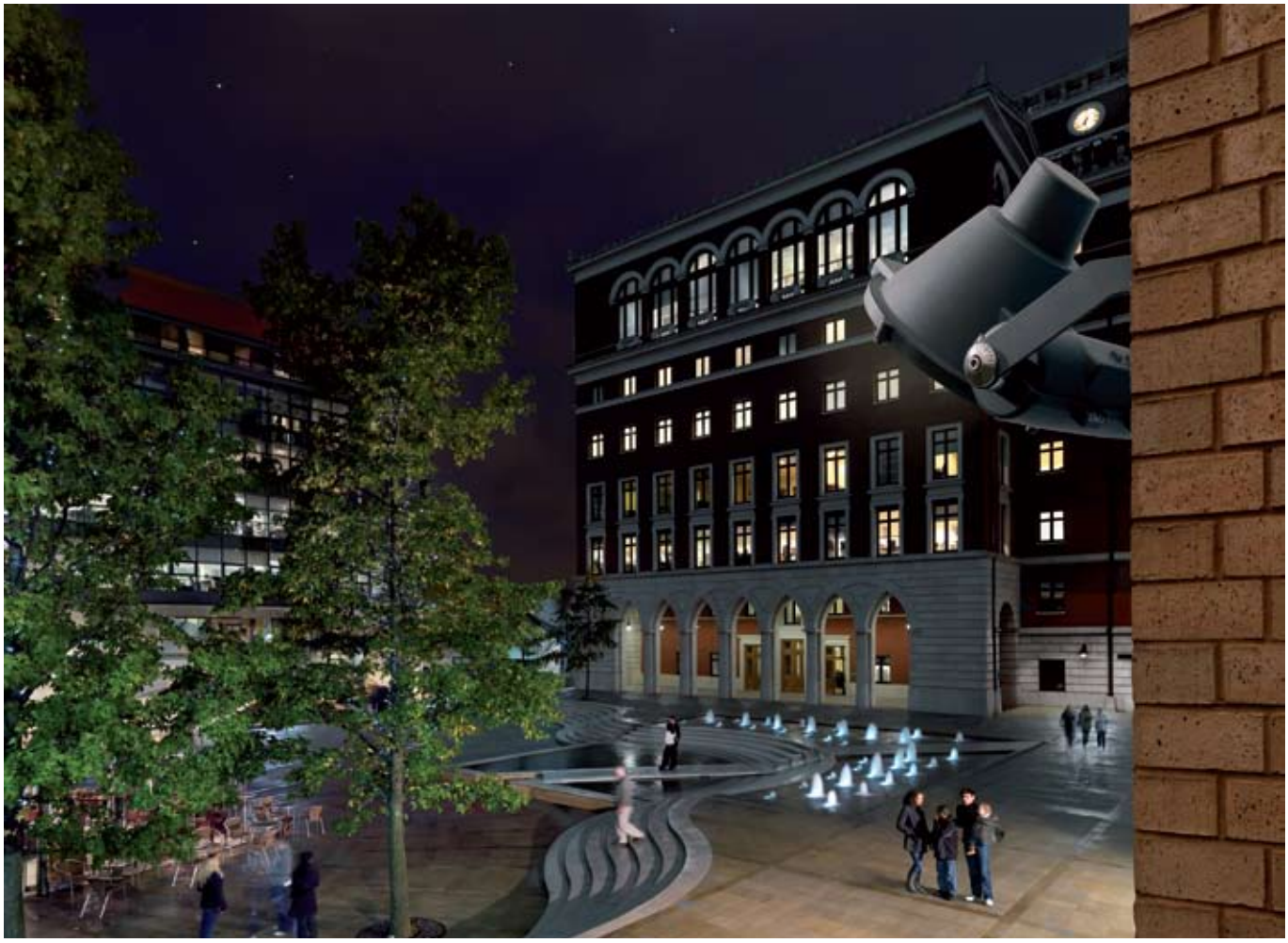
Areaflood
The optical design of Areaflood is notably different from normal floodlights making it the ideal choice for applications where the control of obtrusive light is critical. Instead of having a 'flat glass' construction Areaflood's front glass enclosure is inclined inside the floodlight. The front of the body acts as a cowl for full cut-off and provides a 'virtual' light emitting surface, which is aimed parallel (flat) to the ground. As a result illuminance and uniformity of floodlighting projects can be optimised without the need to tilt the floodlight, thus reducing obtrusive light.

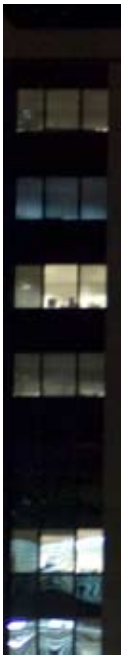
Performance
provide the best visual effectiveness
Efficiency
minimise the use of energy, CO_2 emissions and waste
Comfort
give satisfaction and stimulation

PEC – Performance, Efficiency, Comfort – is the dynamic, results-orientated programme that underpins the Thorn approach to lighting design and implementation. PEC reconciles the need for low direct and environmental costs with the need to deliver workplace and public lighting that promotes efficiency, safety, wellness and productivity. With statutory and environmental pressures increasing, PEC offers Thorn customers the ability to provide optimum lighting solutions for people and places while conserving energy, cash and raw materials.



Principle lighting needs for people





Performance
provide the best visual effectiveness
Efficiency
minimise the use of energy, CO_2 emissions and waste
Comfort
give satisfaction and stimulation

PEC works equally flexibly in any lighting application, from a small office or schoolroom to a major office development, road or football pitch. Each time, the balance between the three components of PEC will be different, while the underlying concept ensures a consistent, high-quality and cost-effective outcome.

Performance and efficiency criteria can be quantified and the solutions engineered to conform to requirements or recommended targets. Comfort criteria are subjective and influenced by psychology of lighting and the solutions are prepared to design rules and creative/artistic experience.

PEC can equally be applied to products, for the luminaire plays an important role in providing the right light on the right place at the right time.

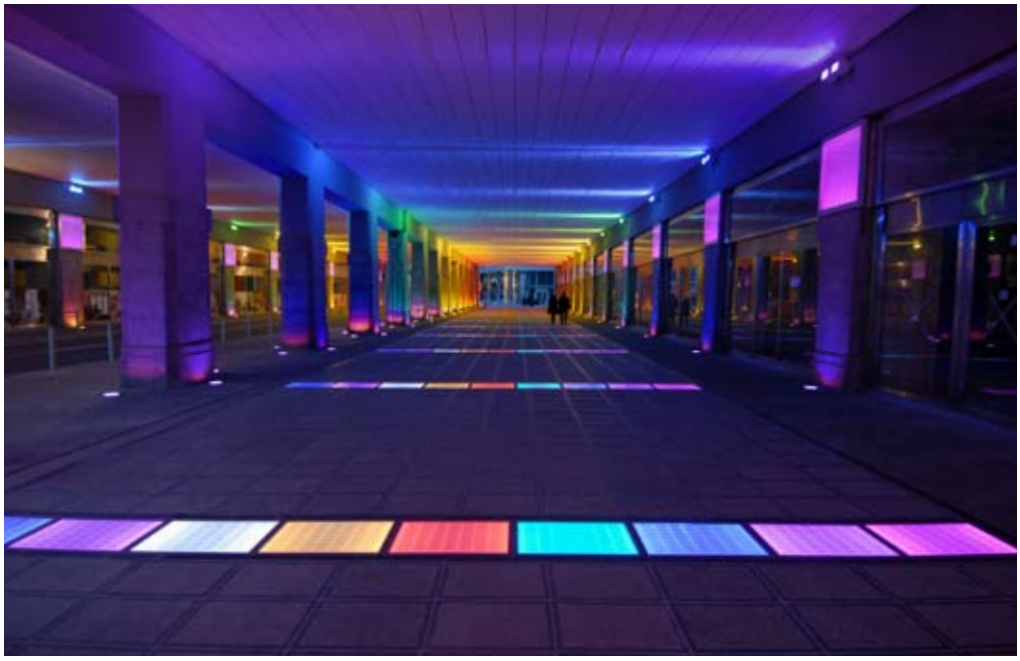
The best way to appreciate and evaluate PEC is to see it in action. Here we illustrate some of the benefits of the programme and the viable, reliable, economic and sustainable results it delivers.

Menlo Soft SR Dual Colour
This system best illustrates how Thorn is meeting its prime environmental objective of offering energy efficient / eco-friendly lighting products to its customers. Increased user comfort is provided by a balance of natural indirect light from two outer lamps (6500K or above) with warmer (4000K) direct light, adjustable by the use of lighting controls. The dynamic lighting is controlled from a wall plate, which enables scene selection and adjustability of the light level and balance so that the user can adjust the light to their mood. Together with a choice of T16 – 16mm lamp ratings operated from digital dimmable ballasts energy use is kept at a minimum. Furthermore the range is now available with microprism diffuser technology (MPT) for an enhanced performance and sharper aesthetic.

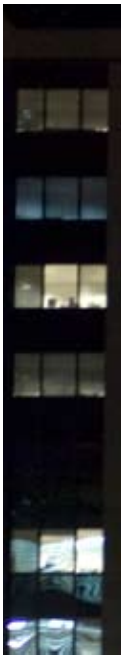
Energy House lives up to its name
Being environmentally responsible is a high priority for Darwin City Council. As part of its energy efficiency drive, power hungry fittings have been replaced with modern luminaires at Energy House - saving over 55% of its energy and maintenance bills.

More than 1,000 office lighting units, using twin 36W lamps, have been replaced with Royal luminaires from Thorn Australia. Each has a 36W lamp, LORs of 80% plus, dimmable electronic ballasts and linkage to occupancy sensors and timer delay switches. And there's more good news for environmentalists – the council has recycled its old lamps.

We work with building designers and end users to improve the energy performance of buildings using lighting controls to provide light only when and where needed



Colour-changing lighting brightens up underpass
Outdoor colour-changing LED Plane luminaires have been chosen to light Saint-Josse commune's previously neglected pedestrian and road underpass, Pont Brabant, in Brussels, Belgium. They were selected by 'light sculptor' Patrick Rimoux because they are capable of revitalising and rejuvenating the passageway, and because they are energy efficient and long lasting.



Good neighbours
The 27,000 seat Skilled Park stadium on Queensland's Gold Coast features a number of energy efficiency and sustainability principles: a 23,000m² fabric roof - the largest in the southern hemisphere; recycled water for pitch irrigation and cleaning; park and ride transport and high performance floodlighting. The stadium was anxious to provide four levels of illumination with good colour rendering for players, officials, spectators and TV cameras and ensure it was a "good neighbour" with limited obtrusive light to the surrounding area. Using 196 Mundial floodlights with 2kW metal halide lamps in various beam distributions, the installation achieves over 2,000 lux and by mounting the fixtures along the roof structure there is no need for corner towers.

Danish arena get TV friendly
With a light level of 2,200 lux, the fluorescent lighting at the Vest Sports Centre in Denmark satisfies ever more stringent colour television requirements and ensures even and shadow-free illumination with comfortable low glare conditions for the handball players and spectators alike. The installation comprises 200 Titus Sport luminaires with 4 x 80W T16 lamps.

It's not just the performance levels that makes the scheme special. With the help of DALI lighting controls the installation is also extremely efficient and flexible. Each individual fitting can be programmed for different scenarios and different levels, for instance the hall can be used as a handball pitch, a boxing arena or a dance floor - for competition, training or entertainment purposes.

Optimised optics increase light output at the same time as reducing obtrusive light and we have a wealth of knowledge concerning how light can be distributed more effectively

Performance
provide the best visual effectiveness
Efficiency
minimise the use of energy, CO_2 emissions and waste
Comfort
give satisfaction and stimulation

	Conventional bridge	Orus bridge
Parameters	CDMTT 150W	CDMT 35W
Layout	Staggered	Single sided
Mounting height (m)	5.5	0.9
Spacing (m)	20	10
Average maintained luminance (cd/m²)	2	1.7
Overall uniformity ratio Uo = Lmin/Lavg	0.4	0.5
Longitudinal uniformity Ul	0.7	0.75
Threshold increment TI (%)	18	5
UFR (contribution to sky glow)	7	2.86
Consumption (W/m (in road length))	7.5	3.5
Raw material (approx.)	100%	40%

Orus
Although road lighting benefits society by reducing night time accidents, it can cause environmental intrusion both by day and by night. The low level Orus lantern, under the line of sight of most vehicles, has enabled columns to be dispensed with altogether. The unique FlatBeam® optic is optimised for 8 to 15m spacings, using either a single-sided or twin opposite layout. The comparison shown achieves a satisfactory technical performance with minimum environmental impact. Although more units are used, energy use is halved, upward light limited and raw materials reduced by 60%. No columns also means greater safety for drivers, passenger and municipality maintenance staff - there are over 200 deaths and 3,000 injuries in the UK alone each year involving cars hitting lighting columns.

Outdoor lighting controls help truck stop to save energy and manage traffic
If you've ever passed a truck stop during the hours of darkness, you'll have witnessed the lighting blazing away. Besides the wasted energy - and cost for the operator - there is often considerable light spill for neighbouring communities. Thorn is fighting back against energy waste with its Telea outdoor lighting control system, assisted by an Austrian truck stop. The Kettenanlageplatz parking stop at St Christophen, on the highway from Salzburg to Vienna, where truck drivers apply snow chains in the winter, has installed Oracle lanterns with outdoor lighting controllers, resulting in the efficient use of energy and good traffic management.

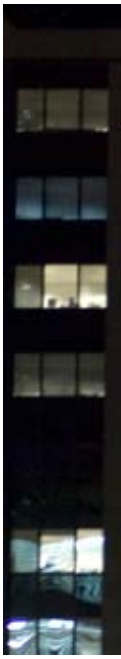
All our employees are actively involved in environmental protection, making their own personal contribution to conserving the environment for future generations and contributing socially in the areas of education and community care

Corporate and Social Responsibility

Thorn believes that every human being is unique and valuable. Therefore it does not tolerate any kind of discrimination either within the company or in collaboration with our business partners.

Within Thorn we conduct ourselves in a fair and respectful way, with honesty and integrity, adhering to the Zumtobel Code of Conduct.

Being conscious of its social responsibility Thorn is committed to undertaking measures and strategies designed to enhance safety in the workplace for all our employees. Child labour is prohibited in all locations. All employees are also actively encouraged in environmental protection and thus can make their own personal contribution to conserving the environment for future generations.



Good citizens

Thorn's continued business success relies very much upon the economic and social well being of the communities in which we operate. Our businesses and employees support charitable, educational and community activities around the world, whether the projects are small and local, or well known and international.

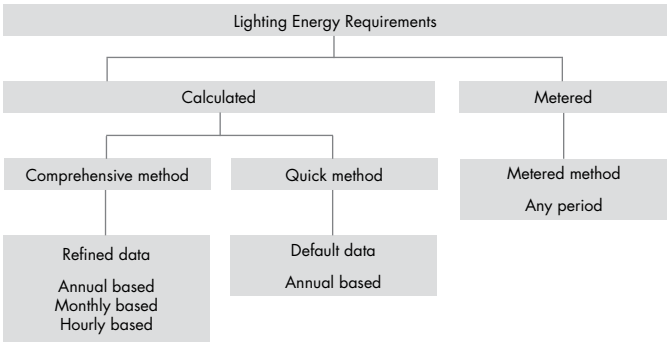
As a member of the Lighting Urban Community International Association (LUCI) Forum, an international network of municipalities, lighting designers, universities and companies that aim to help developing countries by providing good outdoor lighting, Thorn is supporting the illumination of historical landmarks in the city of Jericho in the Palestinian West Bank.

The project (known as 'LightLinks') aims to contribute to the development of urban lighting in disadvantaged communities or regions by encouraging cities from low and high income countries to partner together. The first beneficiary is Jericho, who will receive assistance from the City of Lyon and, of course Thorn. The heritage sites chosen by the Palestinian Ministry of Tourism for attention are the giant tree of Zacchaeus, which is over 2,000 years old, and the ruins of Hisham's Palace with the magnificent Tree of Life mosaic. It is hoped that a third site, the Mount of Temptation, will also benefit from the initiative.

As well as lighting up these tourist attractions, the project also focusses on the transfer of knowledge to the local authorities to enable the quality of illumination of public spaces in the future.

Lighting energy numeric indicator (LENI)

This flow diagram is extracted from the EPB standard and shows two options for the estimation of lighting energy requirements in buildings.



Flow chart illustrating alternative routes to determine energy use

A quick annual energy estimation (where simple annual default values are given) for use in the energy performance certificate of the building and a more accurate comprehensive method (where all the dependency factors are known, including occupancy and the availability of daylight) used for estimating energy over different periods (monthly or annually) and for use in combination with energy needed for heating and cooling the building. The most accurate measure for lighting is by direct metering of the energy used as this is the most positive feedback process on the effectiveness of lighting management and controls.

In some locations outside lighting may be fed with power from the building e.g. an open car park. This load is not included in LENI, but may be included in metering.

Some terminology used in the LENI calculation may be unfamiliar and is, therefore, given below. Note there are two forms of installed power: functional luminaire power and parasitic power for covering lighting controls and the charging of emergency lighting batteries.

Total installed charging power for emergency lighting (P_{em}) – installation input charging power, in watts, of all emergency lighting luminaires in an area.

$$P_{em} = \sum_i P_{ei}$$

where P_{ei} is the emergency lighting charging power in watts.

Total installed control circuit parasitic power (P_{pc}) – installation input power, in watts, of all control systems within luminaires in an area when the lamps are not operating.

$$P_{pc} = \sum_i P_{ci}$$

where P_{ci} is the parasitic power consumed by the controls when the lamps are off, in watts.

Total installed lighting power (P_n) – installation power in watts of all luminaires in an area.

$$P_n = \sum_i P_i$$

Where P_i is the luminaire power in watts. In existing buildings where measured luminaire circuit power is not available an estimation can be made:
1.2 x lamp rating x number of lamps in the luminaire = luminaire power.

Lighting energy numeric indicator (LENI)

Daylight operating hours (t_D) – installation operating hours when daylight is present. Units: hours.

Non-daylight operating hours (t_N) – installation operating hours where daylight is not present. Units: hours.

Annual operating time (t_O) – the annual number of hours with the lamps operating (i.e. turned on)

$$t_O = t_D + t_N$$

where t_D and t_N are defined above.

Standard year time (t_y) – the time taken for one standard year to pass, taken as 8760 hours.

Emergency lighting charge time (t_e) – the operating hours during which the emergency lighting batteries are being charged. Units: hours.

Constant illuminance factor (F_C) – this is a factor relating to the usage of the total installed power when constant illuminance control is in operation in the area . When constant illuminance control is not in operation this has the value of 1. Units: none.
F_C = (1+MF) / 2 where MF is the maintenance factor for the scheme.

Occupancy dependency factor (F_O) – this is a factor relating the usage of the total installed lighting power when occupancy control is in operation in the area. When occupancy control is not in operation this has the value of 1. Units: none

Daylight dependency factor (F_D) – this is a factor relating the usage of the total installed lighting power to daylight availability in the area. When daylight control is not in operation this has the value of 1.
Units: none

The LENI formula is

$$LENI = \frac{W}{A}$$

where

W is the total energy used for lighting a room or zone in kWh/year
and
A is the total useful floor area of the building in m^2.

W is composed of two components

$$W = W_L + W_P \text{ [kWh/year]}$$

where

W_L is the annual lighting energy required to provide illumination so that the building may be used.
W_P is the annual parasitic energy required to provide charging energy for emergency lighting systems and standby energy for lighting control systems.

W_L may be calculated using the formula

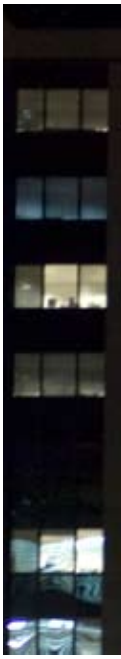
$$W_L = \Sigma\{(P_n \times F_C) \times [t_D \times F_O \times F_D) + (t_N \times F_O)]\}/1000$$

where the individual terms are defined above.

W_P may be calculated using the formula

$$W_P = \Sigma\{\{P_{PC} \times [t_y - (t_D + t_N)]\} + (P_{em} \times t_e)\}/1000$$

where the individual terms are defined above.



Benchmark values and lighting design criteria

													No cte illuminance		Cte illuminance	
				P_n	t_D	t_N	F_C		F_O		F_D		LENI	LENI	LENI	LENI
													Limiting value		Limiting value	
	Quality class	Parasitic Control P_{em} kWh/(m²xyear)	Parasitic Control P_{pc} kWh/(m²xyear)	W/m²	h	h	no cte illumi-nance	cte illumi-nance	Manual	Auto	Manual	Auto	Manual	Auto	Manual	Auto
													kWh/(m²xyear)		kWh/(m²xyear)	
Office	*	1	5	15	2250	250	1	0.9	1	0.9	1	0.9	42.1	35.3	38.3	32.2
	**	1	5	20	2250	250	1	0.9	1	0.9	1	0.9	54.6	45.5	49.6	41.4
	***	1	5	25	2250	250	1	0.9	1	0.9	1	0.9	67.1	55.8	60.8	50.6
Education	*	1	5	15	1800	200	1	0.9	1	0.9	1	0.8	34.9	27.0	31.9	24.8
	**	1	5	20	1800	200	1	0.9	1	0.9	1	0.8	44.9	34.4	40.9	31.4
	***	1	5	25	1800	200	1	0.9	1	0.9	1	0.8	54.9	41.8	49.9	38.1
Hospital	*	1	5	15	3000	200	1	0.9	0.9	0.8	1	0.8	70.6	55.9	63.9	50.7
	**	1	5	25	3000	200	1	0.9	0.9	0.8	1	0.8	115.6	91.1	104.4	82.3
	***	1	5	35	3000	200	1	0.9	0.9	0.8	1	0.8	160.6	126.3	144.9	114.0
Hotel	*	1	5	10	3000	200	1	0.9	0.7	0.7	1	1	38.1	38.1	34.6	34.6
	**		5	20	3000	200	1	0.9	0.7	0.7	1	1	72.1	72.1	65.1	65.1
	***	1	5	30	3000	200	1	0.9	0.7	0.7	1	1	108.1	108.1	97.6	97.6
Restaurant	*	1	5	10	1250	125	1	0.9	1	1	1		29.6		27.1	
	**	1	5	25	1250	125		0.9	1	1	1		67.1		60.8	
	***	1	5	35	1250	125	1	0.9	1	1	1		92.1		83.3	
Sport	*	1	5	10	2000	200	1	0.9	1	1	1	0.9	43.7	41.7	39.7	37.9
	**	1	5	20	2000	200	1	0.9	1	1	1	0.9	83.7	79.7	75.7	72.1
	***	1	5	30	2000	200	1	0.9	1	1	1	0.9	123.7	117.7	111.7	106.3
Retail	*	1	5	15	3000	200	1	0.9	1	1	1		78.1		70.6	
	**	1	5	25	3000	200	1	0.9	1	1	1		128.1		115.6	
	***	1	5	35	3000	200	1	0.9	1	1	1		178.1		160.6	
Manaufacture	*	1	5	10	2500	150	1	0.9	1	1	1	0.9	43.7	41.2	39.7	37.5
	**	1	5	20	2500	150	1	0.9	1	1	1	0.9	83.7	78.7	75.7	71.2
	***	1	5	30	2500	150	1	0.9	1	1	1	0.9	123.7	116.2	111.7	105.0

Benchmark values and lighting design criteria (EN 15193-2007, Annex F Table 1)

Benchmark data is provided (EN 15193-2007, Annex F Table 1) for buildings and is based on the three lighting design classes: basic, good and comprehensive. The values may be evaluated using the quick method of calculation (see page 33). It provides an indication of the installed power and the LENI values for manual and auto controlled lighting management. For example:

Building	Design Criteria Class	Installed Power W/m²	LENI limiting value kWh/(m²xyear) For constant illumination ie where a dimmable lighting system is provided	
Office			Manual	Auto
	Basic	15	38.3	32.2
	Good	20	49.6	41.4
	Comprehensive	25	60.8	50.6

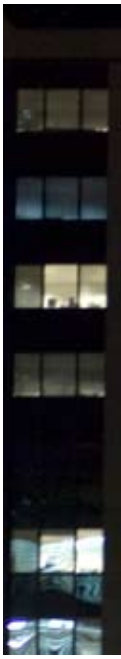
Table 2 Extract from EN 15193-2007, Annex F Table 1, relating to Offices.

Building project: Electronic device assembly plant

Worksheet 1 helps calculate the LENI value. Note that values entered in the spreadsheet are the total values for all luminaires in the installation. If more than one luminaire type is used the total energy usage value (18) should be calculated for each luminaire type and the results summed. This summed value should then be used to calculate the LENI value. The power figures stated in the Application Performance Listing starting on page 34 can be used for these compliance checks.

		Worked Example	Installation 1
Parasitic power			
Total emergency charging power (P_{em})	(1)	165	
Total lighting controls standby power (P_{pc})	(2)	104	
Luminaire data			
Total installed power (P_n)	(3)	28340	
Operating hours			
Daylight operating hours (t_D)	(4)	2500	
Non-daylight operating hours (t_N)	(5)	1500	
Standard year time (t_y)	(6)	8760	8760
Emergency lighting charge time (t_e)	(7)	8760	
Factors			
Constant illuminance factor (F_C)	(8)	0.9	
Occupancy dependency factor (F_O)	(9)	0.9	
Daylight dependency factor (F_D)	(10)	0.8	
Parasitic energy			
Lighting controls parasitic power (2) x [(6) - ((4) + (5))]	(11)	495040	
Emergency lighting parasitic factor (1) x (7)	(12)	1445400	
Total parasitic energy usage ((11) + (12)) / 1000	(13)	1940	
Illumination energy			
Energy usage without daylight/occupancy control (3) x (8)	(14)	25506	
Daylight energy usage (4) x (9) x (10)	(15)	1800	
Non-daylight energy usage (5) x (9)	(16)	1350	
Total energy usage for illumination { (14) x [(15) + (16)] } / 1000	(17)	80344	
Total annual energy usage (13) + (17)	(18)	82284	
Total useful floor area in m²	(19)	2640	
Lighting energy numeric indicator (LENI) (18) / (19)		31.17	

Worksheet 1



Worked example - LENI calculation: Electronic device assembly plant

Location	North East England
Size	Length = 55m, Width = 48m, H = 6m, Useful area = 2640m²
Roof	20% glazed to allow entry of daylight
Walls	2 sides 30% glazed to allow daylight
Interior	Light colour with open plan assembly line layout
Operational hours	= 4000 hrs/year (2500 daylight, 1500 no daylight)
Standard year hours	= 8760 hrs/year
Lighting requirements	– 500 lx on work plane, Uo > 0.7, UGR <19, Ra > 80,
Lighting quality class	– medium (two star)

Lighting solution

230 off Primata II 2x49W T16 lamps battens with slotted white reflector optic and DALI controlled dimmable HF ballast linked daylight detection and auto off control
30 off as above but with E3 emergency lighting capability
6 off 1x18W T26 Exit signs

Required data

Circuit watts of the Primata II luminaire – 109 W
Charge power for Primata II emergency lighting circuit – 3.5 W/Luminaire
Standby power for DALI ballast in the Primata II – 0.4 W/Luminaire
Charge power for Exit sign luminaires – 10 W/Luminaire

Estimations

P_{em} – (3.5 x 30) + (10 x 6) = 165 W
P_{pc} – (0.4 x 260) = 104 W
P_{n} – (109 x 260) = 28,340 W
F_{c} (constant illuminance control MF = 0.8) – 0.9
F_{d} (daylight link control medium daylight supply) – 0.8
F_{o} (presence control manual on/auto off) – 0.9

The calculation for his scheme is shown in Worksheet 1.

Alternative calculation

An alternative, and perhaps more straightforward, method of calculation is to use kWh/m²/time or kWh/m²/year in our example.

This requires a quick re-working of P_{em} , P_{pc} and P_{n} , being:

P_{em} – {(3.5 x 30 x 8760) + (10 x 6 x 8760)}/(2640 x 1000) = 0.55 kWh/(m²xyear)
P_{pc} – (0.4 x 260 x 8760)/(2640 x 1000) = 0.35 kWh/(m²xyear)
P_{n} – (109 x 260)/2640 = 10.73 W/m² (rounded up to 2 decimal points)

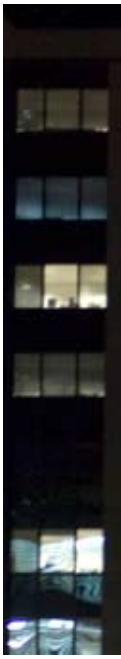
LENI = (0.9 x 10.73)/1000 x {(2500 x 0.8 x 0.9) + (1500 x 0.9)} + 0.55 +
{0.35/8760 x (8760 –(2500 + 1500)]} = (9.66/1000 x (1800 + 1350) + 0.55 +
(0.35/8760 x 4760) = (9.66 x 3.15) + 0.55 + 0.19 = 31.17 kWh/(m²xyear)
LENI = 31.17 kWh/(m²xyear)

Worked example - LENI calculation: Electronic device assembly plant

Table 3 shows the parameters and results for this project in line B. It shows that the addition of the controls will yield a 21% reduction in the energy requirements.
Line A shows the energy requirements if daylight was not admitted into the building and Line C show the Benchmark values for this type of project taken from EN 15193-2007 Annex F Table 1.

													No cte illuminance		Cte illuminance		Gain %
				P_N	t_D	t_N	F_C		F_O		F_D		LENI	LENI	LENI	LENI	
	Quality class	Parasitic Control P_{em} kWh/(m²xyear)	Parasitic Control P_{pc} kWh/(m²xyear)	W/m²	h	h	no cte illumi-nance	cte illumi-nance	Manual	Auto	Manual	Auto	Limiting value		Limiting value		
													Manual	Auto	Manual	Auto	
													kWh/(m²xyear)		kWh/(m²xyear)		
Manufacture	** A	0.55	0.35	10	2500	1500	1	0.9	1	0.9	1	1	43.7	39.4	39.4	35.5	10
	** B	0.55	0.35	10	2500	1500	1	0.9	1	0.9	1	0.8	43.7	34.5	39.4	31.2	21
	** C	1	5	20	2500	1500	1	0.9	1	1	1	0.9	83.7	78.7	75.7	71.2	6

Table 3



The quick method

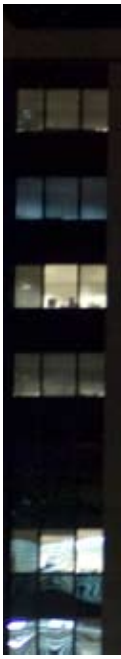
This gives a rough estimate about the annual lighting requirements for typical building types. It includes a number of default values by application (t_D, t_N, F_C, F_D, F_O and W_P) and for the parasitic energy consumed. This is stated at 6 kWh/(m² x year), being 1 kWh/(m² x year) for emergency lighting + 5 kWh/(m² x year) for the automatic lighting controls. These defaults are detailed in EN 15193, Annex F.

$$LENI = \{F_C \times P_N/1000 \times [(t_D \times F_D \times F_O)+(t_N \times F_O)]\}+1+\{5/t_y \times\{t_y - (t_D + t_N)]\}][\text{kWh/(m}^2\text{xyear)}]$$

The quicker method will yield higher values than the comprehensive method as it uses default values rather than actual values.

The list is arranged alphabetically by product range name								
Range / SAP Decription	**Luminaire SAP Code**	**Lamp**	**No of Lamps**	**Total Lamp Initial Lumens (lm)**	**Total Power (W)**	**LOR**	**Luminaire Lumens Per Watt**	**Lumens Per Watt**
Aquaforce II								
AQUAF2 1X36W T26 HF L840	96503023	T26	1	3350	36	0.68	63	93
AQUAF2 1X58W T26 HF L840	96503046	T26	1	5200	55	0.68	64	95
AQUAF2 1X70W T26 HF L840	96503069	T26	1	6550	68	0.48	46	96
AQUAF2 2X36W T26 HF L840	96503092	T26	1	6700	72	0.68	63	93
AQUAF2 2X58W T26 HF L840	96503115	T26	1	10400	107	0.69	67	97
AQUAF2 2X70W T26 HF L840	96503138	T26	1	13100	130	0.69	70	101
Arrowslim T5/T16								
ARROSLM 1X14W	96211392	T16	1	1230	16	0.99	76	77
ARROSLM 1X14W + DIFFUSER RE AC	96211392+96218589	T16	1	1230	16	0.98	75	77
ARROSLM 1X21W	96211394	T16	1	1910	23	0.99	82	83
ARROSLM 1X21W + DIFFUSER RE AC	96211394+96218591	T16	1	1910	23	0.98	81	83
ARROSLM 1X28W	96211396	T16	1	2640	31	0.97	83	85
ARROSLM 1X28W + DIFFUSER RE AC	96211396+96218585	T16	1	2640	31	0.96	82	85
ARROSLM 1X28W + DIFFUSER SA PC	96211396+96218601	T16	1	2640	31	0.69	59	85
ARROSLM 1X28W + REFLECTOR	96211396+96218673	T16	1	2640	31	0.94	80	85
ARROSLM 1X28W + REFLECTOR RAS	96211396+96309199	T16	1	2640	31	0.92	78	85
ARROSLM 1X35W	96211398	T16	1	3320	38	0.97	85	87
ARROSLM 1X35W + DIFFUSER RE AC	96211398+96218587	T16	1	3320	38	0.96	84	87
ARROSLM 1X35W + DIFFUSER SA PC	96211398+96218603	T16	1	3320	38	0.86	75	87
ARROSLM 1X35W + REFLECTOR	96211398+96218674	T16	1	3320	38	0.94	82	87
ARROSLM 1X35W + REFLECTOR RAS	96211398+96309200	T16	1	3320	38	0.92	80	87
ARROSLM 1X49W	96211408	T16	1	4350	53	0.96	79	82
ARROSLM 1X49W + DIFFUSER RE AC	96211408+96218587	T16	1	4350	53	0.94	77	82
ARROSLM 1X49W + DIFFUSER SA PC	96211408+96218603	T16	1	4350	53	0.85	70	82
ARROSLM 1X49W + REFLECTOR	96211408+96218674	T16	1	4350	53	0.87	71	82
ARROSLM 1X49W + REFLECTOR RAS	96211408+96309200	T16	1	4350	53	0.85	70	82
ARROSLM 1X54W	96211410	T16	1	4460	58	0.98	75	77
ARROSLM 1X54W + DIFFUSER RE AC	96211410+96218585	T16	1	4460	58	0.94	72	77
ARROSLM 1X54W + DIFFUSER SA PC	96211410+96218601	T16	1	4460	58	0.68	52	77
ARROSLM 1X54W + REFLECTOR	96211410+96218673	T16	1	4460	58	0.86	66	77
ARROSLM 1X54W + REFLECTOR RAS	96211410+96309199	T16	1	4460	58	0.84	65	77
ARROSLM 1X80W	96211412	T16	1	6150	85	0.98	71	72
ARROSLM 1X80W + DIFFUSER RE AC	96211412+96218587	T16	1	6150	85	0.97	70	72
ARROSLM 1X80W + DIFFUSER SA PC	96211412+96218603	T16	1	6150	85	0.84	61	72
ARROSLM 1X80W + REFLECTOR	96211412+96218674	T16	1	6150	85	0.87	63	72
ARROSLM 1X80W + REFLECTOR RAS	96211412+96309200	T16	1	6150	85	0.84	61	72
ARROSLM 2X14W	96211400	T16	2	2460	32	0.98	75	77
ARROSLM 2X14W + DIFFUSER RE AC	96211400+96218590	T16	2	2460	32	0.98	75	77
ARROSLM 2X21W	96211402	T16	2	3820	45	0.98	83	85
ARROSLM 2X21W + DIFFUSER RE AC	96211402+96218592	T16	2	3820	45	0.98	83	85
ARROSLM 2X28W	96211404	T16	2	5280	60	0.96	84	88
ARROSLM 2X28W + DIFFUSER RE AC	96211404+96218586	T16	2	5280	60	0.96	84	88
ARROSLM 2X28W + DIFFUSER SA PC	96211404+96218602	T16	2	5280	60	0.71	62	88
ARROSLM 2X28W + REFLECTOR	96211404+96218673	T16	2	5280	60	0.92	81	88

The list is arranged alphabetically by product range name								
Range / SAP Decription	**Luminaire SAP Code**	**Lamp**	**No of Lamps**	**Total Lamp Initial Lumens (lm)**	**Total Power (W)**	**LOR**	**Luminaire Lumens Per Watt**	**Lumens Per Watt**
ARROSLM 2X35W	96211406	T16	2	6640	76	0.96	84	87
ARROSLM 2X35W + DIFFUSER RE AC	96211406+96218588	T16	2	6640	76	0.96	84	87
ARROSLM 2X35W + DIFFUSER SA PC	96211406+96218604	T16	2	6640	81	0.87	71	82
ARROSLM 2X35W + REFLECTOR	96211406+96218674	T16	2	6640	76	0.92	80	87
ARROSLM 2X49W	96211414	T16	2	8600	105	0.94	77	82
ARROSLM 2X49W + DIFFUSER RE AC	96211414+96218588	T16	2	8600	105	0.95	78	82
ARROSLM 2X49W + DIFFUSER SA PC	96211414+96218604	T16	2	8600	105	0.85	70	82
ARROSLM 2X49W + REFLECTOR	96211414+96218674	T16	2	8600	105	0.71	58	82
ARROSLM 2X54W	96211416	T16	2	8920	116	0.98	75	77
ARROSLM 2X54W + DIFFUSER RE AC	96211416+96218586	T16	2	8920	116	0.74	57	77
ARROSLM 2X54W + DIFFUSER SA PC	96211416+96218602	T16	2	8920	116	0.68	52	77
ARROSLM 2X54W + REFLECTOR	96211416+96218673	T16	2	8920	116	0.68	52	77
NOTE - DIFFUSER RE PC's ARE THE SAME AS DIFFUSER RE AC's								
Cinqueline								
CINQLINE 3X14W HF WL4 DSB	96235386	T16	3	3600	47	0.81	62	77
CINQLINE 3X14W HF WL4 RPF DSB	96235394	T16	3	3600	47	0.81	62	77
CINQLINE 4X14W HF WL4 DSB	96235390	T16	4	4800	62	0.81	63	77
CINQLINE 4X14W HF WL4 RPF DSB	96235398	T16	4	4800	62	0.81	63	77
Cinqueline SR								
CINQLINESR 4X14W HF WL4 DSB	96235402	T16	4	4800	62	0.81	63	77
ColdForce								
COLDF2 1X36W T26/38 HF	96234623	T26	1	3350	36	0.70	65	93
COLDF2 1X58W T26/38 HF	96234624	T26	1	5200	55	0.66	62	95
COLDF2 2X36W T26/38 HF	96234625	T26	2	6700	72	0.63	59	93
COLDF2 2X58W T26/38 HF	96234626	T26	2	10400	107	0.52	51	97
Corrosionforce								
CORRF2 1X28W T16 HF	96234544	T16	1	2600	32	0.90	73	81
CORRF2 1X35W T16 HF	96234556	T16	1	3300	39	0.93	79	85
CORRF2 1X49W T16 HF	96234568	T16	1	4300	55	0.89	70	78
CORRF2 1X54W T16 HF	96234580	T16	1	4450	58	0.95	73	77
CORRF2 1X80W T16 HF	96234584	T16	1	6150	86	0.88	63	72
CORRF2 2X28W T16 HF	96234588	T16	2	5200	62	0.82	69	84
CORRF2 2X35W T16 HF	96234600	T16	2	6600	77	0.81	69	86
CORRF2 2X49W T16 HF	96234612	T16	2	8600	109	0.86	68	79
CORRF2 1X36W T26 HF	96234474	T26	1	3350	36	0.82	76	93
CORRF2 1X58W T26 HF	96234488	T26	1	5200	55	0.79	75	95
CORRF2 1X70W T26 HF	96234502	T26	1	6550	68	0.78	75	96
CORRF2 2X36W T26 HF	96234510	T26	2	6700	72	0.76	71	93
CORRF2 2X58W T26 HF	96234524	T26	2	10400	107	0.67	65	97
CORRF2 2X70W T26 HF	96234538	T26	2	13100	130	0.68	69	101
Concavia L								
CONCAVIA L 1X165W LMG-lhf IP23 LI + AC RPR DI	96218711+96218751	LMG-lhf	1	12000	165	0.89	65	73
CONCAVIA L 1X165W LMG-lhf IP23 LI + AC RPR DI + KIT COVER PR	96218711+96218751+96218755	LMG-lhf	1	12000	165	0.87	63	73
CONCAVIA L 1X165W LMG-lhf IP23 LI + PC RPR DI	96218711+96228968	LMG-lhf	1	12000	165	0.83	60	73



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Range / SAP Decription	**Luminaire SAP Code**	**Lamp**	**No of Lamps**	**Total Lamp Initial Lumens (lm)**	**Total Power (W)**	**LOR**	**Luminaire Lumens Per Watt**	**Lumens Per Watt**
CONCAVIA L 1X165W LMG-lhf IP23 LI + PC RPR DI + KIT COVER PR	96218711+96228968+96218755	LMG-lhf	1	12000	165	0.82	60	73
CONCAVIA L 1X165W LMG-lhf IP23 LI + RAL NW	96218711+96218750	LMG-lhf	1	12000	165	0.91	66	73
CONCAVIA L 1X165W LMG-lhf IP23 LI + RAL NW + KIT COVER GL IP65	96218711+96218750+96218754	LMG-lhf	1	12000	165	0.74	54	73
CONCAVIA L 1X165W LMG-lhf IP23 LI + RAL WD	96218711+96218749	LMG-lhf	1	12000	165	0.95	69	73
CONCAVIA L 1X165W LMG-lhf IP23 LI + RAL WD + KIT COVER GL IP65	96218711+96218749+96218754	LMG-lhf	1	12000	165	0.86	63	73
CONCAVIA L 1X250W HIE IP23 LI + AC RPR DI + KIT COVER PR	96218712+96218751+96218755	HIE	1	19000	279	0.85	58	68
CONCAVIA L 1X250W HIE IP23 LI + PC RPR DI + KIT COVER PR	96218712+96228968+96218755	HIE	1	19000	279	0.81	55	68
CONCAVIA L 1X250W HIE IP23 LI + RAL NW + KIT COVER GL IP65	96218712+96218750+96218754	HIE	1	19000	279	0.79	54	68
CONCAVIA L 1X250W HIE IP23 LI + RAL WD + KIT COVER GL IP65	96218712+96218749+96218754	HIE	1	19000	279	0.83	57	68
CONCAVIA L 1X250W HIE/HSE IP23 LI HIE + AC RPR DI + KIT COVER PR	96218717+96218751+96218755	HIE	1	19000	279	0.85	58	68
CONCAVIA L 1X250W HIE/HSE IP23 LI HIE + PC RPR DI + KIT COVER PR	96218717+96228968+96218755	HIE	1	19000	279	0.81	55	68
CONCAVIA L 1X250W HIE/HSE IP23 LI HIE + RAL NW + KIT COVER GL IP65	96218717+96218750+96218754	HIE	1	19000	279	0.79	54	68
CONCAVIA L 1X250W HIE/HSE IP23 LI HIE + RAL WD + KIT COVER GL IP65	96218717+96218749+96218754	HIE	1	19000	279	0.83	57	68
CONCAVIA L 1X250W HIE/HSE IP23 LI HSE + AC RPR DI	96218716+96218751	HSE	1	25000	279	0.81	73	90
CONCAVIA L 1X250W HIE/HSE IP23 LI HSE + AC RPR DI + KIT COVER PR	96218716+96218751+96218755	HSE	1	25000	279	0.78	70	90
CONCAVIA L 1X250W HIE/HSE IP23 LI HSE+ PC RPR DI	96218716+96228968	HSE	1	25000	279	0.79	71	90
CONCAVIA L 1X250W HIE/HSE IP23 LI HSE + PC RPR DI + KIT COVER PR	96218716+96228968+96218755	HSE	1	25000	279	0.78	70	90
CONCAVIA L 1X250W HIE/HSE IP23 LI HSE + RAL NW	96218716+96218750	HSE	1	25000	279	0.81	73	90
CONCAVIA L 1X250W HIE/HSE IP23 LI HSE + RAL NW + KIT COVER GL IP65	96218716+96218750+96218754	HSE	1	25000	279	0.73	65	90
CONCAVIA L 1X250W HIE/HSE IP23 LI HSE + RAL WD	96218716+96218749	HSE	1	25000	279	0.83	74	90
CONCAVIA L 1X250W HIE/HSE IP23 LI HSE + RAL WD + KIT COVER GL IP65	96218716+96218749+96218754	HSE	1	25000	279	0.75	67	90
CONCAVIA L 1X250W HME IP23 LI + AC RPR DI	96218724+96218751	HME	1	13000	280	0.83	39	46
CONCAVIA L 1X250W HME IP23 LI + AC RPR DI + KIT COVER PR	96218724+96218751+96218755	HME	1	13000	280	0.80	37	46
CONCAVIA L 1X250W HME IP23 LI + PC RPR DI	96218724+96228968	HME	1	13000	280	0.78	36	46
CONCAVIA L 1X250W HME IP23 LI + PC RPR DI + KIT COVER PR	96218724+96228968+96218755	HME	1	13000	280	0.76	35	46
CONCAVIA L 1X250W HME IP23 LI + RAL NW	96218724+96218750	HME	1	13000	280	0.80	37	46
CONCAVIA L 1X250W HME IP23 LI + RAL NW + KIT COVER GL IP65	96218724+96218750+96218754	HME	1	13000	280	0.72	33	46
CONCAVIA L 1X250W HME IP23 LI + RAL WD	96218724+96218749	HME	1	13000	280	0.83	39	46
CONCAVIA L 1X250W HME IP23 LI + RAL WD + KIT COVER GL IP65	96218724+96218749+96218754	HME	1	13000	280	0.75	35	46
CONCAVIA L 1X400W HIE IP23 LI + PC RPR DI + KIT COVER PR	96218714+96228968+96218755	HIE	1	26000	426	0.82	50	61
CONCAVIA L 1X400W HIE IP23 LI + RAL NW + KIT COVER GL IP65	96218714+96218750+96218754	HIE	1	26000	426	0.77	47	61
CONCAVIA L 1X400W HIE IP23 LI + RAL WD + KIT COVER GL IP65	96218714+96218749+96218754	HIE	1	26000	426	0.85	52	61

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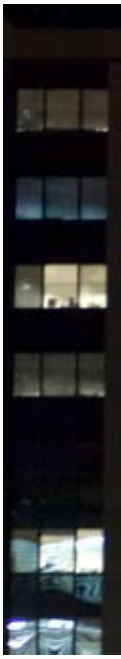
CONCAVIA L 1X400W HIE/HSE IP23 LI HIE + PC RPR DI + KIT COVER PR	96218721+96228968+96218755	HIE	1	30000	433	0.76	53	69
CONCAVIA L 1X400W HIE/HSE IP23 LI HIE + RAL NW + KIT COVER GL IP65	96218721+96218750+96218754	HIE	1	30000	433	0.77	53	69
CONCAVIA L 1X400W HIE/HSE IP23 LI HIE + RAL WD + KIT COVER GL IP65	96218721+96218749+96218754	HIE	1	30000	433	0.80	55	69
CONCAVIA L 1X400W HIE/HSE IP23 LI HSE + PC RPR DI	96218720+96228968	HSE	1	47000	433	0.80	87	109
CONCAVIA L 1X400W HIE/HSE IP23 LI HSE + PC RPR DI + KIT COVER PR	96218720+96228968+96218755	HSE	1	47000	433	0.76	82	109
CONCAVIA L 1X400W HIE/HSE IP23 LI HSE + RAL NW	96218720+96218750	HSE	1	47000	433	0.82	89	109
CONCAVIA L 1X400W HIE/HSE IP23 LI HSE + RAL NW + KIT COVER GL IP65	96218720+96218750+96218754	HSE	1	47000	433	0.73	79	109
CONCAVIA L 1X400W HIE/HSE IP23 LI HSE + RAL WD	96218720+96218749	HSE	1	47000	433	0.86	93	109
CONCAVIA L 1X400W HIE/HSE IP23 LI HSE + RAL WD + KIT COVER GL IP65	96218720+96218749+96218754	HSE	1	47000	433	0.77	84	109
CONCAVIA L 1X400W HME IP23 LI + PC RPR DI	96218726+96228968	HME	1	22000	427	0.81	42	52
CONCAVIA L 1X400W HME IP23 LI + PC RPR DI + KIT COVER PR	96218726+96228968+96218755	HME	1	22000	427	0.73	38	52
CONCAVIA L 1X400W HME IP23 LI + RAL NW	96218726+96218750	HME	1	22000	427	0.85	44	52
CONCAVIA L 1X400W HME IP23 LI + RAL NW + KIT COVER GL IP65	96218726+96218750+96218754	HME	1	22000	427	0.81	42	52
CONCAVIA L 1X400W HME IP23 LI + RAL WD	96218726+96218749	HME	1	22000	427	0.97	50	52
CONCAVIA L 1X400W HME IP23 LI + RAL WD + KIT COVER GL IP65	96218726+96218749+96218754	HME	1	22000	427	0.87	45	52
Cruz 205 L								
CRUZ 205H L 1X18W TC-DEL HF	96106773	TC-DEL	1	1200	20	0.77	46	60
CRUZ 205H L 1X18W TC-TELI HF	96106777	TC-TELI	1	1200	21	0.78	45	57
CRUZ 205H L 1X26W TC-TELI HF	96106778	TC-TELI	1	1800	27	0.79	53	67
CRUZ 205H L 1X26W TC-DEL HF	96107019	TC-DEL	1	1800	27	0.75	50	67
CRUZ 205H L 1X32W TC-TELI HF	96106779	TC-TELI	1	2400	35	0.83	57	69
CRUZ 205H L 2X18W TC-DEL HF	96106774	TC-DEL	2	2400	38	0.69	44	63
CRUZ 205H L 2X26W TC-DEL HF	96107020	TC-DEL	2	3600	51	0.64	45	71
Cruz 205 H								
CRUZ 205H 1X18W TC-DEL HF	96106785	TC-DEL	1	1200	20	0.73	44	60
CRUZ 205H 1X18W TC-TELI HF	96106789	TC-TELI	1	1200	21	0.75	43	57
CRUZ 205H 1X26W TC-DEL HF	96107021	TC-DEL	1	1800	27	0.70	47	67
CRUZ 205H 1X26W TC-TELI HF	96106790	TC-TELI	1	1800	27	0.81	54	67
CRUZ 205H 1X32W TC-TELI HF	96106791	TC-TELI	1	2400	35	0.83	57	69
CRUZ 205H 2X18W TC-DEL HF	96106786	TC-DEL	2	2400	38	0.66	42	63
CRUZ 205H 2X26W TC-DEL HF	96107022	TC-DEL	2	3600	51	0.59	42	71
CRUZ 205V 1X35W HIT G12 HF	96106792	HIT-CE	1	3400	45	0.76	57	76
CRUZ 205V 1X50W HST GX12 HF	96106795	HST-CRI	1	2400	56	0.84	36	43
CRUZ 205V 1X70W HIT G12 HF	96106793	HIT-CE	1	6900	80	0.76	66	86
CRUZ 205V 1X100W HST GX12 HF	96106796	HST-CRI	1	4900	110	0.84	37	45
CRUZ 205V 1X150W HIT G12 HF	96106794	HIT-CE	1	14000	162	0.76	66	86
Cruz 240 L								
CRUZ 240H L 1X26W TC-DEL HF	96106801	TC-DEL	1	1800	27	0.73	49	67
CRUZ 240H L 1X26W TC-TELI HF	96106804	TC-TELI	1	1800	27	0.86	57	67
CRUZ 240H L 1X32W TC-TELI HF	96106805	TC-TELI	1	2400	35	0.79	54	69



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Range / SAP Decription	**Luminaire SAP Code**	**Lamp**	**No of Lamps**	**Total Lamp Initial Lumens (lm)**	**Total Power (W)**	**LOR**	**Luminaire Lumens Per Watt**	**Lumens Per Watt**
CRUZ 240H L 1X42W TC-TELI HF	96106807	TC-TELI	1	3200	46	0.85	59	70
CRUZ 240H L 2X18W TC-DEL HF	96106800	TC-DEL	2	2400	38	0.78	49	63
CRUZ 240H L 2X26W TC-DEL HF	96106802	TC-DEL	2	3600	51	0.63	44	71
CRUZ 240H L 2X26W TC-TELI HF WL4	96107038	TC-DEL	2	3600	51	0.63	44	71
CRUZ 240H L 2X32W TC-TELI HF	96106806	TC-TELI	2	4800	68	0.76	54	71
Cruz 240 H								
CRUZ 240V 1X50W HST GX12 HF	96106825	HST-CRI	1	2400	56	0.87	37	43
CRUZ 240V 1X70W HIT G12 HF	96106823	HIT-CE	1	6900	80	0.80	69	86
CRUZ 240V 1X100W HST GX12 HF	96106826	HST-CRI	1	4900	110	0.87	39	45
CRUZ 240V 1X150W HIT G12 HF	96106824	HIT-CE	1	14000	162	0.76	66	86
CRUZ 240H 1X26W TC-DEL HF	96106816	TC-DEL	1	1800	27	0.70	47	67
CRUZ 240H 1X26W TC-TELI HF	96106819	TC-TELI	1	1800	27	0.86	57	67
CRUZ 240H 1X32W TC-TELI HF	96106820	TC-TELI	1	2400	35	0.84	58	69
CRUZ 240H 1X42W TC-TELI HF	96106822	TC-TELI	1	3200	46	0.79	55	70
CRUZ 240H 2X18W TC-DEL HF	96106815	TC-DEL	2	2400	38	0.70	44	63
CRUZ 240H 2X26W TC-DEL HF	96106817	TC-DEL	2	3600	51	0.57	40	71
CRUZ 240H 2X32W TC-TELI HF	96106821	TC-TELI	2	4800	68	0.69	49	71
Cruz 240 Wallwasher								
CRUZ 240WW 1X35W HIT G12 HF	96106872	HIT-CE	1	3400	45	0.67	51	76
CRUZ 240WW 1X50W HST GX12 HF	96106875	HST-CRI	1	2400	56	0.72	31	43
CRUZ 240WW 1X70W HIT G12 HF	96106873	HIT-CE	1	6900	80	0.68	59	87
CRUZ 240WW 1X100W HST GX12 HF	96106876	HST-CRI	1	4900	110	0.70	31	45
CRUZ 240WW 1X150W HIT G12 HF	96106874	HIT-CE	1	14000	162	0.63	54	86
CRUZ 240WW 1X26W TC-DEL HF	96106867	TC-DEL	1	1800	27	0.56	38	68
CRUZ 240WW 1X32W TC-TELI HF	96106870	TC-TELI	1	2400	35	0.68	48	70
CRUZ 240WW 1X42W TC-TELI HF	96106871	TC-TELI	1	3200	46	0.51	36	70
CRUZ 240WW 2X18W TC-DEL HF	96106865	TC-DEL	2	2400	38	0.59	38	64
CRUZ 240WW 2X26W TC-DEL HF	96106869	TC-DEL	2	3600	51	0.51	36	71
Cruz 280 H								
CRUZ 280V 1X50W HST GX12 HF	96106835	HST-CRI	1	2400	56	0.89	38	43
CRUZ 280V 1X70W HIT G12 HF	96106833	HIT-CE	1	6900	80	0.82	71	87
CRUZ 280V 1X100W HST GX12 HF	96106836	HST-CRI	1	4900	110	0.89	40	45
CRUZ 280V 1X150W HIT G12 HF	96106834	HIT-CE	1	14000	162	0.82	71	86
CRUZ 280H 1X42W TC-TELI HF	96106830	TC-TELI	1	3200	46	0.79	55	70
CRUZ 280H 1X57W TC-TELI HF	96106832	TC-TEL	1	4300	61	0.77	55	71
CRUZ 280H 2X26W TC-DEL HF	96106828	TC-DEL	2	3600	51	0.63	45	71
CRUZ 280H 2X32W TC-TELI HF	96106829	TC-TELI	2	4800	68	0.81	57	71
CRUZ 280H 2X42W TC-TELI HF	96106831	TC-TELI	2	6400	100	0.77	49	64
Cruz 115V								
CRUZ 115V 1X20W HIT G8,5 HF	96106762	HIT-TC-CE	1	1650	24	0.71	49	69
CRUZ 115V 1X35W HIT G8,5 HF	96106763	HIT-TC-CE	1	3300	38	0.73	64	87
CRUZ 115V 1X70W HIT G8,5 HF	96106764	HIT-TC-CE	1	6600	80	0.73	61	83
CRUZ 115V 1X10W TC-DEL HF	96106760	TC-DEL	1	600	12	0.61	30	50
CRUZ 115V 1X13W TC-DEL HF	96106761	TC-DEL	1	900	16	0.71	40	56

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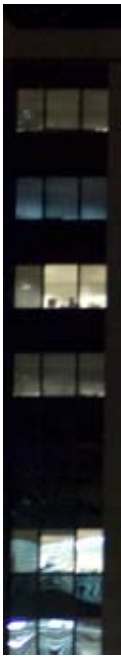
Cruz 160V								
CRUZ 160V 1X18W TC-TELI HF	96106768	TC-TELI	1	1200	21	0.54	32	59
CRUZ 160V 1X26W TC-TELI HF	96106769	TC-TELI	1	1800	27	0.56	38	68
CRUZ 160V 1X32W TC-TELI HF	96106770	TC-TELI	1	2400	35	0.65	45	70
Cruz 160 Gyro								
CRUZ 160G 1X20W HIT G8,5 HF FL	96107039	HIT-TC-CE	1	1650	24	0.79	55	69
CRUZ 160G 1X20W HIT G8,5 HF SP	96106849	HIT-TC-CE	1	1650	24	0.74	51	69
CRUZ 160G 1X35W HIT G8,5 HF FL	96106851	HIT-TC-CE	1	3300	38	0.79	69	87
CRUZ 160G 1X35W HIT G8,5 HF SP	96106850	HIT-TC-CE	1	3300	38	0.73	63	87
CRUZ 160G 1X70W HIT G8,5 HF FL	96106853	HIT-TC-CE	1	6600	80	0.77	64	83
CRUZ 160G 1X70W HIT G8,5 HF SP	96106852	HIT-TC-CE	1	6600	80	0.71	59	83
Cruz 210 Gyro								
CRUZ 210G 1X35W HIT G12 HF FL	96106855	HIT-CE	1	3400	45	0.81	61	76
CRUZ 210G 1X35W HIT G12 HF SP	96106854	HIT-CE	1	3400	45	0.82	62	76
CRUZ 210G 1X50W HST GX12 HF FL	96106861	HST-CRI	1	2400	56	0.81	35	43
CRUZ 210G 1X50W HST GX12 HF SP	96106860	HST-CRI	1	2400	56	0.79	34	43
CRUZ 210G 1X70W HIT G12 HF FL	96106857	HIT-CE	1	6900	80	0.82	71	87
CRUZ 210G 1X70W HIT G12 HF SP	96106856	HIT-CE	1	6900	80	0.85	73	87
CRUZ 210G 1X100W HST GX12 HF SP	96106862	HST-CRI	1	4900	110	0.79	35	45
CRUZ 210G 1X150W HIT G12 HF FL	96106859	HIT-CE	1	14000	162	0.79	69	86
CRUZ 210G 1X150W HIT G12 HF SP	96106858	HIT-CE	1	14000	162	0.82	71	86
Danube								
DA 1X16W TC-DDEL HF CL1 PR RD S WHI	96219064	TC-DDEL	1	1050	18	0.74	43	58
DA 1X28W TC-DDEL HF CL1 OP RD L WHI	96219072	TC-DDEL	1	2050	29	0.64	45	71
DA 1X28W TC-DDEL HF CL1 PR RD L WHI	96219096	TC-DDEL	1	2050	29	0.82	58	71
DA 1X38W TC-DDEL HF CL1 OP RD L WHI	96219120	TC-DDEL	1	2850	40	0.61	43	71
DA 1X38W TC-DDEL HF CL1 PR RD L WHI	96219132	TC-DDEL	1	2850	40	0.78	56	71
NOTE - DATA FOR SQUARE FITTINGS IS THE SAME AS ROUND VERSION								
Cimi								
CIMI 1X14W HF WHI	96205980	T16	1	1200	16	0.71	53	75
CIMI 1X28W HF WHI	96205981	T16	1	2600	31	0.71	60	84
CIMI 1X35W HF WHI	96205982	T16	1	3300	38	0.71	62	87
Duoproof								
DUOPRF 4X14W T16 HF IP65	96232429	T16	4	4800	65	0.51	38	74
DUOPRF 4X24W T16 HF IP65	96232433	T16	4	7000	104	0.55	37	67
DUOPRF 2X28W T16 HF IP65	96232437	T16	2	5200	61	0.58	49	85
DUOPRF 2X35W T16 HF IP65	96232445	T16	2	6600	77	0.58	50	86
DUOPRF 2X49W T16 HF IP65	96232449	T16	2	8600	107	0.55	44	80
DUOPRF 2X54W T16 HF IP65	96232441	T16	2	8900	115	0.51	39	77
DUOPRF 4X28W T16 HF IP65	96232457	T16	4	10400	124	0.63	53	84
DUOPRF 4X35W T16 HF IP65	96232465	T16	4	13200	154	0.66	57	86
DUOPRF 4X49W T16 HF IP65	96232469	T16	4	17200	218	0.69	54	79
DUOPRF 4X54W T16 HF IP65	96232461	T16	4	17800	236	0.59	44	75
DUOPRF 2X36W TC-L HF IP65	96218800	TC-L	2	5800	74	0.53	41	78
DUOPRF 2X36W T26 HF IP65	96218789	T26	2	6700	70	0.49	47	96



The list is arranged alphabetically by product range name								
Range / SAP Decription	**Luminaire SAP Code**	**Lamp**	**No of Lamps**	**Total Lamp Initial Lumens (lm)**	**Total Power (W)**	**LOR**	**Luminaire Lumens Per Watt**	**Lumens Per Watt**
DUOPRF 2X58W T26 HF IP65	96218803	T26	2	10400	107	0.47	46	97
DUOPRF 3X18W T26 HF IP65	96218795	T26	3	4050	53	0.58	44	76
DUOPRF 3X36W T26 HF IP65	96218791	T26	3	10050	110	0.56	51	91
DUOPRF 4X18W T26 HF IP65	96218797	T26	4	5400	70	0.55	42	77
DUOPRF 4X36W T26 HF IP65	96218793	T26	4	13400	142	0.59	55	94
Elevation Premier								
ELEVATION P 3X14W T16 HF WL4	96235378	T16	3	3600	49	0.75	55	73
ELEVATION P 3X24W T16 HF WL4	96235382	T16	3	5250	78	0.71	48	67
Glacier								
GLACIER 5516 TOP 150W HIT-CE 240V GRY+PRISM. Glas	96010572+96101003	HIT-CE	1	14000	160	0.79	69	88
GLACIER 5516 TOP 150W HIT-CE 240V GRY+REFLECTOR ALU	96010572+96004660	HIT-CE	1	14000	160	0.49	43	88
GLACIER 5515 TOP 1X26W TC-D GRY+PRISM. Glas	96004655+96101003	TC-D	1	1800	31	0.82	48	58
GLACIER 5515 TOP 1X42W TC-TEL HF GRY+PRISM. Glas	96004656+96101003	TC-TEL	1	3200	49	0.95	62	65
GLACIER 5515 TOP 1X42W TC-TEL HF GRY+REFLECTOR ALU	96004656+96004660	TC-TEL	1	3200	49	0.62	40	65
GLACIER 5515 TOP 1X70W HIT-CE 240V GRY+PRISM. Glas	96100896+96101003	HIT-CE	1	6400	90	0.86	61	71
HeatForce								
HEATF2 1X36W T26 HF	96234627	T26	1	3350	36	0.81	75	93
HEATF2 1X58W T26 HF	96234628	T26	1	5200	55	0.81	77	95
ImpactForce								
IMPACTF2 1X28W T16 HF	96234392	T16	1	2600	32	0.93	77	83
IMPACTF2 1X35W T16 HF	96234404	T16	1	3300	39	0.91	77	85
IMPACTF2 1X49W T16 HF	96234416	T16	1	4300	55	0.87	69	79
IMPACTF2 1X54W T16 HF	96234428	T16	1	4450	58	0.98	75	77
IMPACTF2 1X80W T16 HF	96234432	T16	1	6150	86	0.86	62	72
IMPACTF2 2X28W T16 HF	96234436	T16	2	5200	62	0.78	65	84
IMPACTF2 2X35W T16 HF	96234448	T16	2	6600	77	0.77	66	86
IMPACTF2 2X49W T16 HF	96234460	T16	2	8600	109	0.82	64	79
IndiQuattro								
INDIQUAT L+ 1X55W TCL HF WL4 DSB	96235138	TC-L	1	4800	61	0.67	53	79
INDIQUAT L+ 1X55W TCL HFD WL6 DSB	96235140	TC-L	1	4800	62	0.67	52	77
INDIQUAT L+ 2X24W T16 HF WL4 DSB	96235142	T16	2	3500	49	0.77	55	72
INDIQUAT L+ 2X24W T16 HFD WL6 DSB	96235144	T16	2	3500	53	0.77	50	66
INDIQUAT L+ 2X40W TCL HF WL4 DSB	96235146	TC-L	2	7000	90	0.64	49	78
INDIQUAT L+ 2X40W TCL HFD WL6 DSB	96235203	TC-L	2	7000	88	0.64	51	80
INDIQUAT L+ 2X55W TCL HF WL4 DSB	96235205	TC-L	2	9700	120	0.62	50	81
INDIQUAT L+ 2X55W TCL HFD WL6 DSB	96235207	TC-L	2	9700	118	0.62	51	82
Invincible II								
INVINC2 2X28W T16 HF DSB IP65	96502856	T16	2	5200	62	0.67	56	84
INVINC2 2X54W T16 HF DSB IP65	96502857	T16	2	8900	118	0.62	47	75
INVINC2 4X14W T16 HF DSB IP65	96502859	T16	4	4800	65	0.66	49	74
INVINC2 4X24W T16 HF DSB IP65	96502861	T16	4	7000	97	0.64	46	72
INVINC2 4X28W T16 HF DSB IP65	96502863	T16	4	10400	124	0.65	55	84
INVINC2 4X54W T16 HF DSB IP65	96502865	T16	4	17800	236	0.63	47	75
INVINC2 3X40W TC-L HF DSB IP65	96502866	TC-L	3	10500	134	0.50	39	78

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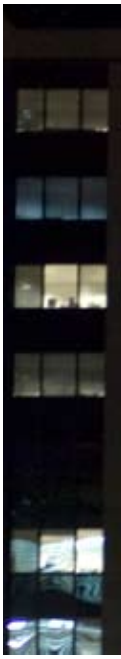
INVINC2 3X55W TC-L HF DSB IP65	96502867	TC-L	3	14400	176	0.45	37	82
INVINC2 2X28W T16 HF PR IP65	96502904	T16	2	5200	62	0.54	45	84
INVINC2 2X54W T16 HF PR IP65	96502905	T16	2	8900	118	0.52	39	75
INVINC2 4X14W T16 HF PR IP65	96502907	T16	4	4800	65	0.63	47	74
INVINC2 4X24W T16 HF PR IP65	96502909	T16	4	7000	97	0.60	43	72
INVINC2 4X28W T16 HF PR IP65	96502911	T16	4	10400	124	0.66	56	84
INVINC2 4X54W T16 HF PR IP65	96502913	T16	4	17800	236	0.66	49	75
INVINC2 3X40W TC-L HF PR IP65	96502914	TC-L	3	10500	134	0.44	34	78
INVINC2 3X55W TC-L HF PR IP65	96502915	TC-L	3	14400	176	0.42	34	82
Jupiter II								
JUPITER 2 1X28 HF + JUPITER 2 1X28W DSB	96232937+96233017	T16	1	2600	31	0.78	65	84
JUPITER 2 1X28 HF + JUPITER 2 1X28W PC OP	96232937+96233021	T16	1	2600	31	0.66	55	84
JUPITER 2 1X35W HF + JUPITER 2 1X35/49/80 DSB	96232939+ 96233019	T16	1	3300	39	0.83	70	85
JUPITER 2 1X35W HF+ JUPITER 2 1X35/49/80 PC OP	96232939+96233023	T16	1	3300	39	0.61	52	85
JUPITER 2 1X49W HF+ JUPITER 2 1X35/49/80 DSB	96232946+ 96233019	T16	1	4300	53	0.79	64	81
JUPITER 2 1X49W HF+ JUPITER 2 1X35/49/80 PC OP	96232946+96233023	T16	1	4300	53	0.62	50	81
JUPITER 2 1X80W HF + JUPITER 2 1X35/49/80 DSB	96232948+ 96233019	T16	1	6150	86	0.78	56	72
JUPITER 2 1X80W HF+ JUPITER 2 1X35/49/80 PC OP	96232948+96233023	T16	1	6150	86	0.61	44	72
JUPITER 2 2X28 HF + JUPITER 2 2X28W DSB	96232938+96233018	T16	2	5200	61	0.79	67	85
JUPITER 2 2X28 HF + JUPITER 2 2X28W PC OP	96232938+96233022	T16	2	5200	61	0.65	55	85
JUPITER 2 2X35W HF+ JUPITER 2 2X35/49/80 DSB	96232940+96233020	T16	2	6600	77	0.86	74	86
JUPITER 2 2X35W HF+ JUPITER 2 2X35/49/80 PC OP	96232940+96233024	T16	2	6600	77	0.63	54	86
JUPITER 2 2X49W HF+ JUPITER 2 2X35/49/80 DSB	96232947+96233020	T16	2	8600	107	0.75	60	80
JUPITER 2 2X49W HF+ JUPITER 2 2X35/49/80 PC OP	96232947+96233024	T16	2	8600	107	0.67	54	80
JUPITER 2 2X80W HF+ JUPITER 2 2X35/49/80 DSB	96232949+96233020	T16	2	12300	175	0.68	48	70
JUPITER 2 2X80W HF+ JUPITER 2 2X35/49/80 PC OP	96232949+96233024	T16	2	12300	175	0.61	43	70
JUPITER 2 3X14W HF+ JUPITER 2 3X14 DSB	96232950+96233374	T16	3	3600	49	0.71	52	73
JUPITER 2 3X14W HF+ JUPITER 2 3X14 PC OP	96232950+ 96233376	T16	3	3600	49	0.58	43	73
JUPITER 2 DI 1X28 HF + JUPITER 2 1X28W DSB	96232966+96233017	T16	1	2600	31	0.88	74	84
JUPITER 2 DI 1X28 HF + JUPITER 2 1X28W PC OP	96232966+96233021	T16	1	2600	31	0.86	72	84
JUPITER 2 DI 1X35W HF + JUPITER 2 1X35/49/80 DSB	96232941+ 96233019	T16	1	3300	39	0.82	69	85
JUPITER 2 DI 1X35W HF+ JUPITER 2 1X35/49/80 PC OP	96232941+96233023	T16	1	3300	39	0.78	66	85
JUPITER 2 DI 1X49W HF+ JUPITER 2 1X35/49/80 DSB	96232968+ 96233019	T16	1	4300	53	0.84	68	81
JUPITER 2 DI 1X49W HF+ JUPITER 2 1X35/49/80 PC OP	96232968+96233023	T16	1	4300	53	0.77	62	81
JUPITER 2 DI 1X80W HF + JUPITER 2 1X35/49/80 DSB	96232970+ 96233019	T16	1	6150	86	0.84	60	72
JUPITER 2 DI 1X80W HF+ JUPITER 2 1X35/49/80 PC OP	96232970+96233023	T16	1	6150	86	0.78	56	72
JUPITER 2 DI 2X28 HF + JUPITER 2 2X28W DSB	96232967+96233018	T16	2	5200	61	0.88	75	85
JUPITER 2 DI 2X28 HF + JUPITER 2 2X28W PC OP	96232967+96233022	T16	2	5200	61	0.88	75	85
JUPITER 2 DI 2X35W HF+ JUPITER 2 2X35/49/80 DSB	96232942+96233020	T16	2	6600	77	0.83	71	86
JUPITER 2 DI 2X35W HF+ JUPITER 2 2X35/49/80 PC OP	96232942+96233024	T16	2	6600	77	0.83	71	86
JUPITER 2 DI 2X49W HF+ JUPITER 2 2X35/49/80 DSB	96232969+96233020	T16	2	8600	107	0.84	68	80
JUPITER 2 DI 2X49W HF+ JUPITER 2 2X35/49/80 PC OP	96232969+96233024	T16	2	8600	107	0.83	67	80
JUPITER 2 DI 2X80W HF+ JUPITER 2 2X35/49/80 DSB	96232971+96233020	T16	2	12300	175	0.84	59	70
JUPITER 2 DI 2X80W HF+ JUPITER 2 2X35/49/80 PC OP	96232971+96233024	T16	2	12300	175	0.83	58	70



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Range / SAP Decription	**Luminaire SAP Code**	**Lamp**	**No of Lamps**	**Total Lamp Initial Lumens (lm)**	**Total Power (W)**	**LOR**	**Luminaire Lumens Per Watt**	**Lumens Per Watt**
Line XS								
LINE XS CIRC 4X32/42W TC-TEL HF GRY PF/BLU	96201442 (42W)	TC-TEL	4	12800	188	0.47	32	68
LINE XS SOFT 2X28W GRY PF/BLU	96013017	T16	2	5280	63	0.88	74	84
LINE XS SOFT 2X35W GRY PF/BLU	96013029	T16	2	6640	80	0.88	73	83
LINE XS TECH 2X21W WHI PF/BLU	96013006	T16	2	3800	48	0.86	69	80
LINE XS TECH 2X28W WHI PF/BLU	96013012	T16	2	5200	63	0.86	71	83
LINE XS TECH 2X35W LG3 WHI PF/BLU	96203819	T16	2	6600	76	0.80	70	87
LINE XS UP 2X21W GRY PF/BLU	96013011	T16	2	3820	46	0.79	66	83
LINE XS UP 2X28W GRY PF/BLU	96013021	T16	2	5280	63	0.79	66	84
LINE XS UP 2X35W GRY PF/BLU	96013033	T16	2	6640	80	0.79	66	83
LINE XS WALL 1X14W T16 GRY PF/BLU	96013531	T16	1	1230	16	0.56	43	77
LINE XS WALL 1X24W T16 GRY PF/BLU	96013590	T16	1	1750	26	0.54	36	67
LINE XS WALL UP 1X36W TC-L HF PF GRY/BLU	96201282	TC-L	1	2900	38	0.53	40	76
Loire								
LO 1X16W TC-DDEL HF CL1 GL S WHI IP20	96219198	TC-DDEL	1	1050	18	0.68	39	58
LO 1X28W TC-DDEL HF CL1 GL L WHI IP20	96226702	TC-DDEL	1	2050	29	0.82	58	71
LO 1X28W TC-DDEL HF CL1 PC L WHI IP65	96219172	TC-DDEL	1	2050	29	0.64	45	71
LO 1X38W TC-DDEL HF CL1 GL L WHI IP20	96226708	TC-DDEL	1	2850	40	0.78	55	71
LO 1X38W TC-DDEL HF CL1 PC L WHI IP65	96219178	TC-DDEL	1	2850	40	0.61	43	71
NOTE - DATA FOR SQUARE FITTINGS IS THE SAME AS ROUND VERSION								
Lopak								
LOPAK 1X250W HIT LI	96012933	HIE	1	22500	301	0.70	52	75
LOPAK 1X400W HIT LI	96012934	HSE	1	38500	412	0.73	68	93
LOPAK 1X150W HST LI	96012930	HST	1	15000	180	0.81	68	83
LOPAK 1X250W HST LI	96012931	HST	1	27500	278	0.79	78	99
LOPAK 1X400W HST LI	96012932	HST	1	50000	440	0.78	89	114
MenloSoft Circular								
MENLOSFT CIRC 1X55W HF 596 WL4	96235290	T16-R	1	4500	64	0.58	41	70
MENLOSFT CIRC 1X22W 1X40W HF 596 WL4	96235294	T16	2	5100	60	0.56	48	85
MenloSoft SR								
MENLOSFT SR 3X24W HF DSB WL4	96235246	T16	3	5250	67	0.61	48	78
MENLOSFT SR 4X14W HF DSB WL4	96235256	T16	4	4800	61	0.61	48	79
MENLOSFT SR+ 3X24W HF DSB WL4	96235249	T16	3	5250	67	0.71	56	78
MENLOSFT SR+ 3X24W HFL DSB WL6	96235253	T16	3	5250	77	0.71	48	68
MENLOSFT SR+ 4X14W HF DSB WL4	96235266	T16	4	4800	61	0.69	54	79
MENLOSFT SR+ 4X14W HFL DSB WL6	96235270	T16	4	4800	65	0.69	51	74
MENLOSFT SR 3X24W HF DSB AH WL4	96235271	T16	3	5250	67	0.60	47	78
MENLOSFT SR 4X14W HF DSB AH WL4	96235275	T16	4	4800	61	0.60	47	79
MENLOSFT SR 3X28W HF DSB WL4	96235279	T16	3	7800	94	0.64	53	83
MENLOSFT SR 3X28W HF DSB AH WL4	96235283	T16	1	7800	94	0.63	52	83
Micropak								
MICROPAK BAT 1X14W T16 HF LI840	96008250	T16	1	1230	17	0.99	72	72
MICROPAK BAT 1X14W T16 HF LI840 + DIFFUSER 1X14	96008250+96007268	T16	1	1230	17	0.94	68	72
MICROPAK BAT 1X14W T16 HF LI840 + REFLECTOR 1X14AS	96008250+96007280	T16	1	1230	17	0.68	49	72
MICROPAK BAT 1X21W T16 HF LI840	96007234	T16	1	1910	25	0.99	76	76

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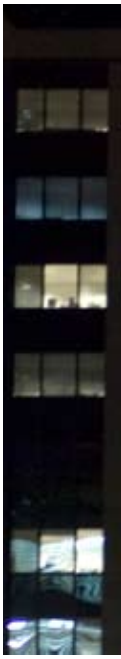
MICROPAK BAT 1X21W T16 HF LI840 + DIFFUSER 1X21	96007234+96007269	T16	1	1910	25	0.94	72	76
MICROPAK BAT 1X21W T16 HF LI840 + REFLECTOR 1X21AS	96007234+96007281	T16	1	1910	25	0.68	52	76
MICROPAK BAT 1X28W T16 HF LI840	96007236	T16	1	2640	31	0.98	84	85
MICROPAK BAT 1X28W T16 HF LI840 + DIFFUSER 1X28	96007236+96007270	T16	1	2640	31	0.92	78	85
MICROPAK BAT 1X28W T16 HF LI840 + LOUVRE 1X28	96007236+96007288	T16	1	2640	31	0.61	52	85
MICROPAK BAT 1X28W T16 HF LI840 + REFLECTOR 1X28M	96007236+96007276	T16	1	2640	31	0.82	70	85
MICROPAK BAT 1X28W T16 HF LI840 + REFLECTOR 1X28AS	96007236+96007282	T16	1	2640	31	0.67	57	85
MICROPAK BAT 1X35W T16 HF LI840	96007238	T16	1	3320	36	0.98	91	92
MICROPAK BAT 1X35W T16 HF LI840 + DIFFUSER 1X35	96007238+96007271	T16	1	3320	36	0.92	85	92
MICROPAK BAT 1X35W T16 HF LI840 + LOUVRE 1X35	96007238+96007289	T16	1	3320	36	0.61	56	92
MICROPAK BAT 1X35W T16 HF LI840 + REFLECTOR 1X35M	96007238+96007277	T16	1	3320	36	0.82	76	92
MICROPAK BAT 1X35W T16 HF LI840 + REFLECTOR 1X35AS	96007238+96007283	T16	1	3320	36	0.67	62	92
MICROPAK BAT 2X14W T16 HF LI840	96007240	T16	2	2460	32	0.97	74	77
MICROPAK BAT 2X14W T16 HF LI840 + DIFFUSER 2X14	96007240+96007272	T16	2	2460	32	0.82	63	77
MICROPAK BAT 2X21W T16 HF LI840	96007242	T16	2	3820	45	0.97	82	85
MICROPAK BAT 2X21W T16 HF LI840 +DIFFUSER 2X21	96007240+96007273	T16	2	3820	45	0.82	69	85
MICROPAK BAT 2X28W T16 HF LI840	96007244	T16	2	5280	63	0.95	80	84
MICROPAK BAT 2X28W T16 HF LI840 + DIFFUSER 2X28	96007244+96007274	T16	2	5280	63	0.80	67	84
MICROPAK BAT 2X28W T16 HF LI840 + LOUVRE 2X28	96007244+96007290	T16	2	5280	63	0.61	51	84
MICROPAK BAT 2X28W T16 HF LI840 + REFLECTOR 2X28M	96007244+96007278	T16	2	5280	63	0.78	66	84
MICROPAK BAT 2X28W T16 HF LI840 + REFLECTOR 2X28AS	96007244+96007284	T16	2	5280	63	0.67	56	84
MICROPAK BAT 2X28W T16 HF LI840 + REFLECTOR 2X28WD DECO	96007244+96007286	T16	2	5280	63	0.67	56	84
MICROPAK BAT 2X35W T16 HF LI840	96007246	T16	2	6640	77	0.95	82	86
MICROPAK BAT 2X35W T16 HF LI840 + DIFFUSER 2X35	96007246+96007275	T16	2	6640	77	0.80	69	86
MICROPAK BAT 2X35W T16 HF LI840 + LOUVRE 2X35	96007246+96007291	T16	2	6640	77	0.61	52	86
MICROPAK BAT 2X35W T16 HF LI840 + REFLECTOR 2X35M	96007246+96007279	T16	2	6640	77	0.78	67	86
MICROPAK BAT 2X35W T16 HF LI840 +REFLECTOR 2X35AS	96007246+96007285	T16	2	6640	77	0.67	57	86
MICROPAK BAT 2X35W T16 HF LI840 + REFLECTOR 2X35WD DECO	96007246+96007287	T16	2	6640	77	0.81	70	86
Optus IV								
OPTUS IV D 2X28W HF GRY DSB IP23	96210911	T16	2	5200	61	0.66	56	85
OPTUS IV D 2X35W HF GRY DSB IP23	96210923	T16	2	6600	76	0.66	57	87
OPTUS IV D 2X49W HF GRY DSB IP23	96203749	T16	2	8600	107	0.66	53	80
OPTUS IV D/I 2X28W HF GRY DSB	96203763	T16	2	5200	61	0.67	57	85
OPTUS IV D/I 2X35W HF GRY DSB	96203765	T16	2	6600	76	0.67	58	87
OPTUS IV D/I 2X49W HF GRY DSB	96203767	T16	2	8600	107	0.67	54	80
OPTUS IV WHITEBOARD 1X28W HF GRY RAS	96211024	T16	1	2600	30.6	0.89	76	85
OPTUS IV WHITEBOARD 1X35W HF GRY RAS	96211028	T16	1	3300	37.6	0.89	78	88
OPTUS IV WHITEBOARD 1X49W HF GRY RAS	96211032	T16	1	4300	52.3	0.93	77	82
Petrelux 9								
PETRELUX P9 2X18W T26 HF	96012770	T26	2	2700	34	0.60	48	79
PETRELUX P9 2X36W T26 HF	96012627	T26	2	6700	72	0.63	59	93
PETRELUX P9 2X58W T26 HF	96007379	T26	2	10400	109	0.58	55	95



The list is arranged alphabetically by product range name

Range / SAP Decription	Luminaire SAP Code	Lamp	No of Lamps	Total Lamp Initial Lumens (lm)	Total Power (W)	LOR	Luminaire Lumens Per Watt	Lumens Per Watt
Planor								
PLANOR 2X39W T16 HF	96004546	T16	2	6400	85	0.76	57	75
PLANOR 2X54W T16 HF SIL	96004547	T16	2	8920	118	0.76	57	76
PLANOR 2X21W T16 HF	96004569	T16	2	3820	46	0.76	63	83
PLANOR 2X28W T16 HF	96004570	T16	2	5280	64	0.76	63	83
PLANOR C 2X39W T16 HF SIL	96004548	T16	2	6400	85	0.63	47	75
PLANOR C 2X54W T16 HF SIL	96004549	T16	2	8920	118	0.63	48	76
PLANOR C 2X21W T16 HF SIL	96004571	T16	2	3820	46	0.63	52	83
PLANOR C 2X28W T16 HF	96004572	T16	2	5280	64	0.63	52	83
Popular Range								
POPPACK BATTEN 1X36W T26 HF LI840	96229554	T26	1	3350	35	0.94	90	96
POPPACK BATTEN 1X36W T26 HF LI840+LOUVRE ECU MP DSB DI	96229554+96217846+96217854	T26	1	3350	35	0.75	72	96
POPPACK BATTEN 1X58W T26 HF LI840	96229555	T26	1	5200	53	0.94	92	98
POPPACK BATTEN 1X58W T26 HF LI840+LOUVRE ECU MP DSB DI	96229554+96217847+96217855	T26	1	5200	53	0.64	63	98
POPPACK BATTEN 1X58W T26 HF LI840+ RNW DI	96229555+96217783	T26	1	5200	53	0.72	71	98
POPPACK BATTEN 1X70W T26 HF LI840	96229556	T26	1	6300	64	0.94	93	98
POPPACK BATTEN 1X70W T26 HF LI840+LOUVRE ECU MP DSB DI	96229556+96217848+96217856	T26	1	6300	64	0.63	62	98
POPPACK BATTEN 1X70W T26 HF LI840+ RNW DI	96229556+96217784	T26	1	6300	64	0.70	69	98
POPPACK BATTEN 2X36W T26 HF LI840	96229557	T26	2	6700	69	0.96	93	97
POPPACK BATTEN 2X36W T26 HF LI840+LOUVRE ECU MP DSB DI	96229557+96217846+96217854	T26	2	6700	69	0.62	60	97
POPPACK BATTEN 2X58W T26 HF LI840	96229558	T26	2	10400	104	0.97	97	100
POPPACK BATTEN 2X58W T26 HF LI840+LOUVRE ECU MP DSB DI	96229558+96217847+96217855	T26	2	10400	104	0.62	62	100
POPPACK BATTEN 2X28W T26 HF LI840+ RNW DI	96229558+96217781	T26	2	10400	104	0.73	73	100
POPPACK BATTEN 2X70W T26 HF LI840	96229559	T26	2	12600	122	0.98	101	103
POPPACK BATTEN 2X70W T26 HF LI840+LOUVRE ECU MP DSB DI	96229559+96217848+96217856	T26	2	12600	122	0.61	63	103
POPPACK BATTEN 2X70W T26 HF LI840+ RNW DI	96229559+96217782	T26	2	12600	122	0.70	72	103
Primata II								
PR2 1/28W T16 HF	96502704	T16	1	2600	32	0.97	79	81
PR2 1/28W T16 HF+ PR2 R 1/2X28/54	96502704+96502758	T16	1	2600	32	0.97	79	81
PR2 1/28W T16 HF+ PR2 HLW PF 1/2X28/54	96502704+96502812	T16	1	2600	32	0.81	66	81
PR2 1/35W T16 HF	96502705	T16	1	3300	39	0.99	83	85
PR2 1/35W T16 HF+ PR2 R 1/2X35/49/80	96502705+96502759	T16	1	3300	39	0.99	84	85
PR2 1/35W T16 HF+ PR2 HLW PF 1/2X35/49/80	96502705+96502813	T16	1	3300	39	0.84	71	85
PR2 1/49W T16 HF	96502706	T16	1	4300	55	1.00	78	78
PR2 1/49W T16 HF+ PR2 R 1/2X35/49/80	96502706+96502759	T16	1	4300	55	0.93	73	78
PR2 1/49W T16 HF+ + PR2 HLW PF 1/2X35/49/80	96502706+96502813	T16	1	4300	55	0.78	61	78
PR2 1/54W T16 HF	96502707	T16	1	4450	58	0.98	75	77
PR2 1/54W T16 HF+ PR2 R 1/2X28/54	96502707+96502758	T16	1	4450	58	0.93	71	77
PR2 1/54W T16 HF+ PR2 HLW PF 1/2X28/54	96502707+96502812	T16	1	4450	58	0.78	60	77
PR2 1/80W T16 HF	96502708	T16	1	6150	86	0.94	68	72
PR2 1/80W T16 HF+ PR2 R 1/2X35/49/80	96502708+96502759	T16	1	6150	86	0.94	67	72
PR2 1/80W T16 HF+ PR2 HLW PF 1/2X35/49/80	96502708+96502813	T16	1	6150	86	0.79	56	72

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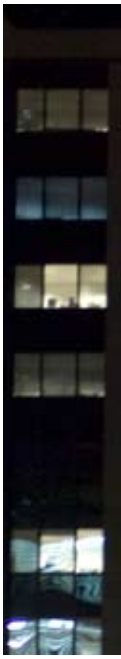
PR2 2/28W T16 HF	96502709	T16	2	5200	62	0.94	79	84
PR2 2/28W T16 HF+ PR2 R 1/2X28/54	96502709+96502758	T16	2	5200	62	0.90	75	84
PR2 2/28W T16 HF+ PR2 HLW PF 1/2X28/54	96502709+96502812	T16	2	5200	62	0.77	65	84
PR2 2/35W T16 HF	96502710	T16	2	6600	77	0.97	83	86
PR2 2/35W T16 HF+ PR2 R 1/2X35/49/80	96502710+96502759	T16	2	6600	77	0.91	78	86
PR2 2/35W T16 HF+ PR2 HLW PF 1/2X35/49/80	96502710+96502813	T16	2	6600	77	0.78	67	86
PR2 2/54W T16 HF	96502711	T16	2	8900	118	0.95	71	75
PR2 2/54W T16 HF+ PR2 R 1/2X28/54	96502711+96502758	T16	2	8900	118	0.86	65	75
PR2 2/54W T16 HF+ PR2 HLW PF 1/2X28/54	96502711+96502812	T16	2	8900	118	0.74	56	75
PR2 2/49W T16 HF	96502712	T16	2	8600	109	0.96	76	79
PR2 2/49W T16 HF+ PR2 R 1/2X35/49/80	96502712+96502759	T16	2	8600	109	0.98	77	79
PR2 2/49W T16 HF+ PR2 HLW PF 1/2X35/49/80	96502712+96502813	T16	2	8600	109	0.84	66	79
PR2 2/80W T16 HF	96502713	T16	2	12300	175	0.95	67	70
PR2 2/80W T16 HF+ PR2 R 1/2X35/49/80	96502713+96502759	T16	2	12300	175	0.76	53	70
PR2 2/80W T16 HF+ PR2 HLW PF 1/2X35/49/80	96502713+96502813	T16	2	12300	175	0.69	48	70
PR2 1/36W T26 HF	96502682	T26	1	3350	36	0.97	90	93
PR2 1/36W T26 HF+PR2 R 1X36	96502682+96502754	T26	1	3350	36	0.86	80	93
PR2 1/36W T26 HF+PR2 HLW PF 1X36	96502682+96502808	T26	1	3350	36	0.73	68	93
PR2 1/58W T26 HF	96502683	T26	1	5200	55	0.96	90	95
PR2 1/58W T26 HF+PR2 R 1X58	96502683+96502755	T26	1	5200	55	0.83	78	95
PR2 1/58W T26 HF+PR2 HLW PF 1X58	96502683+96502809	T26	1	5200	55	0.71	67	95
PR2 2/36W T26 HF	96502684	T26	2	6700	72	0.98	91	93
PR2 2/36W T26 HF+PR2 R 2X36	96502684+96502756	T26	2	6700	72	0.88	82	93
PR2 2/36W T26 HF+PR2 HLW PF 2X36	96502684+96502810	T26	2	6700	72	0.74	69	93
PR2 2/58W T26 HF	96502685	T26	2	10400	107	0.97	94	97
PR2 2/58W T26 HF+PR2 R 2X58	96502685+96502757	T26	2	10400	107	0.84	82	97
PR2 2/58W T26 HF+PR2 HLW PF 2X58	96502685+96502811	T26	2	10400	107	0.72	70	97
Quattro C-Line								
QUATTROC BODY 2X34W TC-L HF +LOUVRE DSB	96235665+96235678	TC-L	2	5600	77	0.69	50	73
QUATTROC BODY 2X34W TC-L HF +DIFFUSER EFL	96235665+96235610	TC-L	2	5600	77	0.49	36	73
QUATTROC BODY 2X36W TC-L HF +LOUVRE DSB	96235580+96235599	TC-L	2	5800	80	0.63	46	73
QUATTROC BODY 2X40W TC-L HF +LOUVRE DSB	96235670+96235678	TC-L	2	7000	85	0.73	60	82
QUATTROC BODY 2X40W TC-L HF +DIFFUSER EFL	96235670+96235610	TC-L	2	7000	78	0.52	47	90
QUATTROC BODY 2X55W TC-L HF +LOUVRE DSB	96235674+96235678	TC-L	2	9700	118	0.66	54	82
QUATTROC BODY 2X55W TC-L HF +DIFFUSER EFL	96235674+96235610	TC-L	2	9700	118	0.46	38	82
QUATTROC BODY 3X18W T26 HF +LOUVRE DSB	96235601+96235608	T26	3	4050	58	0.64	45	70
QUATTROC BODY 3X18W T26 HF +LOUVRE PTX	96235601+96235618	T26	3	4050	58	0.64	45	70
QUATTROC BODY 3X18W T26 HF +DIFFUSER EFL	96235601+96235619	T26	3	4050	55	0.55	41	74
QUATTROC BODY 4X18W T26 HF +LOUVRE DSB	96235613+96235617	T26	4	5400	76	0.69	49	71
QUATTROC BODY 4X18W T26 HF +LOUVRE PTX	96235613+96235618	T26	4	5400	76	0.61	43	71
QUATTROC BODY 4X18W T26 HF +DIFFUSER EFL	96235613+96235619	T26	4	5400	73	0.52	38	74
QUATTROC BODY 2X36W T26 HF +LOUVRE DSB	96235580+96235599	T26	2	6700	70	0.66	63	96
QUATTROC BODY 2X36W T26 HF +DIFFUSER EFL	96235580+96235591	T26	2	6700	70	0.59	56	96
QUATTROC BODY 3X36W T26 HF +LOUVRE DSB	96235622+96235630	T26	3	10050	110	0.64	58	91
QUATTROC BODY 3X36W T26 HF +DIFFUSER EFL	96235622+96235634	T26	3	10050	110	0.61	56	91



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Range / SAP Decription	**Luminaire SAP Code**	**Lamp**	**No of Lamps**	**Total Lamp Initial Lumens (lm)**	**Total Power (W)**	**LOR**	**Luminaire Lumens Per Watt**	**Lumens Per Watt**
Quattro T-Line								
QUATTROT BODY 2X34W TC-L HF LI840+LOUVRE NW DSB	96235558+96235571	TC-L	2	5600	77	0.65	47	73
QUATTROT BODY 2X36W TC-L HF LI840+LOUVRE NW DSB	96235550+96235555	TC-L	2	5800	80	0.61	44	73
QUATTROT BODY 2X40W TC-L HF LI840+LOUVRE NW DSB	96235562+96235571	TC-L	2	7000	85	0.70	58	82
QUATTROT BODY 2X55W TC-L HF LI840+LOUVRE NW DSB	96235566+96235571	TC-L	2	9700	118	0.63	52	82
QUATTROT BODY 3X18W T26 HF LI840+LOUVRE NW DSB	96235530+96235536	T26	3	4050	58	0.67	47	70
QUATTROT BODY 4X18W T26 HF LI840+LOUVRE NW DSB	96235540+96235546	T26	4	5400	76	0.69	49	71
Quattro T5								
QUATROT5 2X28W T16 HF WL4 DSB	96235410	T16	2	5200	60	0.62	54	87
QUATROT5 3X14W T16 HF WL4 DSB	96235464	T16	3	3600	47	0.81	62	77
QUATROT5 4X14W T16 HF WL4 DSB	96235482	T16	4	4800	62	0.81	63	77
QUATROT5 3X14W T16HF WL4 DSB AH	96235486	T16	3	3600	47	0.81	62	77
QUATROT5 4X14W T16HF WL4 DSB AH	96235490	T16	4	4800	62	0.81	63	77
QUATROT5 3X14W T16HF WL4 RPF DSB	96235494	T16	3	3600	47	0.81	62	77
QUATROT5 4X14W T16HF WL4 RPF DSB	96235498	T16	4	4800	62	0.81	63	77
QUATROT5 3X14W T16 HF WL4 FEFL	96235502	T16	3	3600	47	0.68	52	77
QUATROT5 4X14W T16 HF WL4 FEFL	96235506	T16	4	4800	62	0.68	53	77
Radbay								
RADBAY SEALABLE 1X250W HIT/HIE + KIT FRAME CL GL	96006487+ 96003880	HIE	1	22500	278	0.66	53	81
RADBAY SEALABLE 1X400W HIE + KIT FRAME CL GL	96006495 + 96003880	HIE	1	38500	450	0.68	58	86
RADBAY 1X250W HST	96216357	HST	1	33000	305	0.82	89	108
RADBAY 1X400W HST	96216368	HST	1	56500	445	0.83	105	127
RADBAY SEALABLE 1X250W HST AUX + KIT FRAME CL GL	96008464 + 96003880	HST	1	33000	280	0.71	84	118
RADBAY SEALABLE 1X400W HST AUX + KIT FRAME CL GL	96102334 + 96003880	HST	1	56500	432	0.76	99	131
Sienna								
SIENNA 2X28W HF DSB	96205854	T16	2	5200	61	0.77	66	85
SIENNA 2X35W HF DSB	96205869	T16	2	6600	76	0.77	67	87
SIENNA 2X49W HF DSB	96205884	T16	2	8600	107	0.83	67	80
SIENNA 2X54W HF DSB	96205897	T16	2	8900	117	0.69	53	76
Spec-Line Alpha								
SPECALPH 3X18W T26 HF WL4 DSB	96235576	T26	3	4050	53	0.64	49	76
SPECALPH 4X18W T26 HF WL4 DSB	96235578	T26	4	5400	70	0.61	47	77
SPECALPH 2X36W T26 HF WL4 DSB	96235581	T26	2	6700	70	0.60	57	96
SPECALPH 3X36W T26 HF WL4 DSB	96235585	T26	3	10050	110	0.64	59	91
SPECALPH 4X36W T26 HF WL4 DSB	96235589	T26	4	13400	142	0.56	53	94
SPECALPH FDF 3X18W T26 HF WL4	96235623	T26	3	4050	53	0.57	44	76
SPECALPH FDF 4X18W T26 HF WL4	96235628	T26	4	5400	70	0.57	44	77
SPECALPH FDD 3X18W T26 HF WL4	96235632	T26	3	4050	53	0.63	48	76
SPECALPH FDD 4X18W T26 HF WL4	96235635	T26	4	5400	70	0.60	46	77
SPECALPH 3X18W T26 HF WL4 PXT	96235637	T26	3	4050	53	0.66	50	76
SPECALPH 4X18W T26 HF WL4 PXT	96235640	T26	4	5400	70	0.62	48	77
SPECALPH 2X36W T26 HF WL4 PXT	96235643	T26	2	6700	70	0.60	57	96
SPECALPH 3X36W T26 HF WL4 PXT	96235646	T26	3	10050	110	0.66	60	91
SPECALPH 4X36W T26 HF WL4 PXT	96235648	T26	4	13400	142	0.59	55	94

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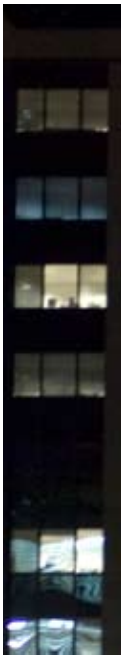
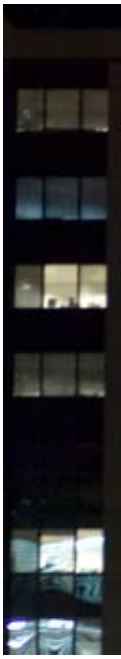
Stormforce								
STORMF2 AC 2X35W T16 HF	96234965	T16	2	6600	77	0.81	70	86
STORMF2 AC 2X49W T16 HF	96234966	T16	2	8600	108	0.86	69	80
STORMF2 PC 2X35W T16 HF	96234983	T16	2	6600	77	0.77	66	86
STORMF2 PC 2X49W T16 HF	96234984	T16	2	8600	108	0.82	65	80
STORMF2 AC 2X70W T26 HF	96234967	T26	2	12400	130	0.68	65	95
STORMF2 AC 2X36W T26 HF	96234981	T26	2	6700	72	0.76	71	93
STORMF2 AC 2X58W T26 HF	96234982	T26	2	10400	107	0.67	65	97
STORMF2 PC 2X70W T26 HF	96234985	T26	2	12400	130	0.64	61	95
STORMF2 PC 2X36W T26 HF	96234944	T26	2	6700	72	0.72	67	93
STORMF2 PC 2X58W T26 HF	96234945	T26	2	10400	107	0.63	61	97
Titus Industry								
TITUS INDUSTRY 1X49W TW	96010204	T16	1	4300	54	0.85	68	80
TITUS INDUSTRY 1X54W TW	96010205	T16	1	4450	58	0.85	65	77
TITUS INDUSTRY 2X49W TW	96010208	T16	2	8600	108	0.89	71	80
TITUS INDUSTRY 2X54W TW	96010209	T16	2	8900	118	0.82	62	75
TITUS INDUSTRY 3X49W TW	96010212	T16	3	12900	162	0.89	71	80
TITUS INDUSTRY 3X54W TW	96010213	T16	3	13350	176	0.82	62	76
TITUS INDUSTRY 3X80W TW	96205454	T16	3	18450	261	0.64	45	71
TITUS INDUSTRY 4X49W TW	96010214	T16	4	17200	215	0.76	61	80
TITUS INDUSTRY 4X54W TW	96010215	T16	4	17800	236	0.75	57	75
Titus Sport								
TITUS SPORT 2X49W	96008788	T16	2	8600	108	0.78	62	80
TITUS SPORT 2X54W	96008789	T16	2	8900	118	0.75	57	75
TITUS SPORT 3X49W	96008790	T16	3	12900	162	0.78	62	80
TITUS SPORT 3X54W	96008791	T16	3	13350	176	0.75	57	76
TITUS SPORT 3X80W	96205433	T16	3	18450	261	0.79	56	71
TITUS SPORT 4X49W	96008792	T16	4	17200	215	0.79	63	80
TITUS SPORT 4X54W	96008793	T16	4	17800	236	0.78	59	75
TITUS SPORT 4X80W	96205439	T16	4	24600	335	0.79	58	73



Ballast	Ballasts are electrical devices used with fluorescent or high intensity discharge (HID) lamps to supply sufficient voltage to start and operate the lamp but then to limit the current during operation. They can be either magnetic or electronic.
Carbon dioxide (CO_2)	An important greenhouse gas. Countries that ratified the Kyoto agreement have committed to reduce their emissions. Lighting designers have the power to hold down CO_2 emissions into the atmosphere (0.42 kg of carbon dioxide is produced for each 1kWh of electricity).
Colour Appearance	The colour emitted by a near-white light source can be indicated by its correlated colour temperature (CCT). Each lamp type has a specific correlated colour temperature measured in degrees Kelvin e.g. 3000K and are described as warm, intermediate, cool and cold.
Colour Rendering	The ability of a light source to reveal the colours of an object. It is determined by the spectral power distribution or spectrum of the light source. Measured by the colour rendering index (CRI or Ra). The higher the number the better, up to a maximum of 100.
Control gear	Most artificial light sources other than incandescent lamps require special control gear to start the lamp and control the current after starting. Depending on the type of lamp involved, the control gear can take the form of ballasts, ignitors or transformers.
Downlight	Ceiling luminaire that concentrates the light in a downward direction. Downlights are generally round or square and recessed into the ceiling, but may also be surface-mounted. They may feature an open reflector and/or a shielding device.
Contrast	Subjective experience of comparative brightness between points or areas of luminance, seen simultaneously or successively.
Contrast Rendering Factor (CRF)	A measure of the degradation of contrast that is caused by veiling reflections (bright reflections in the task).
Digital Addressable Lighting Interface (DALI)	A lighting control protocol set out in the technical standard IEC 929
Efficacy	Measured in lumens per Watt (lm/W) and a useful parameter for assessing how much light is available from the lamp for each Watt of power. Luminaire efficacy is often expressed by dividing the initial lamp lumens by the combined lamp and control gear power.
Emergency lighting	Lighting provided for use when the mains lighting fails for whatever reason.
Glare	Glare is the result of excessive contrasts of luminance in the field of view. The effect may vary from mild discomfort to an actual impairment of the ability to see. When the ability to see is impaired this is called disability glare. Discomfort glare is associated more with interiors; it refers to the discomfort or distraction caused by bright windows or luminaires.
High frequency electronic control gear (HF)	Most artificial light sources other than incandescent lamps require special control gear to start the lamp and control the current after starting. HF electronic gear operates fluorescent tube(s) at high frequency (typically at 30-60 kHz) instead of the mains frequency of 50 Hz offering benefits of higher quality lighting, reduced running costs and ease of use, combined with safe reliable operation. They may also be used with high intensity discharge lamps.
Illuminance	The amount of light falling on an area divided by that area - measured in lux. Generally, 500 lx is needed for office work, whereas a watchmaker requires 4,000 lux. In summer, the sun shines on the ground with 120,000 lux, and a full moon produces 3 lux.
Indirect Lighting	System of illumination where the light from lamps and luminaires is first reflected from a ceiling or wall.
Ingress protection (IP)	Denotes the protection against entry of dust/solid objects and moisture/water, provided by the luminaire enclosure.
Lamp	Lamps are artificial sources of light. There are many types, distinguished by the way they generate light, their light output or luminous flux, their power consumption, their luminous efficiency, their geometry, the spectral composition of the radiation emitted, their luminance and their beam characteristics.
LED/light-emitting diode	An LED or light-emitting diode is a small semiconductor device which emits light, usually coloured, when an electric current passes through it. LEDs are energy saving and have a long service life.

Lighting control system	Lighting control systems are used to actively change the lighting situation. Such changes can take place automatically or as a result of intervention by a user. Lighting control systems often include operating equipment. Lighting can automatically respond to the level of daylight, it can be controlled by presence sensors to switch on or off depending whether people are in the room or can also progress through a sequence of changing scenarios.
Lighting Energy Numeric Indicator (LENI)	Defined in the European standard for assessing the Energy Performance of Buildings (EPBD), EN 15193 as the measure for the annual lighting energy requirement for the building per square metre.The quick method of calculation being: (Total annual energy used for lighting) divided by (Floor area in Sq metres) or {kWh/(m^2 x year)}.
Lighting management	Lighting management covers the entire concept of a controlled or regulated lighting system including emergency lighting and its use. As well as permitting efficient, user-focused operation of the lighting system, it also allows it to be monitored, thus facilitating maintenance.
Light Output Ratio (LOR)	The ratio of the total light output of the luminaire to the output of the lamp(s), under stated conditions.
Lumen (lm)	The unit of luminous flux or the rate of flow of light from a source or received by a surface. When a ray of light hits a solid surface, the process is known as illumination.
Luminaire	Modern term for "light fitting" or "fixture". A complete lighting unit that controls the distribution of light given by a lamp(s) and includes components for fixing and protecting the lamp(s) and for connecting them to the supply circuit. Luminaires for road lighting are often known as lanterns.
Luminaire-lumens per circuit watt	Is the luminaire efficiency factor given by LOR x (total bare lamp flux in the luminaire/circuit Watts).
Luminance	The measured brightness of a surface. The unit is cd/m^2.
Luminous intensity (candelas)	The amount of light that a small light source at the tip of a cone emits through a narrow cone in a given direction.
Lux	The unit of illuminance, equal to one lumen per square metre.
Optic	The reflector and/or refractor system that directs the light emission from the lamp in the luminaire into required directions.
Spill Light	Stray light from a luminaire that incidentally illuminates nearby objects or surfaces within the public environment. Can be a cause of 'light trespass'.
Uniformity	The ratio of the minimum illuminance to the average illuminance over the specified area.
Visual performance	The ability to perceive detail and carry out the visual tasks.
Visual comfort	Our feeling of ease or well being within the visual field.
Visual satisfaction	The qualitative impression of a lit space.



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