New Members

The following new members have been approved and accepted by the TEEAM Council (as at 2nd June 2011). A warm welcome to all the new members and special appreciation is extended to those who introduced these new members. For those who are not yet members……. why wait? Join us and find out how our association can offer our services to you.

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E-mail: aspa_electric@yahoo.com
Contact Person: Mr Asiathamby a/l Perumal
Business: Electrical contractor.

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No. 19, Jalan Putra Perdana 5/4,
Taman Putra Perdana,
47130 Puchong, Selangor Darul Ehsan.
Mobile: +6014-669 0381 Fax: +603-8319 6893
E-mail: propwr@gmail.com
Business: Design, operation, maintenance, testing of electrical systems.

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Taman Sg. Kapar Indah, Kapar,
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Tel: +603-3291 9339, 3291 9329 Fax: +603-3291 0477
E-mail: enquiry@tkg.com.my Website: www.tkg.com.my
Contact Person: Mr Tan Kian Giap
Business: Dealing with all kind of engineering works, machine automation, installation and maintenance.

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47100 Puchong, Selangor Darul Ehsan.
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E-mail: reeepgroup@gmail.com / enquiry@reeepgroup.com
Website: www.reeepgroup.com
Contact Person: Mr Tan Kang Chu
Business: Package / system provider for renewable energy and energy efficiency industry.

FACC Electrical Trading Sdn Bhd
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55100 Kuala Lumpur.
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E-mail: faccsales@gmail.com
Contact Person: Mr Wong Chin Cheong
Business: Electrical trading.

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Contact Person: Mr Chong Tatt Cheong
Business: Electrical contractor.

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E-mail: 1choice.electrical@gmail.com
Contact Person: Mr Teh Chee Tiong
Business: Wholesale.

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Contact Person: Mr Heng Sing Kuang
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Contact Person: Mr Steven Pang
Business: Electrical cable supplies.

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Email: wnkenergy@yahoo.com
Contact Person: Mr Kong Siew Choong
Business: Electrical supplies.

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Membership Recruitment Campaign

TEEAM appeals to members to help in recruiting companies and individuals to join the association to strengthen TEEAM membership base. Incentives are offered by the Membership Recruitment Committee. Members introducing a company member will be entitled for 2 points, while introducing an individual member will be entitled for 1 point. The points can be accumulated and used to redeem free advertisements in Suara TEEAM or redeem membership subscription. For details, please contact the TEEAM Secretariat at Tel: +603 – 9221 4417. Membership application form can be printed from the TEEAM website at www.teeam.org.my

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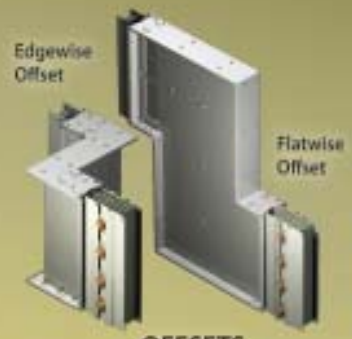

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Challenges and Opportunities in Electrical Industry - Part 16

This paper is prepared by Ir Chew Shee Fuee, TEEAM Vice President.

How to Ensure Transformers Do not Fail?

Within a year I encountered the failure of 2 transformers. The transformers were 11000/ 433 V and of capacity between 1.5 to 2 MVA. Both the transformers concerned were oil-type. The normal maintenance tests like oil tests which include die-electric, moisture content and acidity were carried out in the routine maintenance once in 2 years. No abnormality was found. One transformer even had the Dissolved Gas Analysis (DGA) tests done.

The age of the transformers was between 12-15 years.

The transformers are usually very robust and are expected to last as long as the switchgear and other related electrical equipment. In the normal cases the loading of transformers is usually quite low. Most transformers do not even carry more than 50% of its full rating. Therefore the risk of failure is very low indeed.

It is therefore abnormal if a transformer fails suddenly while in service.

In some instances transformers are subjected to quite high loading. In the context of our climate which is hot and humid it is unwise to run the transformer at high temperatures. It is usually recommended that we do not exceed 75% of its full rating. If it is exceeded it becomes very important to ventilate the room in a more efficient manner so that heat will not be too high to render the transformer oil to deteriorate at a faster rate than normal. Therefore the oil temperature of the transformer is the first indication of any danger of overheating the transformer.

Prolonged overheating can be very damaging to the transformer. Oil test and especially the DGA can give a better picture of the health of the transformer. The results of the DGA will indicate the various threats that can damage the transformer.

The failure areas can be the tap-changing mechanism and even the winding insulation failure. Before these failures then normal temperature will be indicated. The oil tests will also display the abnormality.

The earlier 2 transformers mentioned however had been subjected to oil filtration before their failures. Therefore it is important to ensure the process of oil filtration must be carried out properly because the risk of damaging the transformer can occur during these important processes.

Can We Improve the Protection of Street/Compound Lighting Circuits?

There had been a couple cases of electrocution of young person in contact with cable fault/ exposed live part in a street lighting pole. It has become quite an unhealthy sight nowadays to notice that many covers for electrical connection at street lighting poles are missing. The live connection wires are exposed and can pose a danger to people.

The lighting circuits are usually not protected by residual current device because of the risk of nuisance tripping. Therefore even if the cable insulation has deteriorated it will not trip any circuit and the exposed part can pose danger to the public.

It is important to ensure in the first place no exposure of live parts in any electrical street light. The poles which are metallic must be efficiently grounded.

It will be prudent to deploy the residual current circuit breaker (RCCB) as a mean of protection. The correct application of RCCBs will prevent any human tragedy.

Has the Standard of Wiring in this Country Become Lower?

It has been pointed out that the standard of wiring has become lower than before.

What are the contributing factors to lower wiring standard?

Some suggested that the contract price is the reason. If it is how can we overcome this problem?

The poor wiring can also be caused by sub-contractors who do not engage properly qualified and competent workers. Sub-contracting problems must be the responsibility of the registered contractor and therefore it should not be an excuse.

There is also a blame on wiring work carried out mainly by foreign workers who may not have sufficient training. However the registered contractor still has to bear the full responsibilty for the completed work.

Is it necessary that we rate the registered electrical contractors so that we can improve the image of all electrical contractors?

Can we depend on the supervision of the Electrical Consultant so that wiring standard can be improved?

Electrical contractors have the responsibility to upkeep their professional image and therefore every effort that is made to improve the wiring standard must be taken seriously.

Ir Chew Shee Fuee *B Sc (Hons) (Strathclyde), PEng, CEng, FIEM, MIEE Member, IEEE Member, 1st Grade Electrical Engineer (Competent up to above 500 kV).*

Ir Chew is the Vice President (Engineering Construction and Services) of The Electrical and Electronics Association of Malaysia (TEEAM). He was TEEAM President for 2001 - 2003 and 2003 - 2005 He is the Past President of the Asean Federation of Electrical Engineering Contractors (AFEEC).

Ir Chew is the Managing Director of G H Liew Engineering (1990) Sdn Bhd and QATM Engineering Services Sdn Bhd. He graduated from the University of Strathclyde, Glasgow with a B Sc (Hons) in Electrical & Electronics Engineering. He is a Professional Engineer and is also licensed by Energy Commission as a competent engineer (without voltage limits) and a service engineer to carry out electrical testing up to a voltage of 500 kV.

Ir Chew has more than 30 years experience in electrical control and relay protection. He is also specialised in electrical site tests on power equipment, electrical fault investigation, service and maintenance of electrical switchgear and relays. His work also includes electrical supervision of substations and electrical audit. He presents lectures on electrical apparatus and the protection system. He is at present a WG representative in the development of Green Technology Road Map Phase 1. He is also a member of the National Energy Efficiency Technical Working Group. He is the Immediate Past President of IET Malaysia (Institution of Engineering & Technology) and Board Member of IET's APRB (Asian Pacific Region Board). He can be reached at E-mail: sfchew@ghliew1990.com.

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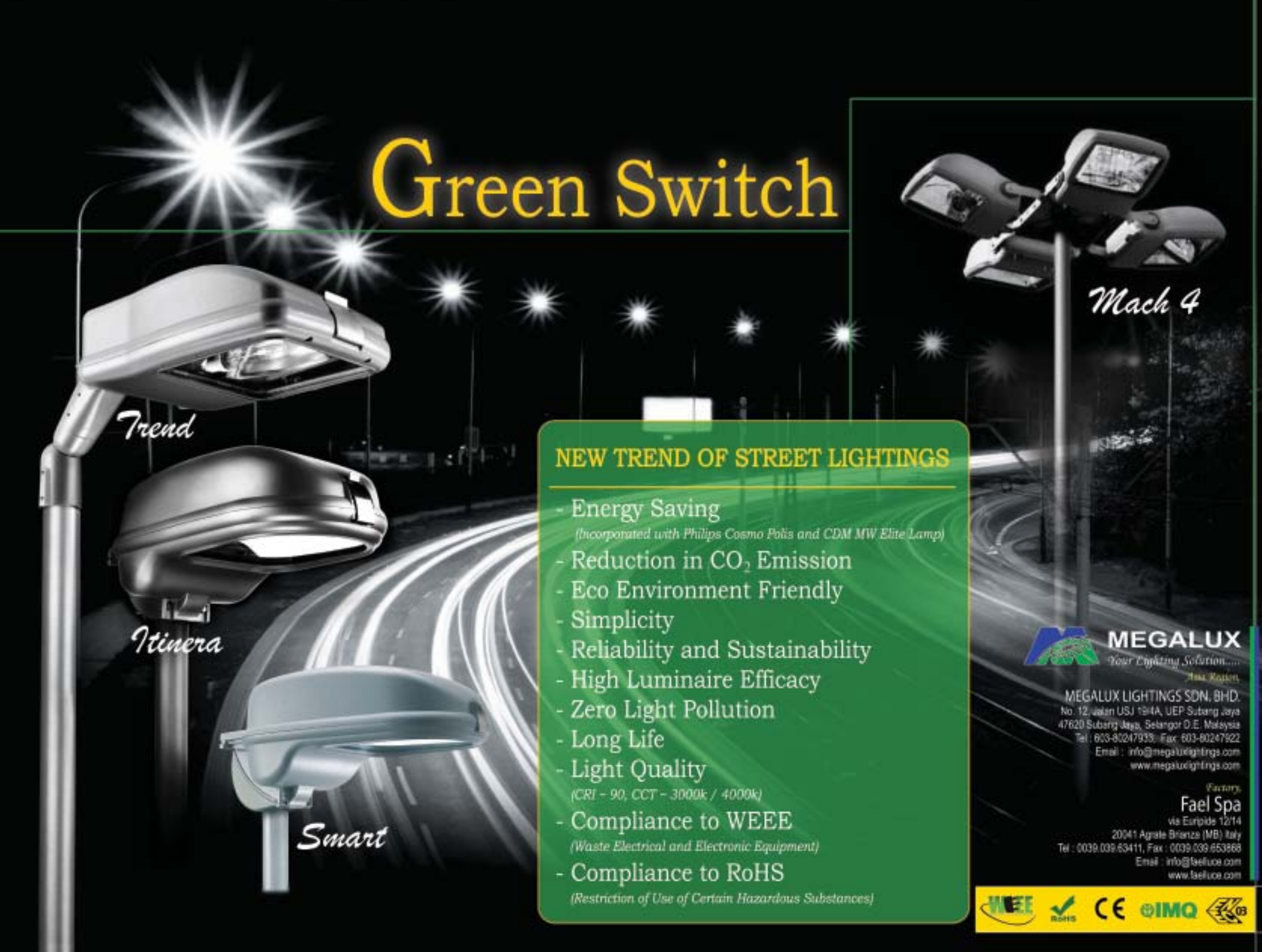

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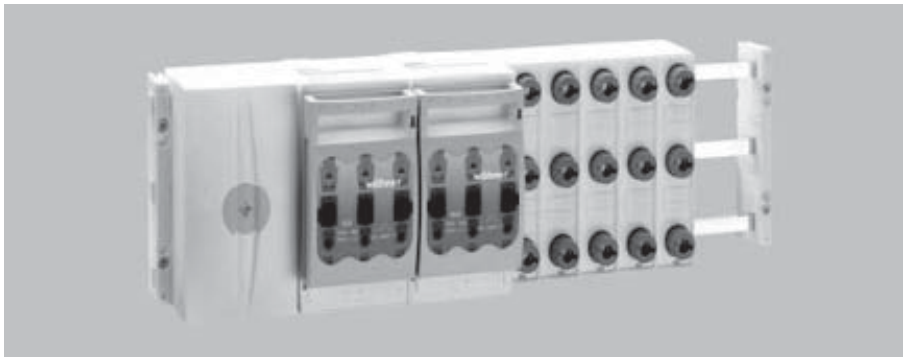
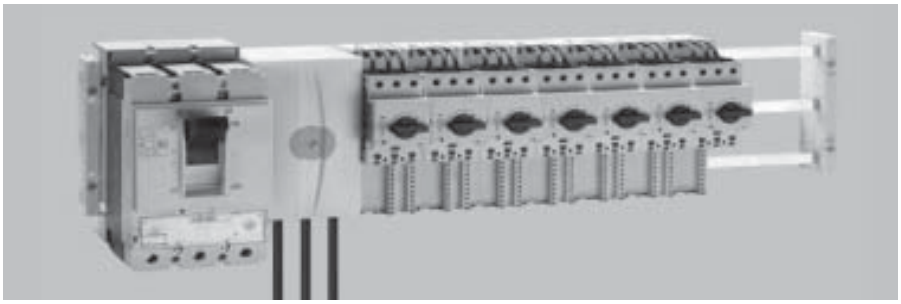
Busbar System with Reduced Space Requirements

In the machine and panel building sector, the available space for power distribution is limited more and more. Nevertheless, the requirements regarding flexibility, availability and safety remain high. The 60-mm-System compact is ready to meet these requirements. It combines the availability and system ideas of the well-proven 60mm-System classic but with reduced space requirements.

Today, it is hard to imagine low voltage power distribution without busbar systems. The prevailing ones are 60-mm-systems due to their space efficiency. They are characterised by a center distance of the busbars of 60 mm between the phases. In the 60-mm-System classic, many different configurations can be realised within one system, eg through bus-mounting fuse bases, switch disconnectors or adapters for motor circuit breakers. If triple-T section busbars are used, it is possible to arrange for systems up to 2500A through the large range of available busbars.



Picture 1 – *60mm-System compact with connecting terminal plate.*



Picture 2 – *60mm-Syste compact with UL listed busbaradaptor EQUES® EasyConnector.*

Systems in harmony

Compared to the existing Classic-system, the main benefit of the Compact-System is its obvious space saving and its variable suitability. The reduction of space requirements by up to 20% is mainly a result of the lower installation height of only 160 mm instead of 200 mm.

Through the uniform distance between the busbars of 60 mm and the same distance to the mounting plate, the components from the compact-System can be combined with those of the existing classic-System, and partly vice versa. These combination opportunities make panel builders more flexible when designing their panels.

The mounting of the components of the 60 mm-system compact can be done without drilling. Therefore, time is saved during the assembling process as all components can be mechanically fastened and safely contacted on the busbars in one step.

In addition to the aforementioned features, safety is also one of the priorities of the 60-mm-System compact.

Variable distribution on limited space

With the 3-pole version of the busbar support from the Compact-System, 12x5 mm and 12x10 mm flat busbars can be used for phases L1, L2 and L3.

This means it is possible to realise system distributions up to 360A in very limited spaces (picture 1).

The feeding of such distributions can occasionally be done through heavy current sources, which can, in case of a fault, lead to high short circuit exposures. To handle this exposure, the system has to be appropriately short-circuit proof. The 60-mm-System compact reaches a peak current withstand capacity 1 pk of up to 54 kA for 12x10 mm flat busbars at a distance between the busbar supports of 250 mm.

The feeding of the system can be realised through the connecting terminal plates, the universal conductor terminals or the new, smaller brace terminals as per the familiar principle. A further possibility is represented by the bus-mounting fuse switch disconnector.

When the outgoing feeds are designed for use with fuses this can be realised with the fuse base. They are used for overload and short circuit protection, for instance in distributions in buildings.

The fuse-free outgoing sides in the 60-mm System compact are facilitated through busbar adapters. For mechanical fastening and safe contacting of motor starter combinations, with ratings of 32A and 63A is available. It features, just as the adapters of 60-mm-System classic, a slideable DIN rail, an adjustable combination base (5 mm to 10 mm and back) as well as temperature-resistant AWG conductors. They can be combined with many motor overload switches. A typical application field of such fuse-free outgoings is the machine and control panel building sector. In addition to the feeding and the outgoing sides, possible empty spaces can be included in the layout using cover sections.

The aforementioned combination possibility with components from the Classic-system can also be done for the feeds, as shown in picture 2.

The feeding of the compact-System is realised here with a busbar adapter from the Classic-system and the appropriate circuit breaker.

Conclusion

The space-saving components of the 60 mm system compact open up new opportunities to realise distribution when space is tight, combined with the well-proven advantages of the busbar system technology. The large system variety of the new Compact System is ready to meet the increasing requirements of such distributions.

This is an abstract from an article written by Dipl-Ing (BA) Mario Engelhardt, Product Manager of Wöhner GmbH & Co KG Rödental/Germany.

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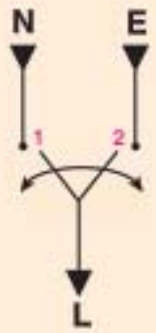
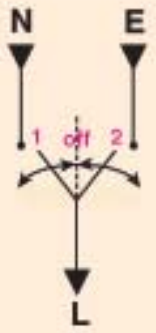
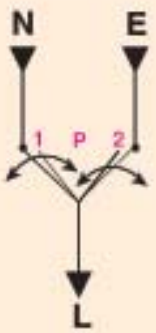
ATS 2 pole, 3 pole, and 4 pole	 Open Transition Without "OFF" position	 Open Transition With or Without "OFF" position	 HIGH SPEED Open Transition With "Sync Check" feature	 Close Transition With "Sync check" feature
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Registration of Liable Employer

PSMB was incorporated on 16th May 2001 under the Pembangunan Sumber Manusia Berhad Act, 2001.

Section 13(1) of the PSMB Act 2001 stipulates that every employer who is covered under the Act is required to register with PSMB within such time and manner as may be prescribed.

Regulation 4(1) of the PSMB Act 2001 states that an employer to whom the Act applies shall submit the Registration of Employer Form (Form 1) to PSMB within thirty (30) days after this regulation comes into effect.

Any employer who is convicted for not registering with PSMB may be fined up to an amount not exceeding RM10,000 or an imprisonment for a period not exceeding one year or both (Section 13 (2)).

According to the First Schedule of PSMB Act 2001, definitions of industries covered are as follows:

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	2. Employers with ten or more but less than fifty employees and with a paid-up capital of two million five hundred thousand ringgit (RM2,500,000) and above		
	3. Employers with ten or more but less than fifty employees and with a paid-up capital of less than two million five hundred thousand ringgit (RM2,500,000)		May opt to be registered
B	**Service Sector**		
	1. Employers with ten or more employees	(i) Hotel, that is, the provision on a fee basis, of lodging, in hotels, inns, boarding houses, rent houses, chalets, resorts or other similar places, whether open to the general public or restricted to members of a particular organisations;	Required to register
		(ii) Air transport, that is, the provision of transportation by air, on a fee or contract basis, of passengers or freight whether by regular services or by private charter, including the overhaul, repair, maintenance and cleaning of aircraft;	
		(iii) Tour operating business, that is, any business of organising or conducting for sale or commission of inbound tours only or travel agency business;	
		(iv) Telecommunication, that is, the provision of a system for the conveyance, through the agency of electric, magnetic, electro-magnetic, electro-chemical or electro-mechanical energy of – (A) Speech, music and other sounds; (B) Visual images; (C) Signals serving for the impartation (whether as between persons and persons, things and things or persons and things) of any matter otherwise than in the form of sound or visual images; or (D) Signals serving for the actuation or control of machinery or apparatus;	
		(v) Freight forwarding, that is any arrangement of freight by air, sea or land from the port of loading/origin to the port of discharge/destination, or the provision of total logistic activities, and includes the business of a forwarding agent, that is a business involving activities for the obtaining of customs clearance for freight, but does not include delivery transportation by business units for their own use;	
		(vi) Shipping, that is, the operation of vessels for the transport of freight or passengers overseas or coastwise, including towing services on the high seas or within harbours, the operation of vessels for transport by rivers, canals and other inland waterways including ferries operated across rivers, domestic lakes or within harbours, water taxies, sight-seeing boats, towing or tugboats services on inland waterways, and includes the overhaul, repair, maintenance and cleaning of ships;	
		(vii) Postal or courier, that is, the delivery of postal articles such as letters, postcards, newspapers, books, documents, pamphlets, patterns or sample packets, parcels, packages or other articles or things transmissible by post or courier services;	
		(viii) Advertising, that is, the provision of advertising services by advertising agencies to or for clients on a fee or contract basis in various types of media or the conducting of market research work;	
		(ix) Computer services, that is, software development or improvement, the maintenance of software or database, systems integration or networking, contract staffing, facilities management, computer installation or maintenance service, or the provision of advisory service or consultancy;	
		(x) Energy, that is, the supply and provision of electrical energy or electricity when generated, transmitted, distributed or utilised for any purpose except the transmission of any communication or signal;	
		(xi) Training, that is, the business of providing general or specialised training or skills by any body corporate or body of persons but does not include training by Government of the Government of any State training providers;	
		(xii) Higher education, that is, the providing of instruction or training on or teaching of a course of study leading to the award of a certificate, diploma or degree upon the successful completion thereof or the providing of distance education provided by educational institutions established and managed directly by the Government or the Government of any State or provided by any University or University College established under the Universities and University Colleges Act 1971 [*Act 30*] or the University Technology Mara Act 1976 [*Act 173*] or the Politeknik Ungku Omar Act 1974 [*Act 145*].	
		(xiii) Direct selling, that is, a door-to-door sale or a mail order sale within the meaning of Direct Sales Act 1993 [*Act 500*];	
		(xiv) Port services, that is, the undertaking of all or any work of every description in connection with the management or operation of the port by any private port, inland port or, any company, firm or person authorised by way of license to undertake such work;	
		(xv) Engineering support and maintenance services, that is, the operation, testing or maintenance of electrical, electronic, software engineering and mechanical systems and equipment, including but not limited to the testing and the commissioning of any new equipment which services are provided to any companies, businesses, factories or public authorities;	
		(xvi) Research and development, that is the conducting of research and development activities includes- (A) Pure research such as experimental or theoretical work undertaken primarily to acquire new scientific or technical knowledge; (B) Applied research such as original or critical research undertaken in order to acquire a new scientific or technical knowledge, or directed towards a specific practical objective; and (C) The use of scientific or technical knowledge in order to produce new or substantially improved materials, devices, products or services to install new processes or systems prior to the commencement of commercial production or applications, or improving substantially those already produced or installed;	

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		(xvii) Warehousing services, that is, the provision of a bonded warehouse or any other place licensed for the warehousing of dutiable goods which includes all goods subject to the payment of customs duty and on which duty has not yet been paid;	
		(xviii) Security services, that is, the provision of private security services that includes providing guard and patrol, security consultancy, armoured car or providing advice relating to the security of property, premises, personnel, plant and equipment;	
		(xix) Private hospital services, that is, the provision of treatment or wards to a patient in any premises other than a Government hospital or institution and includes any private maternity home but does not include private nursing home within the meaning of the Private Healthcare Facilities and Services Act 1998 [*Act 586*]; and	
	2. Employers with fifty or more employees	(xxi) Hypermarket, supermarket and departmental store services, that is, the sale of items such as groceries, daily necessities, garden produce, meat, confectionary, beverages, domestic hardware and toilet requisites, men's wear, women's wear, children's wear and any other types of apparels, electrical goods, furniture or any other goods for sale.	

Imposition of levy

Section 14(1) of PSMB Act 2001 stipulates that there shall be paid by every employer to whom the PSMB Act 2001 applies, a HRD levy in respect of each of his employees at the rate of one per centum of the monthly wages of the employee.

Any employer who fails to pay any levy due within such period as may be prescribed commits an offence and shall on conviction be liable to a fine not exceeding twenty thousand ringgit or to imprisonment for a term not exceeding two years or to both.

Imposition of levy on employer who opts to be registered

Section 15(2) of PSMB Act 2001 stipulates that there shall be paid by employer a HRD levy in respect of each of his employees at the rate of 0.5 per centum of the monthly wages of the employee.

Source: Official website of Ministry of Human Resources Malaysia, ie www.hrdf.com.my (please select "services").

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Guidelines for Specification of LED Lighting Products 2010

Introduction

With Light-emitting diode (LED)'s emerging as a new functional light source there is a need to ensure performance claims are made in a consistent way. This is the second edition of the guidance notes, taking into account new IEC standards and the development of LED technology. These guidance notes are harmonised with these standards. They have been produced by the lighting liaison group representing the major lighting organisations in the UK and provide a template for the basis of the specification of LED performance criteria.

These criteria are designed to ensure that performance claims can be matched against traceable data. They are also designed to ensure that the performance data relate to the luminaire during operation and not just to the performance of the LED, LED module and LED luminaire.

*A light engine may be a single or group of LED's and may have a remote phosphor plate. The light engine is considered as a light module whose performance is the combined effect of the different elements that make it up.

Summary

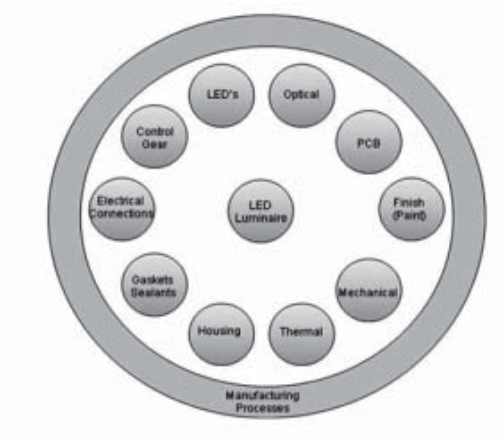
Typical questions a user should ask are shown below. More details are given in further sections of this guide.

Question	Answer	Realistic Performance Indications	Evidence required
How is life defined	By a combination of lumen maintenance and failure fraction.	Life should always be stated as: 1. Light Loss - Usually either L90 or L70 (L50 for decorative luminaires) – no. of hours; and 2. Physical Failures - LED Life F10 – no. of hours EG If the rated life of a product is 50,000 hours, this means light loss of L70 and physical failures of Fx (where x is the percentage no. of failures) at the rated life of 50,000 hours. *(Note: it should be assumed that the manufacturer has tested to a maximum of 6000 hrs and extrapolated beyond that – unless they explicitly state differently)*	See section 3.0
What is the lumen depreciation	Rate and percentage of light loss	Light output > 90% of initial Cat 1 Light output > 80% of initial Cat 2 Light output > 70% of initial Cat 3	See section 3.0
What is the colour rendering index	The rated CRI should include any shift over life.	Initial CRI and CRI change	See section 3.0
How stable is the Colour temperature	Defined by the colour shift through life	Within a 1-step ellipse: Cat E Within a 3-step ellipse: Cat D Within a 5-step ellipse: Cat C Within a 7-step ellipse: Cat B Greater than a 7-step ellipse: Cat A	See section 3.0
What ambient temperature is the luminaire performance based on.	For indoor 25^{0}C for outdoor 15^0		
What is the photometric distribution	Measurement of the light intensities at various angles and may be absolute or relative	Candelas (cd) and degrees	See section 3.0
Driver current	The current at which the LED's are driven	Measured in mA	
Power Factor	The power factor for the whole circuit	0.85 or better	

This guide is in 3 sections. A description of the parameters that affect system performance, the data and measurement required of the manufacturer and a specification list to ensure the user realises the claimed performance.

1.0 System Reliability

An LED luminaire is in many ways more complex than a traditional lighting fixture, in that many system components and operating conditions require tighter control to provide optimum performance. It is an electromechanical system that includes, in addition to the essential light emitting source, provisions for heat transfer, electrical control, optical conditioning, mechanical support, and protection, as well as aesthetic design elements. Because the LEDs themselves are expected to have long life, all of these other components, adhesives, and other materials must be equally long lived, or, to the extent they are not, they will limit the system lifetime.



Factors affecting the luminaire performance are:

LED Performance

While LEDs do not radiate heat, with current products half or more of the input energy may be converted to heat that must be conducted away from the diodes.

Optical Performance

LEDs are directional light sources, giving the lamp or luminaire designer new challenges when compared to existing lamp technology. The use of reflectors, lenses and diffusers, or a combination there of, allows a designer to direct light in many different ways. The efficiency of the optical system must be considered and factored into the overall efficiency value of the lamp or luminaire.

PCB

A PCB is the interface between an LED and heat-sink and carries with it a thermal resistance value. The higher the resistance the less efficient the system is at soaking away heat from the LED, this may well impact on the LED lumen output performance and ultimately the life, lumen maintenance and/or catastrophic failure of the LED.

Finish

The paint finish/colour may affect the heat dissipation from the luminaire.

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Mechanical

The mechanical integrity of a luminaire is important in several different areas including: IPxx rating to suit the application, heat-sinking that will not become compromised with time and or lack of maintenance, vibration resistance, specifically so that the heat-sink does not become detached from the LED PCB, bonding mechanisms are suitable for the life of the lamp or luminaire.

Thermal

The performance of an LED is dependent on its temperature during operation. The design of the luminaire will influence its operating temperature and hence published characteristics.

Housing

LEDs allow new design freedom and housings can be used both for styling and heat-sinking purposes. Consideration should be made for maintenance and/or cleaning of the heat-sink, so that the overall thermal performance of the lamp or luminaire remains within specification.

Gaskets

Many LEDs and specifically phosphor can react to different chemicals; some gaskets can out-gas chemicals that can affect the performance of some LEDs. A luminaire manufacturer should work with the LED supplier and qualify any new gasket materials.

Sealants

Many LEDs and specifically phosphor can react to different chemicals; some sealants can outgas chemicals that can affect the performance of some LEDs. A luminaire manufacturer should work with the LED supplier and qualify any new sealants materials.

Electrical

Electrical overstress is now a well known cause of catastrophic failure of LEDs. Some LEDs contain an on board Transient Voltage Suppression chip (TVS), which provides some level of protection. A well designed lamp or luminaire will feature the necessary design or protection in order to minimise damage at installation or power-up.

Control Gear (Driver)

For proper operation, the power supply and electronics must provide a well-controlled DC drive current and possibly other control features, and must not fail for the life of the product. Failure rate of the external control gear shall be included in the overall assessment of total life / failure rate.

Drive Current

Drive current affects LED operating temperature and thus life and output. Normally around 350mA is quoted but this can be higher, the higher the LED is driven the brighter it will be but it may have a shorter operation lifetime and be less efficient. Some of the new multi die LEDs are designed to operate and perform at higher drive currents.

Manufacturing

There are many process variables during any manufacturing process. Experience, track record and a traceability system are a vital part of providing a user or specifier with confidence and a route to tracking any issues.

Operational Environments

There are many different types of environments luminaires will be required to operate. Humidity can be higher in certain applications and can cause rapid degradation of materials used within the luminaire. Temperature can be higher in certain applications and can cause rapid degradation of materials used within the luminaire. The luminaire manufacturer should work with the material suppliers and qualify any new materials if the application requires operating in high humidity and/or high temperature conditions.

The reliability of the luminaire will be a combination of all of the above.

2.0 Life

For clarity, 3 systems are defined:

LED Light Source

The LED die (or chip) is contained in a suitable package allowing simplified electrical connection or assembly.

LED Module

This is the LED together with mechanical and optical components making a replaceable ite aire.

LED Luminaire

This is the complete system consisting of all elements described in Section 1.

2.1 Lifetime Lx

Life is the length of time during which an LED Light source*, LED Module or LED Luminaire provides more than claimed percentage x of the initial luminous flux, under standard conditions. An LED product has thus reached its end of life when it no longer provides the claimed percentage of the initial luminous flux, Lx. Life is always published as combination of life at claimed lumen maintenance and failure fraction, Fy applying at the time of reaching the claimed percentage of the initial luminous flux. Lx.

* For LED Light Sources this is designated in LM-80 Lifetime (Lp)

There is no validated way to translate the lumen maintenance curve of an individual LED light source into a curve for the LED Module or LED luminaire. Life testing of the LED light source is carried out according to LM-80 up to 6000h or 10,000h. Beyond these values statistical predictions are made. See Figure 1.

A reliable luminaire manufacturer will indicate the basis of these projections. It should be noted that if a product contains a good quality LED light source that has LM-80 data available and the LED Module or Luminaire maker calculates lifetime data based upon the LM-80 data this represents an extremely good start in ensuring the LED Module or Luminaire could be reliable.

For LED Modules and LED Luminaires the lumen maintenance curve can also be affected by the combined effect of all components of a Light source/luminaire as described in Section 1. LED Modules and LED Luminaires have life testing carried out to 6000h.

For general lighting applications, it is recommended to define Life as the length of time it takes an LED Module or LED Luminaire to reach (depending on the application) 90% or 70% of its initial light output (L90 or L70). For decorative lighting applications, it is recommended to define useful life as the length of time it takes to reach 50% of its initial output.

Lifetime (Lx) is published in combination with the failure fraction,

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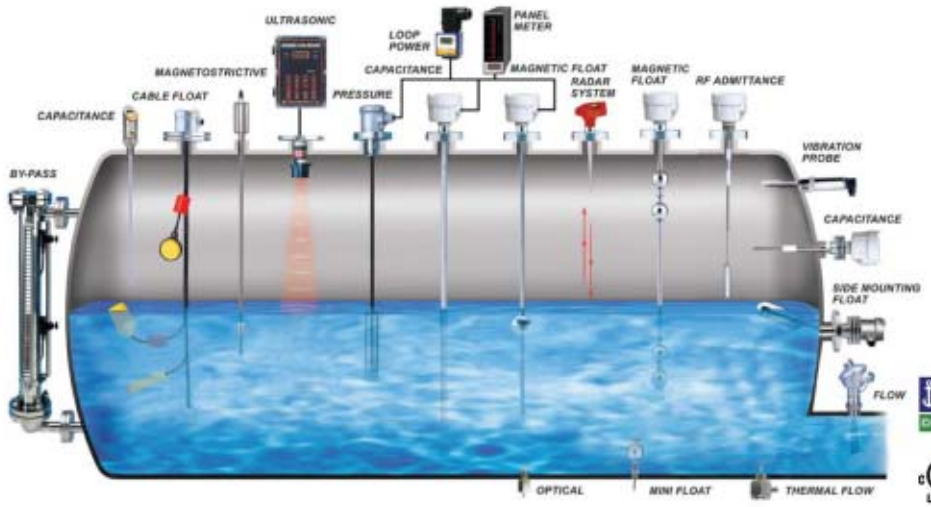

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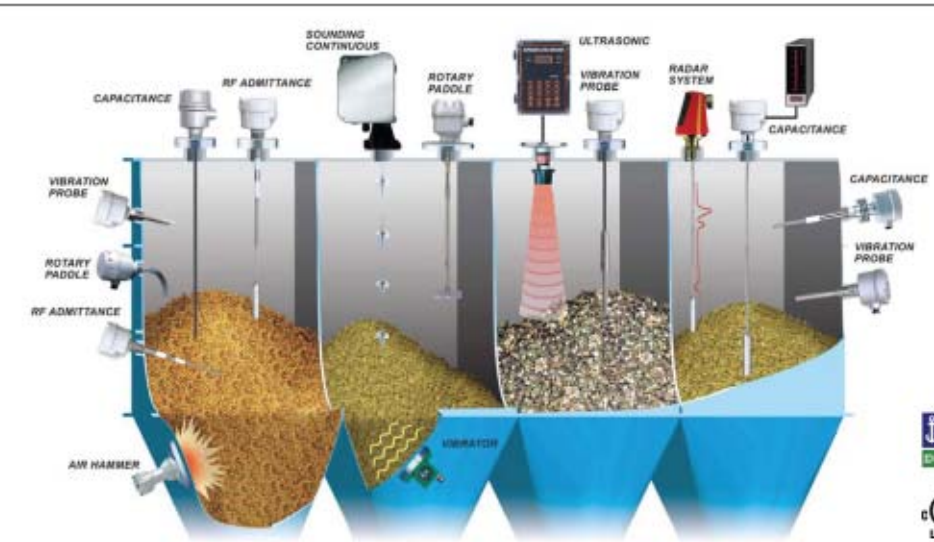

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2.2 Failure Fraction (Fy)

This is the percentage y of a number of LED Light sources* of the same type that have reached the end of their individual lives where y designates the percentage (fraction) of failures.

* For LED Light Sources this is designated in LM-80 Lifetime (Bp).

For LED Modules this failure fraction expresses the combined effect of all components of a Light source/luminaire as described in Section 1.

Failure Fraction should be declared at the Lifetime Lx and can only be based on testing up to 6000h together with statistical predictions. For general lighting applications this should be less than 10% (F10).

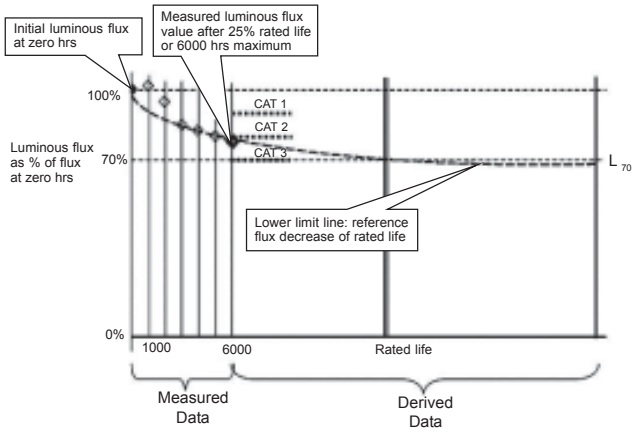

Figure 1

3.0 Luminaire manufacturers design data, made available for traceability

3.1 LED Light source data

The following data for the LED light source must be measured at a junction temperature of 25°C:

Drive current/voltage/power for the LED

- *Life Lx*

  See section 2.1

- *Failure Fraction*

  Fy. See section 2.2

- *Colour Temperature LED*

  The initial colour point (x & y) of the LED and the colour temperature derived from it.

- *CRI for the LED*

  The initial Colour Rendering Index (CRI) of the LED.

3.2 Measured LED Module data

This is principally the same as that for the 'Measured Luminaire Data' (see 3.3 below).

3.3 Measured Luminaire data

The following measured data for the luminaire data should be presented for an ambient temperature of 25°C. (15°C for Exterior luminaires).

Note: Where a declared ambient air temperature other than 25 °C is advised by the manufacturer a correction factor will need to be established to correct the measured luminous flux value at 25 °C to the luminous flux value at the declared ambient. This shall be done using relative photometry in a temperature controlled cabinet.

Rated Power

Total luminaire power including drivers should be measured under standard conditions and expressed in Watts.

Power Factor

The power factor should be clearly stated in all cases. Although product standards may not require this below 26W, it should be noted that some clients, and in particular contractors and local authorities working with un-metered supplies (the majority of public lighting in the UK), will require power factor correction of 0.85 or better.

Rated Lumen Output

The initial luminous flux shall be measured after thermal stabilisation of the LED luminaire.

Light Loss Maintenance Factor (LLMF)

This will be the light lost at rated life.

Rated Luminaire Efficacy

Properly measured, Luminaire Efficacy combines both the light source system efficacy and luminaire efficiency, allowing for a true comparison of a luminaire regardless of the light source. Luminaire efficacy is the preferred metric for LEDs because it measures the net light output from the luminaire divided by power into the system, accounting for driver, optical and thermal losses.

The board temperature Tboard of the LED package installed in the luminaire,

Lumen Depreciation

The lumen depreciation rate is judged by the light output at 25% of rated life (with a maximum duration of 6000 h) compared to the initial output. The depreciation classification is:
Light output > 90% of initial Cat 1
Light output > 80% of initial Cat 2
Light output > 70% of initial Cat 3

Life Lx

See section 2.1

Failure Fraction

Fy. See section 2.2

Colour Temperature

The initial colour point (x & y) of the LED and the colour temperature derived from it or bin class related to C78.377-2008 where colour temperature values are recommended as 2700K, 3000K, 3500K, 4000K, 5000K, 6500K.

Colour Maintenance

The colour shift is judged by the colour point shift at 6,000 hours compared to the initial colour point (x & y) of the luminaire.

Colour Temperature Tolerance

Tolerance (categories) on nominal x & y values measured for both initial and at 25% of rated life (with a maximum duration of 6000 h)
All measured x & y's within a 1-step ellipse Cat E
All measured x & y's within a 3-step ellipse Cat D
All measured x & y's within a 5-step ellipse Cat C
All measured x & y's within a 7-step ellipse Cat B
All measured x & y's > 7-step ellipse Cat A

Tolerances beyond a 4-step ellipse are considered unacceptable for general illumination purposes.

Colour Rendering Index for the Luminaire

The initial Colour Rendering Index (CRI) of a luminaire is measured. A second measurement is made after a total operation time of 25% of

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rated life (with a maximum duration of 6000 h). The measured CRI values shall not have decreased by more than 3 points from the rated CRI value for initial CRI values and 5 points from the rated CRI value for maintained CRI values.

*Intensity Distribution**

*Applicable for luminaires which modify the distribution of the light source.

Photometric data is available in two formats. Absolute Photometry does not require the use of a separate lumen output for the light source. Relative Photometry requires the LED package flux to be quoted. Both methods produce the same result. The manufacturer should state the format in which the photometric data is supplied.

Absolute photometry of LED luminaires should be conducted according to IES LM-79-08 Photometric Measurements of Solid-State Lighting Products. Relative photometry should be conducted according to EN13032-1 (2004) Light and lighting-Measurement and presentation of photometric data of lamps and luminaires-Part 1: Measurement and file format.

These standards contain advice on measurement uncertainty. Luminaire performance data to be quoted at operating temperature Tboard.

Photometric results that are calculated by deviation from the tested sample by the use, for example of higher or lower drive currents or dies from bins other than the bin used for the tested device are to be clearly identified as such. Correction factors used are to be provided with the results.

Temperature Cycling Shock Test:

The non-energised LED luminaire shall be stored firstly at – 20 °C for 1 hour. The luminaire is then immediately moved into a cabinet having a temperature of + 35 °C (see 1.2) and stored for 1 hour. Five such cycles shall be carried out. At the end of the test the LED luminaire shall operate and remain alight for 15 min.

Supply Voltage Switching Test:

At test voltage the luminaire shall be switched on and off for 30 seconds. The cycling shall be repeated for a number equal to half the rated luminaire life in hours (example: 10K cycles if rated luminaire life is 20 000 hours). At the end of the test the LED luminaire shall operate and remain alight for 15 min.

Thermal Endurance Test

The LED luminaire shall be operated at nominal voltage and at an ambient temperature of + 35 ° C for outdoor luminaires, + 25 ° C for indoor luminaires and + 35 ° C for recessed luminaires until a test period equal to 25 % of the rated luminaire life (with a maximum of 6000 hours) has passed. At the end of this time, and after cooling down to room temperature, the luminaire shall remain alight for at least 15 min. (NOTE: Higher temperature for testing as only testing to 25% life).

4.0 Data required for specification

Initial Luminaire Lumen Output L100

Light Output Depreciation Category (1, 2 or 3)
Luminaire life L(x) (where x is the percentage of L100 at the declared life).

Failure Fraction F(x) (where x is the percentage of failures at L(x))
Colour Temperature Category (A, B, C or D) at initial and 25% of rated life (with a maximum duration of 6000 h).

Colour Rendering Index Value

Colour Rendering Index Value Shift

Luminaire Electrical Characteristics
Total power consumed
Initial power factor
Power Factor @ at initial and 25% of rated life (with a maximum duration of 6000 h)

Appendix A References

Product type	Safety Standard	Performance Standard
Self-ballasted LED-lamps for general lighting services >50V - Safety specifications	IEC 62560 Edition 1Publication expected 2010	IEC 62612/PAS Publicly Available Specification
Control gear for LED modules	IEC 61347-2-13 Published 2006	IEC 62384 Published 2006
LED Modules for general lighting - Safety specifications	IEC 62031 Edition 1 Publication 2008	Draft under preparation
LED Luminaires	IEC 60598-1	No standard
LED's and LED modules	IEC TS 62504 Terms and Definitions for LED's and LED modules in general lighting	
CIE Technical Committees	TC2-46 CIE/ISO standards on LED intensity measurements	
	TC2-50 Measurement of the optical properties of LED clusters and arrays	
	TC2-58 Measurement of LED radiance and luminance	
	TC2-63 Optical measurement of High-Power LEDs	
	TC2-64 High speed testing methods for LEDs	

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Source: These guidelines are written by the Institute of Lighting Prefessional (ILP).

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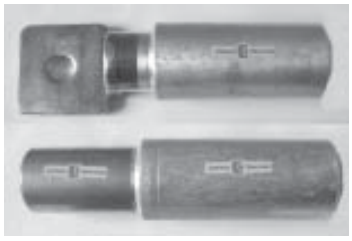

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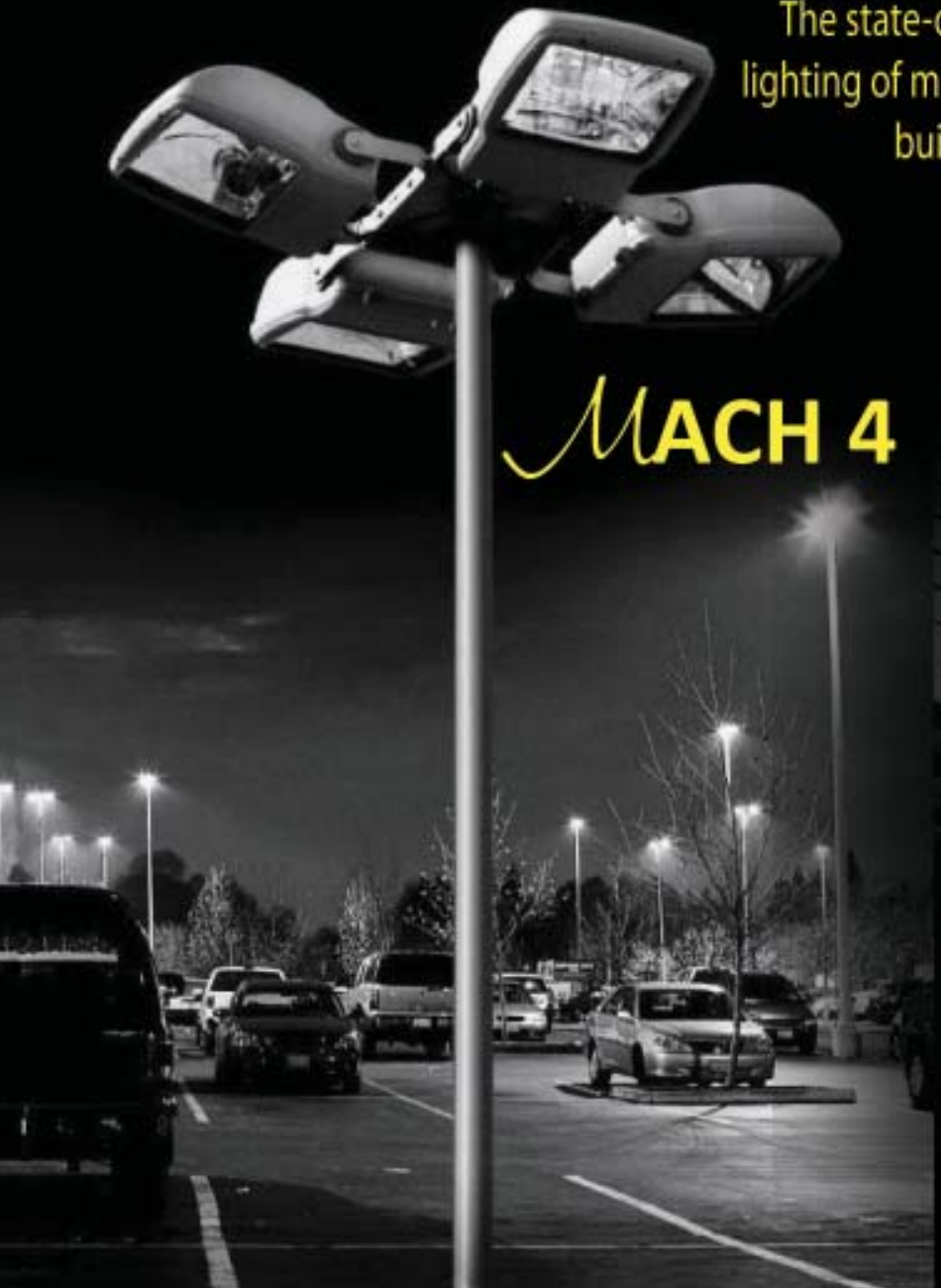

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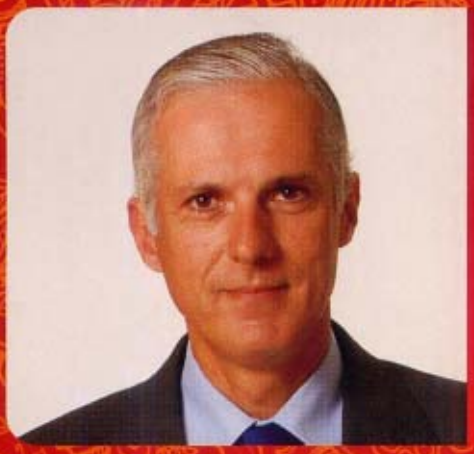

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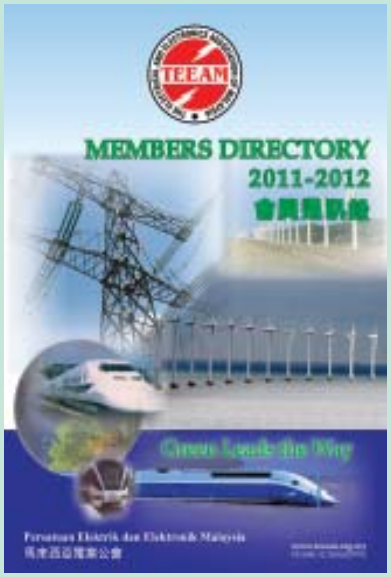

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