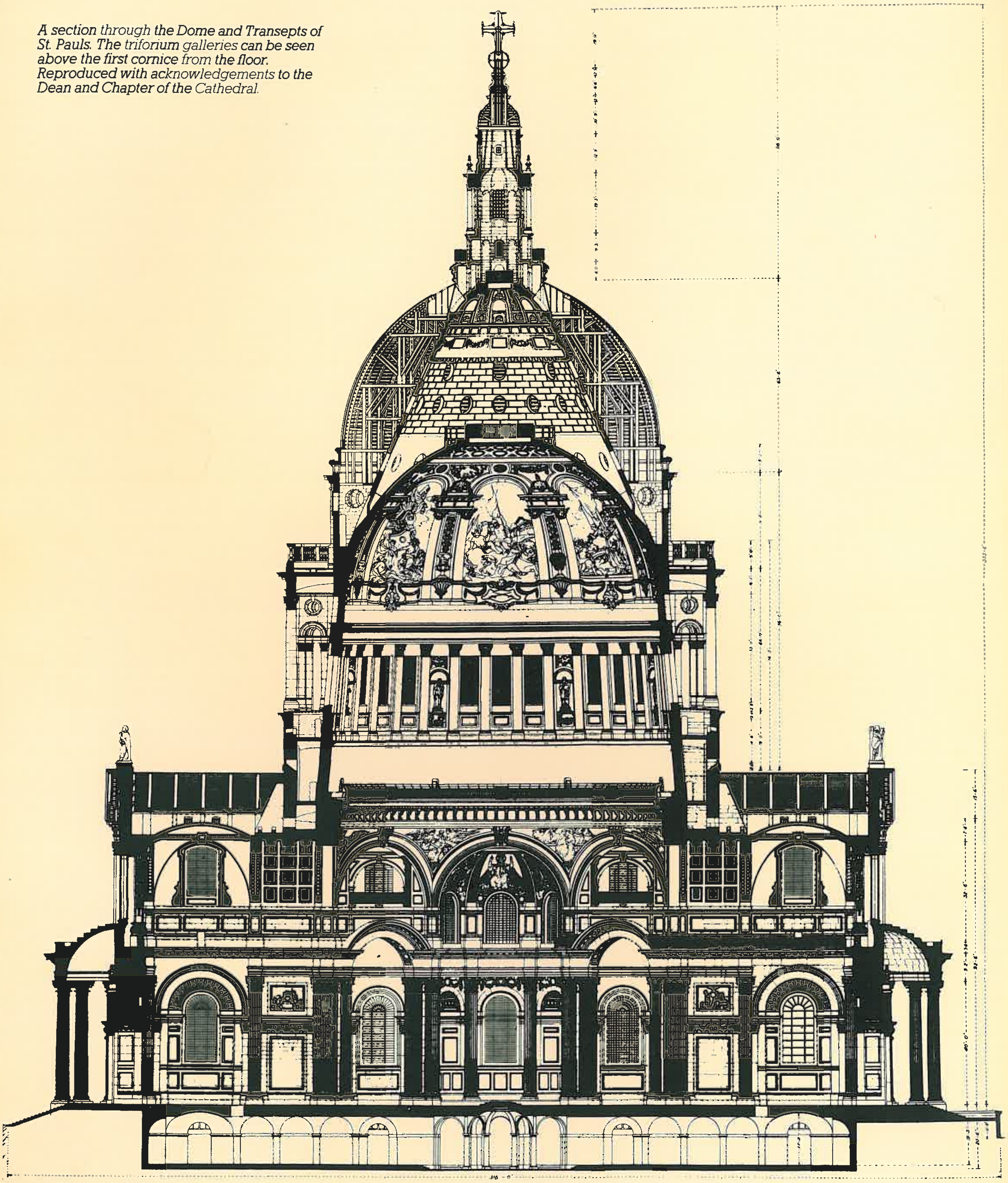
Lighting Journal 25

ST. PAUL'S CATHEDRAL.

LONDON

A section through the Dome and Transepts of St. Pauls. The triforium galleries can be seen above the first cornice from the floor. Reproduced with acknowledgements to the Dean and Chapter of the Cathedral.



CROSS SECTION LOOKING EAST

Arthur F.E. Poley. Mens et Delt

Lighting Journal 25

Summer 1982

This is the twenty-fifth issue of The Lighting Journal. Issue no 1 appeared in the Autumn of 1968: it was a slim volume of only 22 pages, two of which were in colour, and was edited by Harry Hewitt. It contained articles on lighting for television, the problems of metrication, then exercising most of our minds, and one on air-handling lighting fittings, at that time a decided novelty.

The second issue had advanced to 24 pages, four in colour, and by issue no six it had 28 pages and carried an article describing the first use of the CSI lamp for football floodlighting. By this time integrated lighting, heating and ventilating schemes were beginning to appear, and one of the first, that at the SWEB headquarters at Bristol was described in the following issue. Issue number 8 contained the first foreign translations and number 9 had 32 pages, the present size of the Journal. A new format, with the type in three columns was introduced in issue no 12 and number 20, the Swan centenary issue, was the first to be printed in colour throughout.

Ever since its inception, the Journal has presented a balanced picture of the basic research and innovation in light-sources made by the Company as well as describing important installations and lighting techniques. Recent issues have described the introduction of 26mm fluorescent tubes, improvements in both colour and range of SON lamps and their advantages for a great many lighting applications and in the last, number 24, the 2D lamp was introduced.

This issue is no exception to the rule. Articles include an account of the use of CSI and other types of lamp in St. Paul's cathedral for the Royal wedding, an important installation in Czechoslovakia and the latest developments in tungsten-halogen studio lamps. Two useful articles appear on the techniques of emergency lighting and the importance of good lighting design to achieve economic use of power. With the present rate of technological progress, it will be interesting to see how the art and science of lighting develops over the next twenty-five issues.

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Bryan Wilkes, Head of Lighting BBC Television Outside Broadcasts

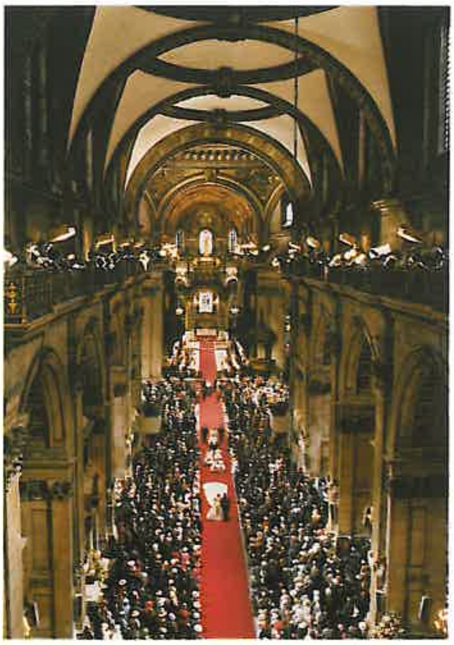
Lighting the Royal Wedding

Bryan Wilkes joined the BBC in 1941. He left for a four-year spell with the Fleet Air Arm but after rejoining in 1947 worked at Alexandra Palace, Lime Grove and at Wembley where he began his career in outside broadcasting. He has been a transmitter engineer, television technical assistant and cameraman. As cameraman he covered the Queen's Coronation at Westminster Abbey, his camera being the one which recorded for the nation the moment of crowning.

He has specialised in Outside Broadcast lighting from 1954, first as Assistant, then Director and later as Manager and finally as Head of Lighting. He is a Fellow of the Royal Society of Arts and a Freeman of the City of London and it is appropriate that his latest assignment was for St. Paul's Cathedral in the heart of the city. He has taken a close interest in the CSI lamp from its inception and has worked closely with THORN EMI Lighting in developing it as an important source for colour television outside broadcasting. He even introduced its use to the U.S.S.R. when lighting the first televised productions from the Bolshoi Theatre and the New State Circus in Moscow.

Left: The supreme moment of the Royal wedding is captured in this photograph, taken from the South Transept. Note the CSI lamps mounted in the 'quarter dome near the top of the picture and the battery of PAR lamps beside them concentrating on the Bach Choir behind the camera.

Below: The Royal procession leaves the Cathedral. The CSI lamps mounted on the triforium gallery on either side of the nave are clearly visible.



The televising of the Royal wedding at St. Paul's was by any criterion a major achievement, especially in view of the difficulties set by the need to conform with the tight timetable imposed by the Cathedral authorities. What distinguished this event for broadcasters was not only its scale and its setting but its significance in the life of the nation — the wedding of our future King and Queen — which meant that it would be the most important outside broadcast for some time, demanding meticulous planning and execution and the best resources available. Lighting alone, for example, accounted for nearly £100,000 of combined BBC and ITV cash, an expenditure in modern lighting technology unparalleled in the history of outside broadcasts.

For some in BBC Television the royal wedding was, in many ways, just another multi-camera outside broadcast, following the pattern set by previous Royal events. However, the sense of occasion did 'get to' some of the steeliest professionals, when it was realised this would be the 'The Wedding of the Century' with probably the biggest 'live' audience of all time — around 600 million or even more. Like a country's GNP, figures of this magnitude are difficult to comprehend.

Initial preparations

Because the venue for the Wedding was not immediately known, it was at first assumed that it would be Westminster Abbey, but we quickly learned that it was to be St. Paul's Cathedral, a bigger and loftier building to light, but just as impressive, in a different way. Of course, previous broadcasts from St. Paul's had paved the way; we had last lit the Cathedral for the Queen Mother's 80th birthday, and before that there had been Queen Elizabeth's jubilee service and Sir Winston Churchill's funeral service. But, with the developments which had taken place in lighting technology and the improved standards, we could now achieve a higher illuminance for a lower power consumption.

The Cathedral needed to be lighted to a level of at least 1700 lux, so that cameras could use aperture settings of around f4 — 5.6 to achieve good depth of field and the best optical performance from their lenses. In previous broadcasts we had barely bettered 1000 lux, leaving cameras operating at maximum lens aperture with the difficulties of short depth of field when zoomed into narrow angles of view.

It had already been agreed that the BBC should design and organise the lighting, with ITV sharing the costs. Three Movietone film cameramen and over 50 stills photographers selected to cover the wedding would automatically benefit too.

So, after several sessions at the cathedral, with BBC producer Michael Lumley and ITV's Jim Pople, an outline of the lighting plot was prepared relating lights to camera positions. Then we discussed the arrangements with Lee Electric (Lighting) Ltd of Wembley, who hold the contract for all BBC outside broadcasts lighting in the United Kingdom and EEC countries.

Lee Management indicated that they could meet our needs from their extensive stock of equipment, relying on the high-technology CSI (compact source iodide) and CID (compact iodide, daylight) lamps for most of the lighting because of their superior efficacy and colour stability.

Camera dispositions

When the lighting plot was completed a number of visits to the cathedral were necessary, with my electrical supervisor, to detail the layout and plan the installation. This involved liaising with a number of different authorities, including the Receiver of St. Pauls and his Clerk of Works, with the London Electricity Board who would provide the power and with the police over security.

Fortunately the movements of the main participants in the ceremony were to be fairly straightforward. Our chosen camera positions would be able to cover the full ceremony and congregation quite easily. Eventually it was decided by the producer that 12 camera positions were required for the BBC to enable the ceremony to be covered adequately. ITV used nine. Several of these were joint positions in which our own camera was located next to ITV's equipment.

A camera high above the west portico would provide a wide angle shot of the cathedral, with the ability to zoom into closer shots in the nave and chancel. Another camera on the North side of the aisle just inside the west portico with a lens height of about 2.5m provided pictures of arrivals. ITV had a similar camera placed in the South aisle. The lighting in this area was provided by eight 2.5 kW and fourteen 1 kW CID lamps, their colour-temperature of 5,500K proving an admirable match with the daylight pouring through the west door. The respective vision engineers had been briefed beforehand that as the cameras panned away from the CID lit area there would be a gradual transition of colour temperature from 5500K to 4300K, the nave and the remainder of the cathedral being lighted by 1kW CSI lamps in the housings, designed by Lee Electric known as single and twin CSI.

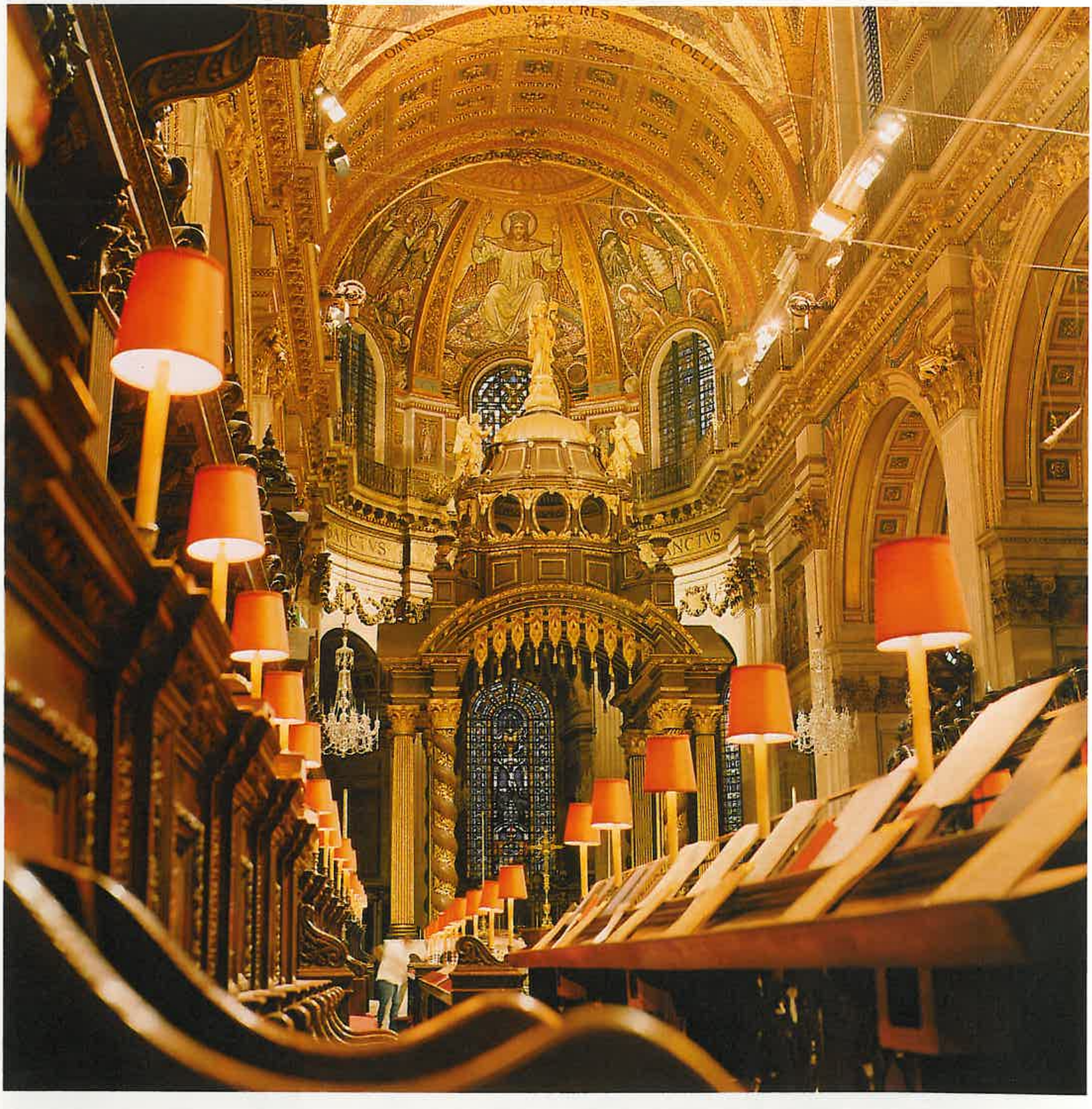
A view of the empty choir stalls looking East. Lights are directed upwards to illuminate the mosaics on the ceiling vaults.

Colour changes

This change of colour temperature extended over an area of about ten metres until the CSI took over completely and worked very well in practice, colour-change was not obvious on the screen. Further eastwards along the nave, cameras were positioned on both sides of the main aisle and in the north and south transepts. One BBC camera was positioned in the north transept by the font — providing a side-on-shot of the Bach Choir and the Symphony Orchestra. Two large windows in this area, each 10 x 3m had to be colour corrected by using a combined filter of .3 neutral density/orange which prevented a blue cast from falling across the choir. Three other large windows on the south side of the cathedral had filter frames fixed to the exterior of the windows, each with .6 N.D./orange correction filter which reduced and corrected the incoming sunlight by 2 stops.

Close-up shots

Other cameras were positioned behind the Royal Family and Earl



Spencer's family in the N.E. and S.E. transept aisles. They were able to provide frontal shots of the respective families as well as side shots of Prince Charles and Lady Diana, also three quarter and frontal shots of guests sitting under the dome area — mainly close friends of the Bride and Groom and the crowned heads of the world. A camera placed just above the north choir stalls gave an 'over the shoulder' (the Archbishop's) frontal shot of the couple. Two more cameras placed at East and West sides of the whispering gallery were able to zoom the length of the nave and to the altar. One final camera — giving the now well-known shot looking vertically down from the centre of the Dome — completed the disposition of cameras within the Cathedral.

A difficult problem

The Bach Choir of some 200 members — complete with opera singer, Kiri Te Kanawa, and a symphony orchestra all under the direction of Sir David Willcocks were to add so much to this Royal occasion by the majesty of their music. Lighting this large number of people squeezed into the north transept for close-up shots proved difficult; the angle from the triforium gallery above them was very steep, too steep for a pleasant keylight effect. The solution was to use a number of twin CSIs from the South side of the dome — in the South-west quarter dome, with a throw of lamp to subject of some 70m. Diffused spot spreader lenses did the trick and allowed us to 'skate' the light past an immense chandelier, without creating a shadow problem. Other lighting of the choir and orchestra was provided from a lower level, about 7m above each side of the rostra, from CSIs with medium angle spreader lenses and 2kW tungsten-halogen lamps, colour corrected to match the CSI providing the necessary illuminance.

The Dome

At floor level, under the dome, there was a seating area of some 30m in diameter. The nearest lighting position was from three of the four quarter domes, the fourth being forbidden territory as it is full of organ equipment.

Top: The figure of St Paul on the top of the canopy over the High Altar received special lighting treatment.

Below: Lamps were mounted at a dizzy height beneath the Nave vaults to light part of the area beneath the dome.

A battery of PAR lamps being carried into the cathedral.

The quarter domes are above the level of the triforium and even further away from the subject. For such a large area and a tremendous throw for the lamps we used three Dino-lights on molevator stands each with 24 x 1kW PAR 64 lamps, colour corrected to match CSI: they provided an illuminance of 1,400 lux. To this was added 12 x Twin CSI bringing the level up to 1,700 lux — the CSI's providing that extra punch and sparkle.

Frescos and mosaics

The interior of the dome has eight frescoes painted by Sir James Thornhill, illustrating the life of St. Paul. Six twin CSI's on the whispering gallery lit these to a level that allowed the cameras to zoom into extreme narrow angle and gave many people, both viewers and those present, their first clear glimpse of his work. The ceiling mosaics above the choir and altar — gold and delicate shades of blues, greens and reds, needed a different lighting technique to enhance the colours and to make the gold sparkle even more than it normally does. This was achieved by using uncorrected PAR 36 lamps in Lee's eight-light fittings positioned in the triforium gallery. By using the cameras, colour balanced for the ceremony to CSI lamps, and without rebalancing them for the lower blue gain setting on the camera control unit the appearance of the mosaics was enhanced by giving them a warm cast — adding richness.

The CSI lamps

Altogether 273 1kW CSI lamps in Lee fittings were installed. Most of these were in fixed positions but seven CSI twin fittings in the whispering gallery were on moveable stands. The fixed lamp housings were clamped to scaffold tubing installed on the narrow triforium gallery by St. Paul's scaffolders and at the lower level by Lee Scaffolding Ltd.

In my view, Thorn CSI was the only practical choice for this event. In the old days, we would have had to rely on 10kW tungsten lamps, with their attendant problems of bulk, weight and heat. We calculated that our total electrical load for lighting would then have been 1.6MW rather than the 690kW we actually used. CSI has proved to be a valuable lamp for O.B.'s; the BBC was the first to recognise its potential in our specialised field and worked closely with the Company as they developed it as a source able to meet the stringent requirements of TV lighting directors and film cameramen. We have now used it successfully for a decade. The lamp has revolutionised location lighting of some events and without it we would have needed two or three times the 17 tons of lighting equipment we eventually moved into St. Paul's.

With CSI there are few problems. The lamp is well tried, reliable and — because it is compact — did not dominate visually or take up too much room in the cathedral. Heat generated is modest and is readily conducted away by fins on the lamp housings; musicians, though always concerned about any nearby sources of heat, were far less likely to be put out by CSI than by the sources we might have used a few years ago.

The power supply

Our mains power supply was drawn from the National Grid through Paternoster main sub-station, near the cathedral. In the event of failure of the mains, the power would have been restored immediately by either of two standby supplies routed from different parts of the Grid system. From the Paternoster main sub-station three separate supplies enter the cathedral precincts. We drew about 400 amps per phase from a 1500 amp per phase capacity supply near the Choir School on the East side. Another similar supply was drawn from the chapter house area on the North side and a third supply from the South side.

A major concern was the possibility that a momentary failure would extinguish the CSI and CID lamps which would not restrike immediately supply was resumed. To cover this situation, a 130 kVA standby generator was separately cabled to 3 Dino-lights and 9 Maxibrutes. Between them these accounted for 126 kW for lighting PAR 64's — which would survive mains failure — just sufficient to allow pictures to be transmitted if the worst happened. The Maxi-Brutes and Dino-lights had colour correction filters fitted together with specially made glare shields — they served four purposes, correction of tungsten to CSI; the filter was held neatly and securely away from contact with the lamps; side spill light was avoided and in case of a "bubble burst" they offered additonal security to the normal safety mesh. At all times, electricians had access to generous stocks of chokes and lamps at strategic points within the cathedral.

Installation

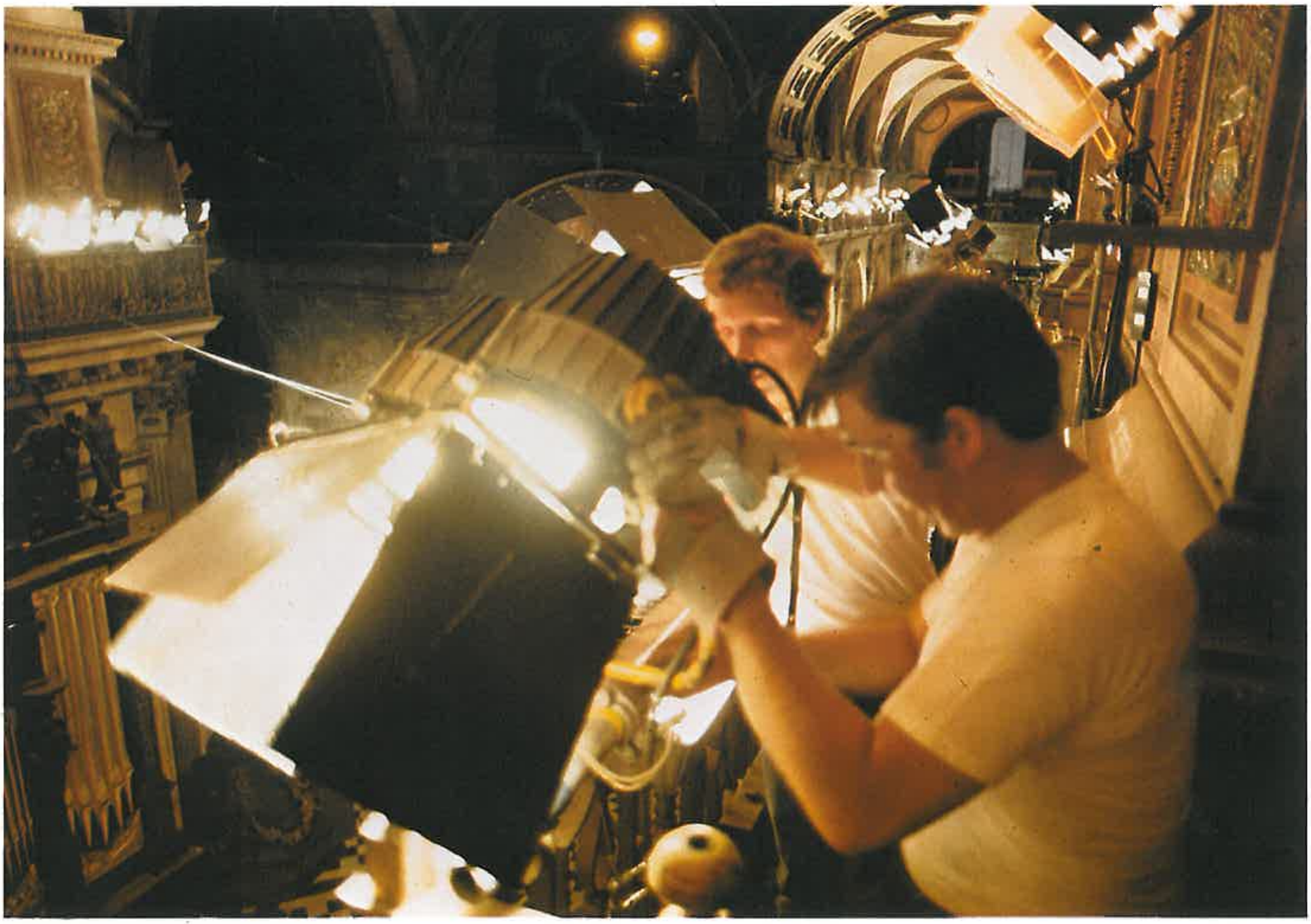
Electricians started work at the cathedral on 13th July, and had five nights and two days in which to install all the lighting equipment. Lamps started to go in on the 15th. 'Setting' of the lamps took three nights, work of any nature during the day not being possible, as the cathedral remained open to the public and for normal church services right up to Sunday evening — with the wedding on the Wednesday. All personnel, including the 130 or so BBC staff at the cathedral on the day, had to be security vetted.

Indeed the heavy security surrounding the preparations created additional problems for us; one was that explosive-sniffing dogs and their police handlers had to check every piece of equipment and scaffold tubing, including our additional fire extinguishers, plus walking round the narrow triforium gallery at irregular intervals. They could easily have knocked the lamps off their setting angle, so that their alignment had to be checked after each search. However, with close co-operation all round we jointly and amicably overcame this problem.

On the day, electricians stationed in the triforium were linked by portable 2 way radio to a supervisor who was, in turn, in direct contact with me in the master control vehicle parked with other O.B. technical vehicles in an area immediately to the north of St. Paul's.

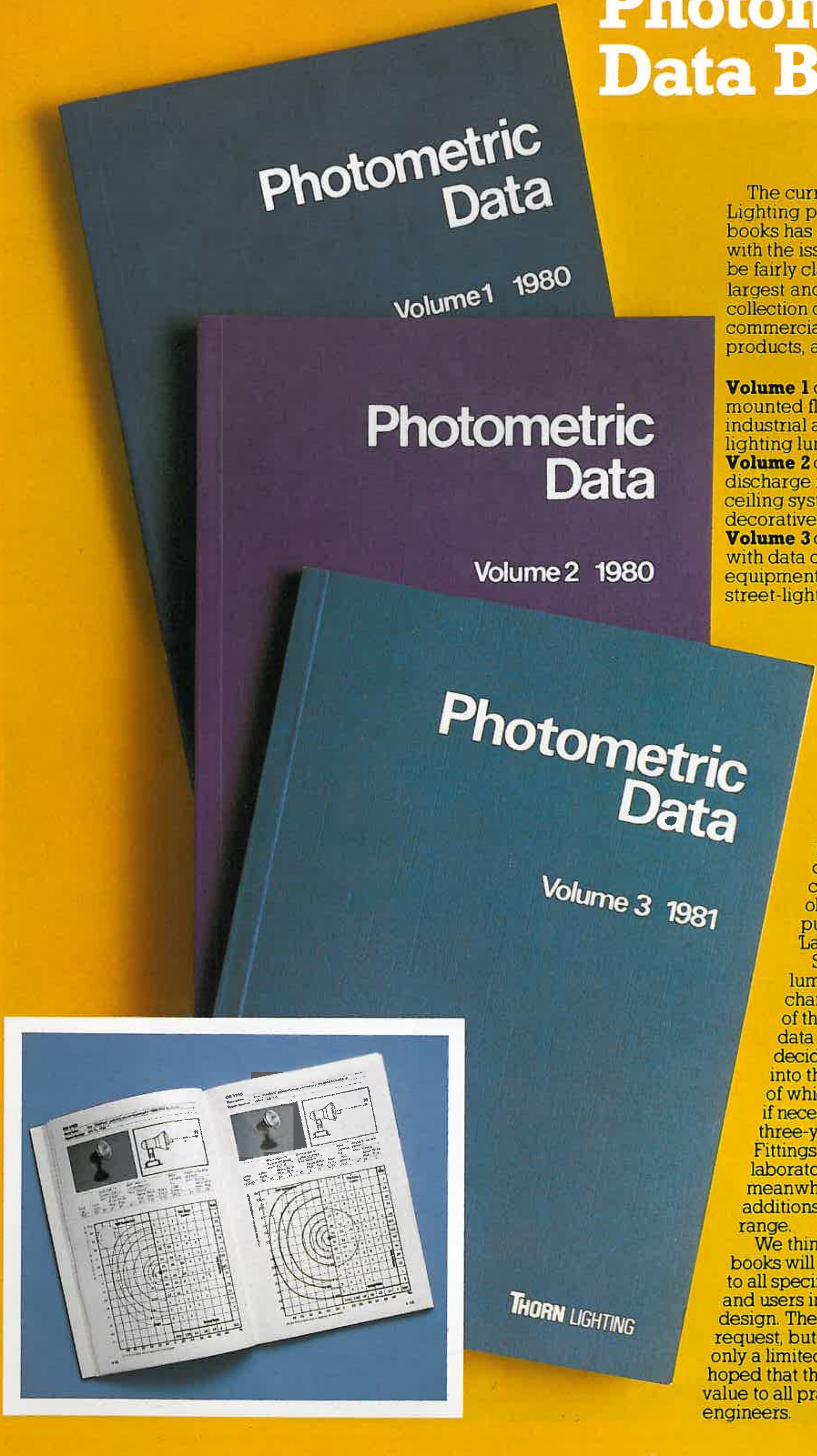
After the wedding we had to act fast to move some of our cameras immediately, and bring eight miles of cable and 17 tons of lighting equipment out by 8.30 a.m. on Friday 31st July, to fit in with St. Paul's constant programme of events and services. For us at the BBC, another Outside Broadcast was over — albeit one which we shall all remember for a long time, for its challenge, its transmission success and for the pageantry and joy of the occasion.

In conclusion I would like to thank the BBC Director of Engineering for his permission to publish this article.



Fixing and adjusting CSI lamps in the narrow triforium gallery was a difficult task.

Photometric Data Books



The current set of Thorn Lighting photometric data books has now been completed with the issue of Volume 3. It can be fairly claimed that this is the largest and most comprehensive collection of such data, on a commercially available range of products, anywhere in the world.

Volume 1 covers mostly surface-mounted fluorescent and discharge, industrial and commercial interior lighting luminaires.
Volume 2 covers fluorescent and discharge recessed luminaires, ceiling systems and display and decorative tungsten fittings.
Volume 3 completes the collection with data on exterior, floodlighting, equipment and, for the first time on street-lighting lanterns.

Each volume includes an introductory section giving guidance on the use of the data. This is intended merely as an *aidé memoir*, not a text book; detailed information on calculation methods can be readily obtained from publications such as 'Lamps and Lighting'. Since the range of luminaires is constantly changing, and because of the sheer volume of data required, it was decided to split the data into three volumes, each of which could be revised if necessary at two to three-year intervals. Fittings data sheets and laboratory reports will meanwhile be available on additions or alterations to the range.

We think that these three books will prove of great value to all specifiers, consultants and users involved in lighting design. They are free on request, but although there is only a limited number, it is to be hoped that they will prove of value to all practicing lighting engineers.

Brian Jones

Emergency Lighting Requirements and Techniques

Mr Jones is Product Manager for Industrial Luminaires at THORN EMI Lighting Ltd.

There are two forms of emergency lighting; 'standby lighting' and 'escape lighting'. The former is defined as 'that part of emergency lighting which may be provided to enable normal activities to continue'. While this is an over-simplification it is sufficient for its purpose. This article will deal solely with the second form, that is, with 'escape lighting', defined by BS5266 as 'lighting provided for use when normal lighting fails, to ensure that the means of escape can be safely and effectively used at material times.'

Legislation affecting escape lighting

Escape lighting is affected by a considerable amount of legislation. Direct reference is made to it in the 'Cinematograph (safety) regulations: 1955: no 1129. This regulation, coupled with British Standard CP1007, at present under review, gives guidance on escape lighting in cinemas, theatres and other places of entertainment. Other controls are by inference. The Fire Precautions Act, 1971, states that it is necessary to ensure that 'means of escape can be safely and effectively used at all material times'. The local Fire Authority will indicate the need to install escape lighting. To assist them, the Home Office has published some guides to the Fire Precautions Act for certain premises. Guide No1 covers Hotels and Boarding Houses, No2, Factories and No3 Offices, Shops and Railway Premises. The 'Health and Safety at Work' Act of 1974 specifically places a duty upon the employer to ensure as far as possible, that places of work and the access routes to and from them are maintained in such a condition that they are safe and without risk to health. Under a Designation Order enforced from the first of January 1977, Fire Authorities are responsible for escape requirements in all aspects. Generally, now, the Authority will insist on escape lighting in all buildings requiring certification where either working hours or normal occupancy extend into the hours of darkness, or there is no or insufficient natural light during daylight hours.

The British Standard Specification

The legislation states *where* emergency lighting must be provided but it required a British Standard Specification (BS 5266 Pt1 1975) to lay down minimum standards for its design, installation and use. BS 5266 is

The Thorn range of emergency lighting equipment. The two small fittings below the 'Exit' sign are designed to fit into existing fluorescent or discharge luminaires.

entitled 'The Code of Practice for the Emergency Lighting of Premises' and provides specifications for a number of categories of emergency lighting systems. Those that immediately concern us are the 'self-contained' and 'slave' luminaires or signs.

A self-contained luminaire, as its name implies is one in which all the elements, the battery, lamp or lamps, control and test units and monitoring facilities, if provided, are contained in one housing; a slave luminaire is energised from a central source of supply.

New standards governing performance

1978 saw the publication of ICEL 1001, 'The industry Standard for the Construction and Performance of Battery-operated Emergency Lighting Equipment', produced by ICEL Ltd, the Industry Committee for Emergency Lighting, a joint enterprise of the Lighting Industry Federation and the BEAMA Committee on Emergency Lighting. The certification is under the auspices of the BSI and is run along the same lines as the Kitemark/Safety mark scheme. ICEL1001 pt1 lays down stringent standards on construction and performance and is recognised by the leading local authorities in the British Isles. It has been regularly reviewed and modified by the addition of a schedule of interpretations to keep it in line with the developing international specification, 15C 598.2.72 which was incorporated into British Standards as BS4533 Section 102.22 in 1981. The next stage will be the incorporation of the Photometric Standard ICEL 1002 into the British Photometric Standard BS 5225, possibly as an addendum. Once that has been achieved and a way of certifying central battery systems established, ICEL will give way to a Kitemark type scheme from BSI. For the 'considerable' interim, ICEL1001 Pt1 has been revised. All of Thorn Lighting's emergency lighting luminaires conform with these standards.

Some notes on the regulations

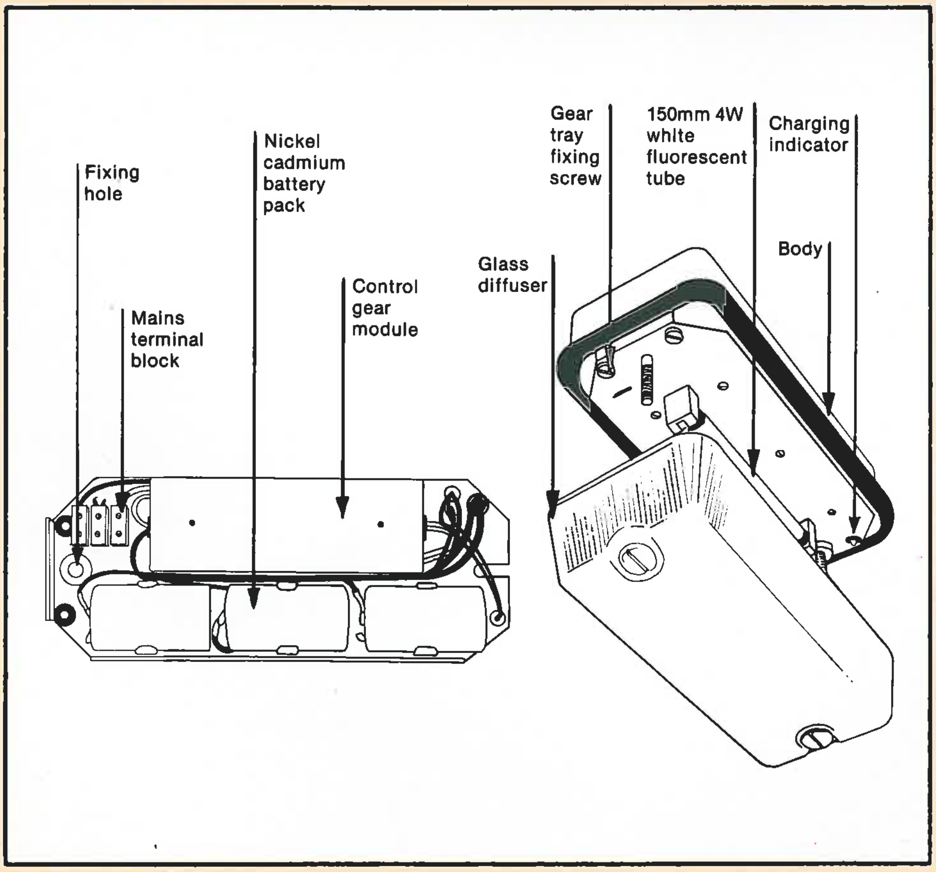
It should be noted that in the UK, local authorities often have power to make regulations for premises licensed for private or public entertainment through national or local legislation. It is normal practice for these regulations to require escape lighting.

The aim of BS5266 is to ensure that all emergency lighting is capable of operation when the normal lighting supply fails. Thus it must be independent and the lighting level must be sufficient and the illumination last long enough for the appropriate action, whether it be associated with hazardous tasks or simply escape from danger, to be safely carried out. For escape, it currently stipulates that the *minimum* illuminance at any point on the escape route must be 0.2 lux. This minimum level applies at all times up to the end of the specified duration period of the emergency lighting system. A maximum diversity factor of 40:1 is recommended, but it is likely that this may be changed or dropped altogether since the specification is currently under revision.

Measuring the illuminance

The illuminance of 0.2 lux must be measured on the centre line of the escape route on the working plane, in this case a floor level; on stairways the plane of measurement is the pitch line. The width of the escape route is not specified, however, but may be assumed to be two metres on average of which 50% can be lighted to a minimum of 0.1 lux. In other words, the fall-off of illuminance should not exceed 50% across the width of the escape route. It is important to note that this is a measurement of direct illuminance from the luminaire and does not include inter-reflections from walls or ceilings, which are usually beneficial. Manufacturers' data for spacing: mounting height ratios are therefore based on direct illuminance alone.

There may be occasions where a higher minimum illuminance is desirable, but two points must be borne in mind when considering the statutory minimum. Firstly, 0.2 lux was carefully established from empirical data as representing the lowest level of illumination necessary for safety. It is related to a normal illuminance of 1,000 lux and caters for persons with varying qualities of eyesight. Secondly, any increase in illuminance brings a proportional increase in the power required to service a system.



A typical self-contained escape lighting luminaire showing its component parts.

Siting emergency lighting

Positioning emergency lighting luminaires must take several factors into account.

1. The minimum illuminance level of 0.2 lux already discussed coupled with the maximum diversity ratio of 40:1.
2. Luminaires and signs must be positioned to show clearly exit routes and final exits from premises; a sign rather than a luminaire being used if the route or exit itself is not readily identifiable.
3. Exterior areas of final exits must be lit to the same level of illumination as immediately inside the exit and this illumination level should be maintained until street lighting takes over.
4. Changes in floor level must be lit. e.g. steps, ramps, stairs.
5. Changes in direction and corridor intersections must be lit.
6. Control/Plant rooms, lifts, small service rooms and toilet rooms exceeding 8 sq. metres gross area must also be illuminated.
7. All fire alarm call points and fire fighting equipment must be easily identifiable under emergency lighting conditions.

Once the above factors have been taken into account the remaining emergency lighting is normally quite simple to plan.

Installation aids and maintenance

One of the obvious difficulties for the electrical contractor is to determine the correct spacing and mounting heights of fittings on the escape route to provide the required illuminance. The table gives typical spacing data for Thorn luminaires in an easily assimilable form. The actual siting of fittings seldom presents problems once the escape route has been identified. The key positions are established in accordnace with the recommendations in the Code of Practice at corridor intersections, stairs etc, and then the positions of the intermediate fittings can be established from the tables.

The Code of Practice recommends that luminaires should not be mounted less than two metres from the working plane, this is above floor level, for emergency lighting. However this is governed by a number of constraints. There may be occasions where 2.5 metres will have to be exceeded, perhaps to avoid glare, but it is important that luminaires should not be located in a smoke collecting zone.

Regular testing and cleaning of fittings it essential. A full test schedule is published in BS5266. The diffusing surfaces of the fittings must be kept clean, and dirt should be removed from their upper surfaces if they are suspended, to avoid both loss of light and overheating. In exceptionally dirty conditions the spacing between fittings may have to be reduced to up to a third to compensate for contamination of the light-transmitting surfaces.

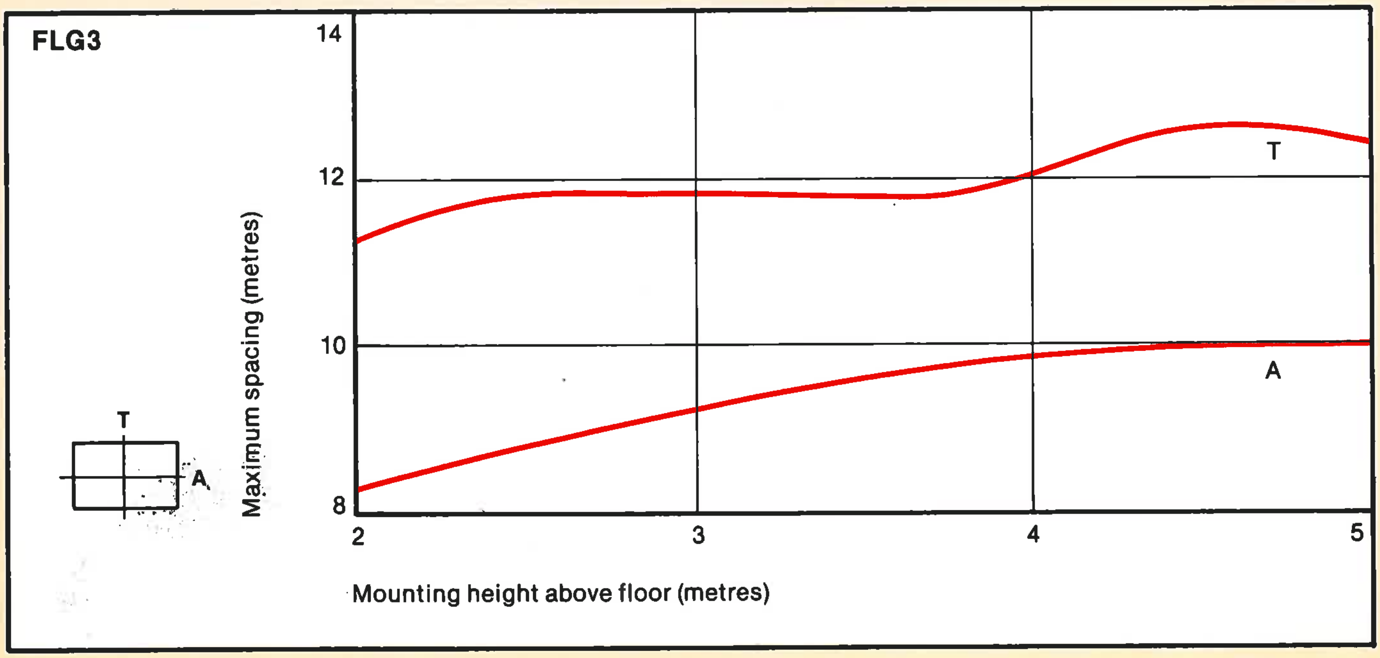
A word about signs

The importance of signs cannot be over-estimated. Direction of escape must be unambiguous using the terms EXIT or EMERGENCY EXIT. Any legend containing the word 'fire' is deprecated as so many evacuations are due to other causes, so that the term can be misleading. Directional arrows can be used if necessary to avoid confusion.

Although more expensive in terms of capital and installation cost, the use of internally lighted direction signs is to be preferred to that of painted signs, although these are permitted. With internally lighted signs greater brightness is possible than with a painted sign, an important consideration if the sign is partially obscured by smoke. Colour, size and style of character for illuminated signs are specified in BS 2560:1978, Specification for Exit Signs (internally illuminated) and BS 4218:1978 for self luminous signs.

The mounting height for all escape signs should be between 2 metres and 2.5 metres whenever possible. Where a sign is not sited directly over a door it is important to ensure that the exit door cannot be confused with other doors, openings etc. Good use can be made of suspended signs, double-sided signs and directional arrows to avoid confusion.

Spacing: mounting-height diagram for the fitting on the opposite page; taken from the Thorn Technical Handbook.



Choosing the system

The first choice that has to be made is between luminaires powered from a central source (slave luminaires) and self-contained luminaires. Advantages of the former are, first, that since the lamps are supplied from a static inverter system delivering an A.C. supply, standard lighting fittings, fluorescent or tungsten can be used. Mains bye-pass circuitry is standard, and allows the normal lighting to be maintained, although perhaps at a reduced level. Alternatively, in a D.C. system, current is fed from the battery to the emergency lighting fittings, so that fluorescent lamps must be operated from individually mounted inverters. Secondly centrally powered installations have a long life, up to 25 years, and large systems may prove less costly than self-contained systems. On the debit side, they require large, well-ventilated battery and control rooms and fittings need to be wired separately from the normal system in fire-resistant cable.

Self-contained luminaires are usually small and make use either of krypton-filled incandescent lamps or miniature fluorescent tubes. They are powered by sealed nickel-cadmium rechargeable cells controlled by an electronic circuit providing automatic switching and recharging. Wiring costs can be reduced as they can be fed from the nearest unswitched supply point. This also has the advantage that if the mains wiring is damaged they are activated immediately. Local damage to part of the system does not affect other areas and the fitting will operate until it is devoured by flames. Other advantages include less maintenance, as the cells do not need topping up, the fittings can easily be resited if necessary and no control room is needed. Disadvantages are that the cells deteriorate more rapidly, seven years is an average life, although the new BS4533-102.2 calls for them to be changed every four years. They are sensitive to temperatures above 45°C.

The choice may not simply be one of economics. Local enforcement officers may insist that installations above a certain size must be fed centrally, but on balance the self-contained system is likely to be preferred.

Tungsten or fluorescent lamps?

Assuming that a self-contained system has been chosen, the final decision is between using fluorescent tubes or krypton-filled tungsten lamps in it.

In common with all incandescent light-sources, krypton lamps, although initially cheaper, have a shorter life and lower light-output than fluorescents, consequently they are rapidly losing favour and many manufacturers have dropped them from their range. Fluorescent tubes normally of the 4W, 6W or 8W ratings are very popular. Luminaires are available for them in all modes, maintained, non-maintained and sustained and the higher light-output they attain allows fewer fittings to be used to maintain the correct illuminance.

Current trends suggest that a future development will be the use of standard full-length tubes specially adapted for this purpose, obviating the need for special emergency lighting fittings within a scheme with consequent improvements in its appearance. More efficient batteries will increase lighting levels without degrading duration times, possibly new types of lead-acid cells will be developed. With these and the development of new light-sources emergency lighting is clearly heading for some interesting and profitable developments.

The fluorescent installation on the left appears perfectly normal, but removing a diffuser (right) reveals the escape lighting luminaire mounted between the fluorescent tubes.

Iain Maclean and John Clarke

Palace of Culture, Prague

Mr Maclean is Manager of the Project Coordination Department of THORN EMI Lighting Ltd. at Enfield and Mr Clarke is Zone Manager of the Direct Exports Division at Romford.

THORN EMI Lighting attaches considerable attention to specification business, that is, to projects that stem mainly from architects and consultants both at home and internationally. These projects form the backbone of the work done by lighting and special projects engineers. Because many specifiers need more than just a lighting scheme, meeting a specification is clearly not just a case of adding a few fancy trimmings to existing products. A scheme is designed specifically to complement the overall environment of a building, so that other services, such as air-diffusion and fire-protection systems are integrated with the lighting.

There may be carefully defined parameters to work to or a general outline to develop; either way, the consultant and system designer will work closely together during the early stages of a project to ensure that the final design is tailored to meet the specifier's requirements. This part of the work is often complex and some projects can take several years to complete — a long and arduous path of constantly revising schemes and designs may have to be followed before everyone is satisfied with all elements. Full enviromental testing in the laboratory of large-scale mock-ups of sample areas, including all inter-related services, such as lighting ceilings and air-diffusion, and normally a fee is charged for this although no charge is made for the detailed layouts and designs. The extensive in-house research and development facilities available to the Company allows it to deal satisfactorily with these special projects.

The building

All these facilities were fully utilised during the course of negotiations and subsequent contract for the Palace of Culture in Prague. This is an imposing new building overlooking the ancient city. Within its glass and concrete walls, a floor area of over 160,000 square metres contains large numbers of individual meeting and committee rooms, several restaurants and a 3,000 seat Conference Hall. It is anticipated that it will be used for some 1200 events every year.

The work carried out by the Company is not only remarkable because it is one of the largest prestige projects we have undertaken recently but because it is a classic example of full scale and detailed co-ordination covering almost the whole range of lighting, heating and ventilation disciplines.

The initial stages

Exico, the London based associate of the Czechoslovak Import/Export Agency, Transakta, first approached us in the Summer of 1978 when they were requested to find a suitable supplier of lighting and ceiling products for the new Palace of Culture then in the early design stage. Initial meetings were held in London with Exico and it was soon realised by all concerned that if we were seriously interested in this potential business a visit to Prague to meet the project designers was necessary. Such a complex scheme could not be handled as an ordinary lighting scheme would be, therefore the Zone manager and the manager of the Project Coordination Department flew to Prague and began to work out in detail the numerous types of lighting and ceilings required for the many and varied areas. They also looked at costing and commenced the tortuous process of negotiating the contract.

Imaginative suggestions were made about possible types of ceiling system that could be used in the larger areas and the Chief Engineer of the Ceiling

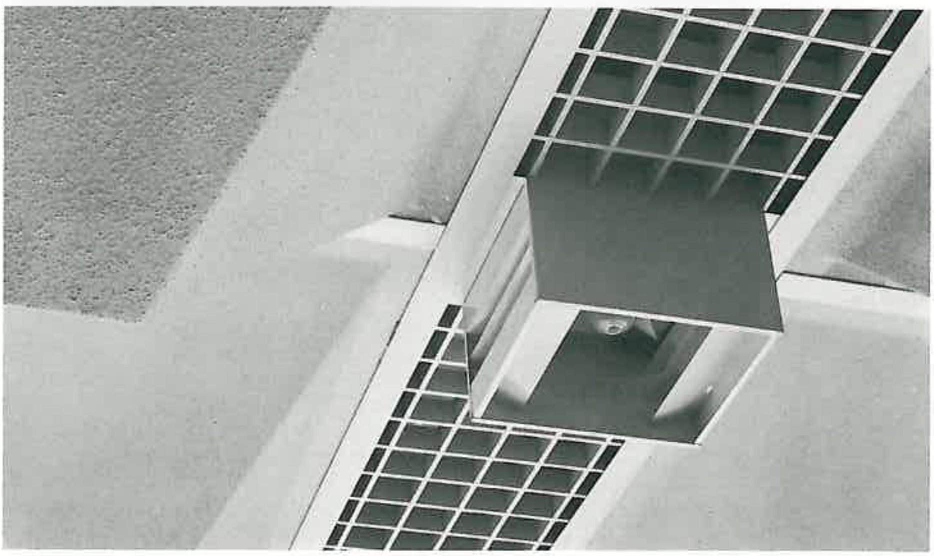
Systems Design Department, produced a sketch book of ideas that helped to fire the imagination of the architects. Several visits were made to Prague to progress the design and the gradual establishment of a sense of mutual trust and respect for individuals' talents led to an invitation from the Czechoslovaks to design and supply ceilings and lighting equipment for areas such as the foyer, crush bars, committee and meeting rooms.

Entrance hall lighting

The main Entrance Hall with its height of over 15 metres required a design for the ceiling which had to have a sense of scale as well as meeting the lighting requirements of 400 lux. Wedge-shaped coffers manufactured from moulded glass reinforced gypsum were mounted in a specially designed aluminium grid made from heavy extruded sections. The lighting was provided by a system of fully recessed louvered fluorescent fittings, interspersed with 250W high-pressure sodium semi-recessed downlights, mounted in the troughs between the coffers. The downlights were specially designed to provide a percentage of sideways light to help reveal the shape and form of the wedge-shaped ceiling units. These, in common with all ceiling units, both shaped and flat, were finished with a textured surface.

Committee rooms

In the committee rooms, extensive use was made of the Programme 2 integrated ceiling system, using perforated steel coffers. Careful coordination was necessary with the manufacturers and suppliers of the Moduline air-diffusers to ensure dimensional compatability. Fully active mock-ups of these ceilings were constructed in the laboratories to prove satisfactory air handling characteristics. Large meeting rooms and foyers on three floors were supplied with a variety of louvred ceilings, "Magnagrid", "Leaf-lite" and "Can-Can", together with the appropriate lighting equipment.



The ceiling of the entrance-hall is made up of fibre-glass coffers mounted on a heavy aluminium framework which also supports the lighting fittings, a detail of which is shown below.

Two committee rooms. A virtue has been made of the uneven flashing of the leaf-lite ceiling, due to limited head-room, as it relieves the monotony of the ceiling. In the room shown below a Programme 2 ceiling has been installed.

Later modifications

At a late stage in the design of the ceiling void above these decorative ceiling systems, it was decided to introduce a planked ceiling to hide air-handling and other equipment. This effectively reduced the depth of the lighting plenum to a few centimetres, necessitating the partial recessing of the fluorescent fittings into the planked ceilings. The spacing between the lines of fluorescent tubes could not be reduced owing to the severe limits imposed on lighting levels and the total electrical load in these areas. In spite of the design of special wide distribution reflectors very uneven flashing of the louvers resulted, but the client visited Enfield to view the appearance of these ceilings and accepted this. The Czech air-conditioning engineer also spent a considerable time in the Enfield Laboratories, working with our engineers and testing and assessing the performance of all the air diffusion equipment to be installed above the various louvered ceilings. This programme of development, modification and testing was so detailed and comprehensive that it was covered by a separately negotiated contract valued at over £20,000.

Testing components

All the equipment had to be manufactured and tested to comply with the strict Czechoslovak safety standards and this necessitated a visit by our engineers to the Czechoslovak Standards Institute for final approval. Particular concern had been expressed over the construction of our power-factor correction capacitors, because of the possibility of oil leakage, but since the capacitors used were all of the dry-film construction, this proved unfounded.

Installation

Once the design was finalised and the supply contract signed, separate negotiations commenced for on-site installation supervision by our engineers this being the most satisfactory way of assuring trouble-free installation of complex purpose-made equipment. As many of the products were unknown in Czechoslovakia it was necessary to train the local ceiling contractors in handling these specialised systems. Two men spent 40 weeks on site providing the supervision and training. To assist them, Thorn also supplied all the fixings, suspensions, tools and a laser levelling device which, upon completion of the contract, became the property of the builder.

It was the careful co-ordination by Project Engineers in London and site supervisors in Prague that led to all material being manufactured and delivered to time and indeed, of all the international contractors employed on the project we were the only one to finish ahead of schedule. Completion of the ceilings was in November 1980 ready for the opening ceremony by President Brezhnev of the U.S.S.R. at the Czechoslovakian State Congress in February 1981.

Quite even 'flashing' has been achieved in this cafeteria, using 'Magna-grid. The picture below shows the impressive main staircase.

R.I. Bell

Energy Management & Interior Lighting Design

Thorn 250W 'Lopak' fittings housing SON deluxe lamps provide general lighting in this rather low-pitched factory of the Abertay Paper Sack Company in Northern Ireland. The 44 luminaires replaced 64 8'0" 125W fluorescent fittings, reducing the load from 19.5 to just over 12kW and increasing the illuminance from 150 to 200 lux.

Mr. Bell is Senior Lighting Engineer at THORN EMI Lighting Ltd.

In the United Kingdom last year the cost to consumers of electricity used for lighting was in excess of £1,000m. By adopting sound design and management principles, this figure could easily be reduced by £300m.

Lighting accounts for less than 4% of all of the primary energy consumed within the UK and about 16% of the total electricity consumption. Figure 1 shows the breakdown of electricity consumption within the UK.

In domestic and industrial premises, lighting consumes a small proportion of the electrical energy but in commercial premises it accounts for about 42%. Even so, the operating costs for the lighting of a typical office are only about 0.5% of the total operating costs, with the biggest proportion, 84%, being spent on wages and salaries.

Methods of conserving energy

Simply conserving energy and costs by reducing lighting and other standards is not the pathway to success. Indeed it reduces the efficiency and effectiveness of the work-force, so that the employer would risk a substantial increase in the largest portion of his operating costs for a reduction of only 0.5%. Hardly a sound risk!

Analysing the situation

A great many people are still short-sighted and are only concerned with the capital cost of the installation, without regard to the economics of operation that can be achieved for a slightly higher investment, but it is this that really matters. However, no-one will spend good money to reduce energy consumption unless the savings offer a good return on that investment.

It is essential, before embarking on a new design or the modification of an existing one, to establish what financial criteria should be used to analyse the merits of alternative schemes. A common method of comparison is to determine the payback period for the increased investment of one scheme over another. Payback periods for lighting schemes of greater than 4 or 5 years are seldom justified unless other non-financial benefits exist.

Design objectives

Having established the necessity to do so, the first and most important step in planning or modifyng a lighting installation is to establish the lighting objectives. Ignore this stage and the result will be design by default.

Figure 2 shows a design flow chart. If a designer goes correctly through each of stages on the flow chart (paying particular attention to the objectives stage) he will encounter all of the decisions that are needed for good energy management and good lighting design.

Objectives can be considered under three broad headings:

1. To enable the occupants to work and move about in safety.
2. To enable tasks to be performed quickly, accurately and easily.
3. To achieve the desired visual conditions within the building.

These three requirements are essential for good and effective lighting, but the first, that of safety, is a statutory obligation and must be fulfilled.

Design criteria

The next stage is to attempt to translate these objectives into a set of design criteria, although many of them cannot be expressed in physical terms or measurable quantities. For example the need to make an office look prestigeous, lively or modern cannot be quantified.

Recommended illuminance

The recommended illuminances for visual tasks in the IES Code should be followed. There are conditions where they may be reduced, e.g. where work has only to be performed for short periods, causing less than normal fatigue, but in many others they may have to be increased, as, for example where contrasts in the task are low enough to cause serious errors in perception, where there is poor visibility or where less than 500 lux is recommended in a windowless building.

Glare control

In order to ensure a comfortable lighting system that will not induce fatigue or eye strain, the control of discomfort glare is necessary. The degree of glare which can be tolerated decreases as task difficulty increases, and, for this reason, the limiting glare indices are maximum and should not be exceeded. In the case of abnormally difficult tasks, the limits may have to be reduced, but otherwise there is no point in designing schemes to have a lower glare index than necessary.

The direction and colour of light

The directional effects of illumination determine the way in which texture and form are revealed. Lighting from the correct direction can make solid shapes easier to see or can help to reveal surface texture, defects, or marks such as scribe lines or scratches. Light from the wrong direction can cause bright reflections on the surface of the task and reduce contrast and hence the ability to see.

The colour of the light and the appearance of surface colours within the room are important considerations. Lamps can be classified according to their colour appearance and colour rendering properties.

It is important to make sure that these are fully understood and not ignored.

Daylight and artificial lighting

The next step in the design procedure is to select the most suitable lighting approach. The lighting could be daylight, combined daylight and artificial lighting, or artificial lighting alone. The amount of glazing will influence many aspects of energy use.

If the ratio of glass area to floor area is over 15% solar gains will be excessive without special precautions. This means that cooling will be required in the Summer, and that excessive radiation loss will occur in the Winter to cause discomfort.

A ratio of 5 - 15% will produce good daylighting with moderate heat losses and gains, and artificial lighting will not be required during the main part of the day.

If the ratio is less than 5% then it is likely to be inadequate for daylighting alone, and artificial lighting will be required for the greater part of the day.

Combined daylight and artificial lighting systems can be designed in which the inadequacies of daylight are supplemented by the electric lighting. These can be automatic or manual, with the rows of fittings near the windows being switched off when not required.

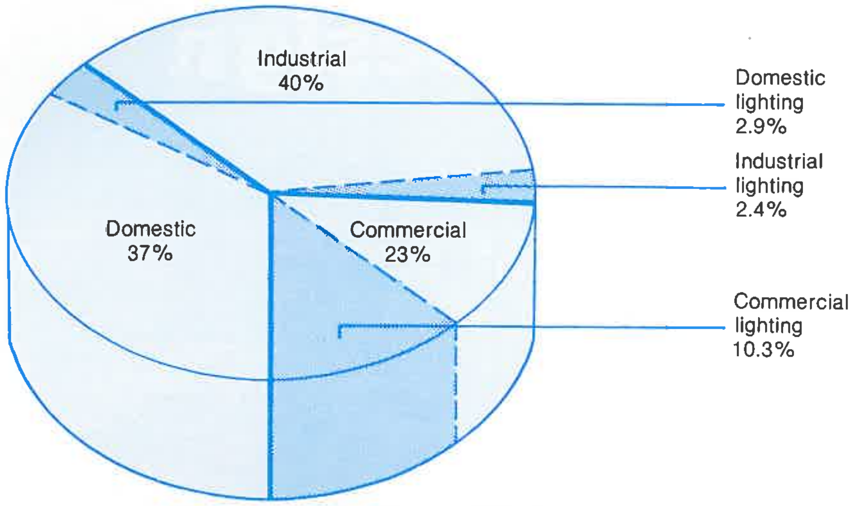


Fig. 1 Electric Power Consumption in the United Kingdom

Local, localised & general lighting

The electric lighting system itself can be designed to be general localised or local. General lighting is simple to plan and install and requires no co-ordination with work places, which may not be known or which may change, so that the greatest advantage of such a system is that it permits complete flexibility of task location. Its major disadvantage is that energy is wasted by illuminating the whole area to the level needed for the most critical tasks.

An example of localised lighting at the new Trustees Savings Bank in Birmingham. An average illuminance of 400 lux is achieved in the banking-hall from 70W SON reflector lamps mounted in specially designed luminaires. A higher level of lighting is provided from fluorescent lamps in the cashiers' and clerical section.

Localised lighting

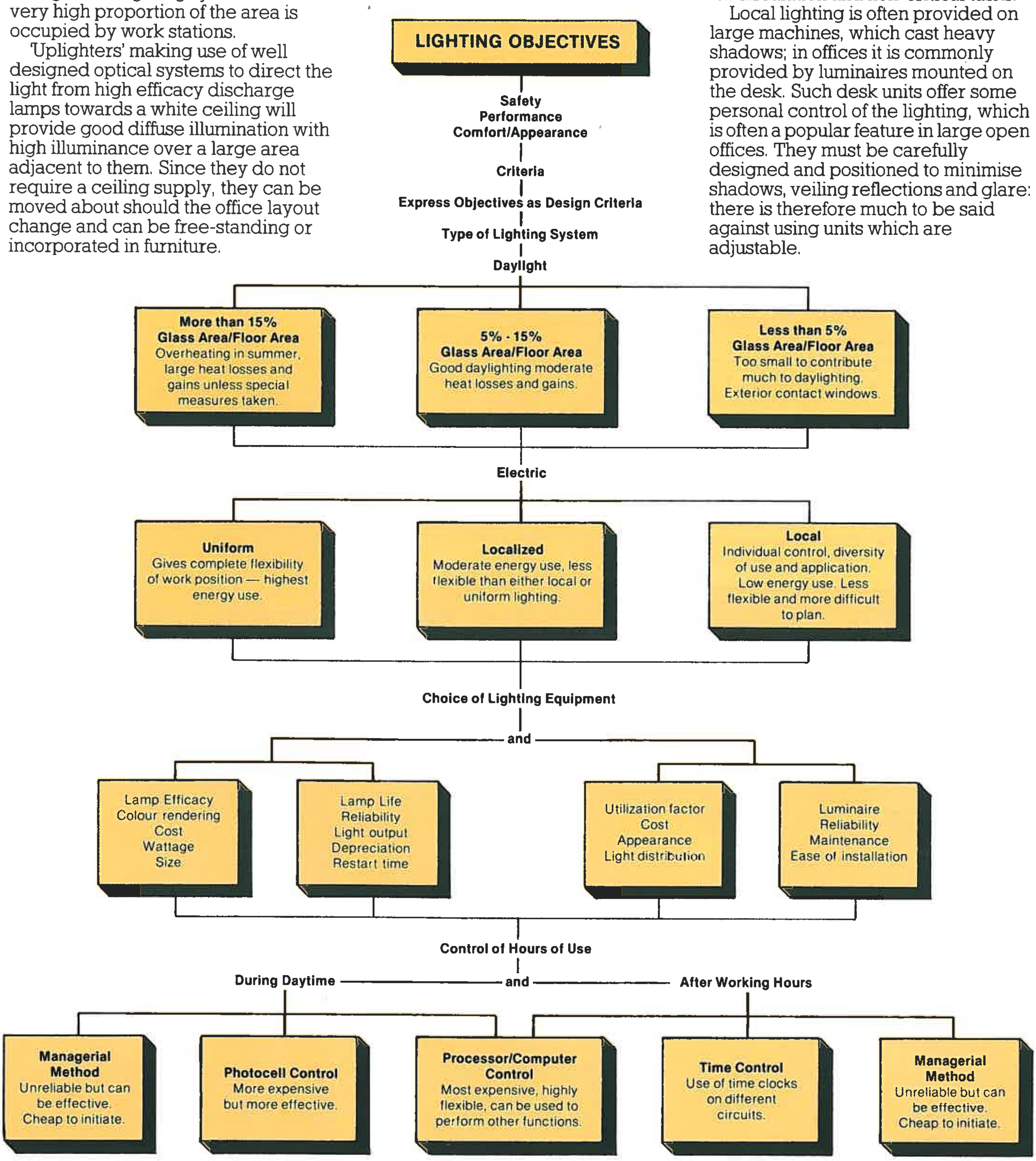
In a localised lighting system the luminaires are related to the position of tasks and work stations, providing the correct service illuminance at those points with lower general illumination. Such systems consume less energy than general lighting systems unless a very high proportion of the area is occupied by work stations.

'Uplighters' making use of well designed optical systems to direct the light from high efficacy discharge lamps towards a white ceiling will provide good diffuse illumination with high illuminance over a large area adjacent to them. Since they do not require a ceiling supply, they can be moved about should the office layout change and can be free-standing or incorporated in furniture.

Local lighting

Local lighting provides illumination only over the small area occupied by the task and its immediate surroundings. Some form of general lighting system must be installed to provide sufficient ambient illumination for circulation and non-critical tasks.

Local lighting is often provided on large machines, which cast heavy shadows; in offices it is commonly provided by luminaires mounted on the desk. Such desk units offer some personal control of the lighting, which is often a popular feature in large open offices. They must be carefully designed and positioned to minimise shadows, veiling reflections and glare: there is therefore much to be said against using units which are adjustable.



Choice of lamp & luminaire

The choice of lamp affects the range of luminaires available and vice versa, so one cannot be considered without reference to the other.

It is tempting when choosing a lamp to opt for the most efficient type, on the assumption that it will be best choice. This is frequently not the case. It is vital that the lamp satisfies all of the design requirements. Furthermore, it is the combined performance of the lamp and luminaire which determines the overall efficiency.

A sound approach for the inexperienced designer is to compile a list of suitable lamps; rejecting those which do not satisfy his design objectives. The availability of suitable luminaires can then be checked and the economics of the combinations assessed.

In general, the higher the wattage of a particular lamp, the more efficient it will be. However, this does not mean that one should always use the minimum number of high wattage lamps. Shadows and other problems usually mean that such a system would be less effective and therefore wasteful. Using more lamps of lower wattage will often result in a better performance.

The level of illuminance is doubled in a restricted area by the use of localised fluorescent lighting in a car factory in Ulster. 'Pluslux' tubes were chosen for their high efficacy and good colour-rendering properties.

Colour rendering of lamps

Lamps must have satisfactory colour rendering properties. Visual tasks requiring accurate perception of colour are less common than is generally realised, but there are many merchandising situations where good colour rendering is important. Many offices and other commercial interiors become pleasanter places to work in if lamps with good colour-rendering properties are used. Efficiency no longer has to be sacrificed; the new lamps in the 26mm diameter range are actually more efficient than standard types with poorer colour-rendering.

The introduction of the SON deluxe lamps has widened the use of SON lamps, already proved the best choice in most industrial situations, to commercial premises where previously tungsten, MBF or fluorescent lamps were used.

The run up time of many high pressure discharge lamps is too long for applications requiring the rapid provision of illumination, unless auxiliary tungsten or fluorescent lamps are provided. This puts limits on the degree of switching which can be employed to control the hours of use.

Another important factor is the life of the lamp and how well the lamp maintains its light output. A sensible lamp replacement policy can avoid energy being wasted.

Developments in control-gear

Associated with the lamp is the choice of control gear. New electronic starters for fluorescent lamps (including the new 26mm diameter lamps) offer all of the performance and reliability advantages of starterless circuits, but without the associated energy losses.

Completely electronic gear with even greater efficiency is a possibility today, but the state of development of power semi-conductors is such that the potential savings do not warrant the increased cost of equipment. However, the scope for electronic control gear in the next few years is vast. Once electronic current control devices are incorporated into luminaires they need not be used only

for limiting the lamp current. They could also be used to switch the power to the complete luminaire, and could be controlled in a wide variety of ways. Infra-red switches, low voltage control circuits or mains-borne switching telemetry are just a few possibilities.

Choice of luminaires

Luminaires have to withstand a variety of physical conditions, involving such things as vibration, moisture, dust, high or low ambient temperatures or vandalism. They must also be electrically safe, a matter covered by the BS safety mark.

The chosen luminaire must not only be efficient but must also provide a satisfactory illumination distribution and satisfactory modelling. This can be checked by using the IR (Illumination Ratio) charts, devised for the multiple criterion design method, given in Technical Report number 15 of the CIBS.

Final decisions about which luminaire to use can be based on cost, efficiency, glare control or other factors, and may have to be left to a later stage in the design process.

Control of hours of use

Additional and often substantial savings can be made by controlling the hours of use for lighting. It is not uncommon to find buildings fully illuminated at night whilst a small band of cleaners do their rounds.

The simplest method of control is to encourage people to switch off lighting that is not required. This will vary enormously in success, so alternatively staff can be appointed to switch off lights, but this too may prove ineffective. Self-adhesive labels reminding people to turn off unwanted lights are a worthwhile investment. The location of switches is important. A good switch layout costs very little more in time or money than a bad one, but can save a considerable amount of energy.

Infra-red, ultra sonic and other forms of remote switch control are becoming popular. These allow individuals or small groups of individuals to control lighting in their part of the office. Many of these systems are expensive and still a trifle gimmicky. Nevertheless, they do offer savings and their use is becoming more widespread.

Other expensive but effective systems include the use of photocells to turn out the lights when the natural illuminance reaches a preset value, time switch control, which requires an override system for safety and the use of a central processor or mini-computer to control all services. Properly implemented, such schemes, at present in their infancy, can reduce wiring costs because only low voltage control wires need be installed for switching. They can also be programmed to perform load balancing to minimise maximum demand charges.

Conclusion

The performance of light sources and luminaires has been steadily improving over the years and will continue to make advances. The new generation of fluorescent lamps and the new localised lighting systems for offices are recent examples of this tendency.

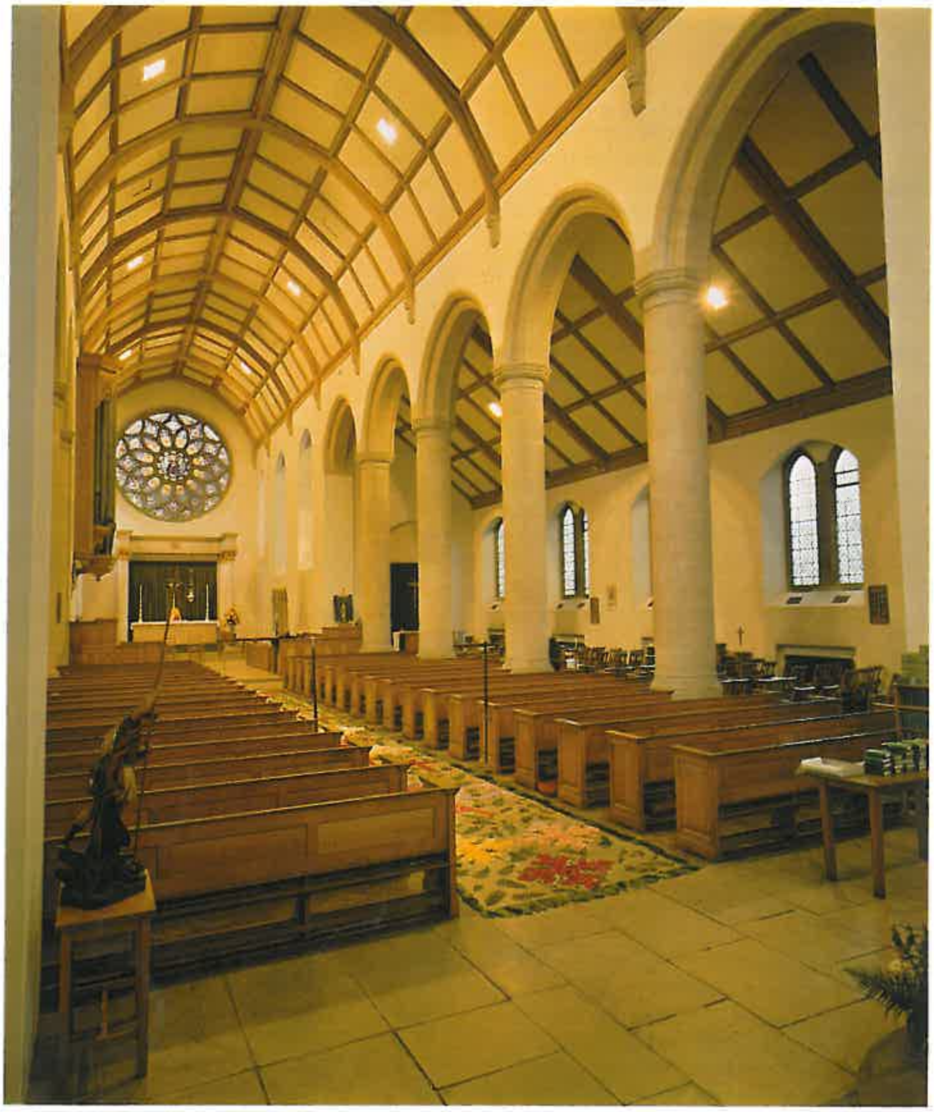
Despite this, very few lighting installations in use today realise the full benefits from existing equipment. This is mainly due to inadequate briefing and lack of detailed attention to the design and installation stages of a lighting project, and a frequent failure to realise the importance of a sensible maintenance programme.

There is nothing magic or mysterious about good energy management. It is synonymous with good lighting design.

In this office of the Standard Chartered Bank in Gracechurch Street in the City of London, individual indirect lighting luminaires have been provided. The use of SON lamps makes this system economically possible and many office workers enjoy the chance to regulate their own lighting environment.

Some recent SON installations

There seems no end to the variety of lighting applications using SON lamps Outdoor lighting ranges from impressive industrial installations such as the Phillips Oil Rig being manufactured by the Ayrshire Marine Construction Company at Hunterstone to the medieval castle of Montagnana which was used in Zeffirelli's film of Romeo and Juliet pictured below it. Right is All Saints' church, Bishops Stortford, where the high efficacy of SON lamps cut the power consumption to a third of that when filament lamps were used and raised the illuminance from 40 to 400 lux. Their very long life also eased lamp replacement costs. At the foot of the page is an interesting use of 250W SON deluxe lamps in specially designed pendants at Barclay's head office in the City of London and, by way of contrast, part of Paignton's new pier in the West Country.



K.R. Wolfe and K.B. Robinson

New incandescent light sources for studio and theatre

Film, TV and Theatre all rely on lighting to create and alter the mood and impact of the dramatic presentation, and the lighting director plays an important role in manipulating colour, shadow and contrast for effect. This is all made possible by the development of lamps specifically for these applications and they include the most powerful lighting packages available. Recent developments in discharge lamps for studio lighting were described in the article on CSI and CID lamps in Lighting Journal 21. This article, therefore, is concerned with incandescent filament lamps. These have undergone major developments in the last decade due to the use of the halogen cycle.

The reasons for making tungsten halogen lamps

Studio lamps are designed to operate with a colour temperature (effectively filament temperature) compatible with the film or electronic camera, usually 3200°K. This is only a few hundred degrees below the melting point of the tungsten coil and at this level, it is evaporating fairly quickly. The evaporation rate is very dependent on temperature and any hot spots evaporate more quickly — get thinner and hence hotter. This hot spot formation is due to microscopic metallurgical defects in the wire, such as gas bubbles, grain boundary effects etc. Initially, these may only cause an increase in temperature of a few degrees but this is aggravated through life. These parts of the filament always overheat at switch-on because the electrical resistance of tungsten varies with the temperature. Eventually the melting point of tungsten is exceeded at one of these spots and the coil fails. The evaporated material will, in the meantime, have blackened the lamp envelope.

A great deal of work is being done to make the filament wire more homogeneous to reduce premature lamp failure, but the life of a filament lamp remains dependent on the rate of evaporation of tungsten. In theory, this may be modified to advantage by three methods. The first, decreasing the filament temperature, alters the colour of the light, and is unacceptable for photographic work. The second, increasing the molecular weight of the gas filling, may increase the risk of arcing between the coils of the filament. We are left with the expedient of increasing the gas pressure on the filament. This obviously increases the risk of explosion of the lamp and a much stronger envelope construction is necessary. This generally means using a smaller bulb, since a thicker wall, the other alternative, leads to undesirable stresses.

In a non-halogen lamp this would have been impossible as the evaporated tungsten would rapidly blacken the reduced surface area. In a halogen design, however, this restriction is removed. By using a higher melting point material such as fused silica to cope with the higher surface loading of the bulb a considerable reduction in size is made possible. The new bulb is inherently stronger and the increase in filling pressure this permits leads to effective life increases of the order of 2-6 times. A comparison of halogen and non-halogen equivalent lamps demonstrates the radical changes which result.

The halogen only keeps the glass clean

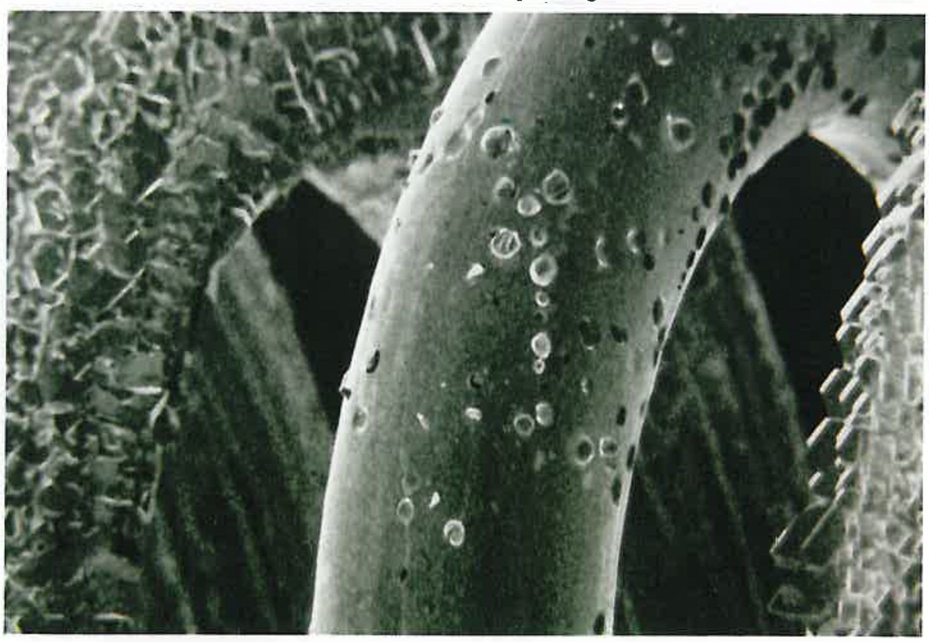
Inclusion of a halogen additive only keeps the envelope clean. It is the use of a smaller fused silica bulb which leads to a life gain. The application of a halogen cycle in a large glass envelope (and many such designs do exist) does not give any significant improvement in lamp life because the tungsten evaporation rate is unaltered.

Halogen lamps are generally found in the high efficacy applications where blackening is otherwise a problem e.g. Auto lamps — up to 70W, projection lamps from 50 to 1000W and studio lamps from 500 to 10,000W. The high wattages of the studio lamps make them unique and this class of lamp remains a limited and specialised market in which automation is not economic. In addition fused silica is an expensive material compared with glass and the processing equipment required to handle it is necessarily more complex due to the increase in working temperature from 500°C to 2000°C. Thus considerable expertise is required, particularly at the top end of the range, to produce designs competitive with glass constructions. Some of the problems encountered in the manufacture of studio lamps from quartz are discussed below.

Seals

When making a conventional glass-to-metal seal, it is possible to match the coefficients of expansion of the two materials, but quartz has a coefficient of 5.4 x 10^{-7} which is virtually zero in comparison with metals. In order to

Part of the filament of a 5kW lamp seen under an electron microscope towards the end of its life. Note the tungsten deposited on the normal turns, whilst the smooth 'hot spot' is rapidly evaporating.



Top: A halogen and conventional 5kW lamps compared. The smaller halogen lamp has the pinch seal and eliptical bulb form characteristic of this type of lamp.
Bottom left: a quartz/metal seal of the concentric foil type compared with, right, one of the Housekeeper cup type.

make a seal, advantage is taken of the fact that molybdenum and quartz 'wet' to form a layer of molybdenum disilicide a few molecules thick. Thus a hermetic seal can be produced only if the expansion and contraction of the metal is not too great to overcome the tensile strength of the materials or the surface bonding effects. In order to ensure this, the thickness of metal needs to be kept to a maximum of 25-50 microns. Since appreciable currents must pass through the seal, the cross section area required can only be obtained by the use of a wide foil.

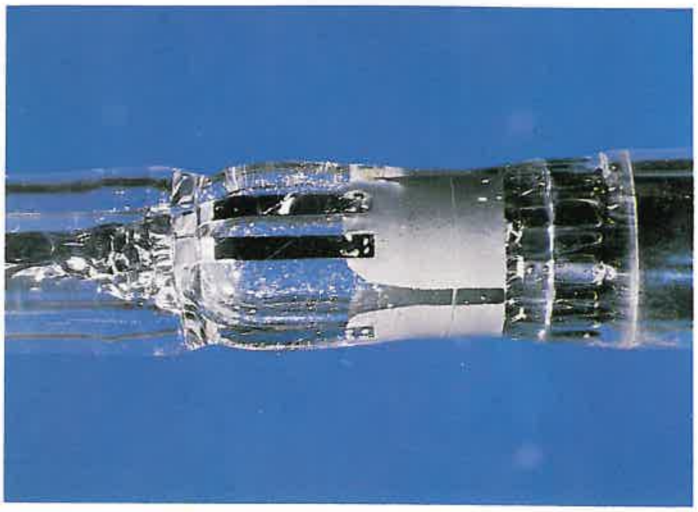
There are several ways of using this to produce a practical seal, such as by wrapping the foil or foils around an inner tube and sealing into an outer tube, or by producing a molybdenum cup of the right dimensions with the current lead hermetically sealed through the thicker base (this has the advantage that the seal foil does not carry the current). However, both these methods tend to require skilled quartz workers using hand assembly operations, which are expensive. The solution, a simple pinch seal developed originally for small mercury discharge lamps, has been refined and developed so that today, examples in factory production include a single ended 220V 10kW (equivalent to a 90 amp total capacity seal) and four lead-through seals for twin filament TV studio lamps up to 5kW ratings.

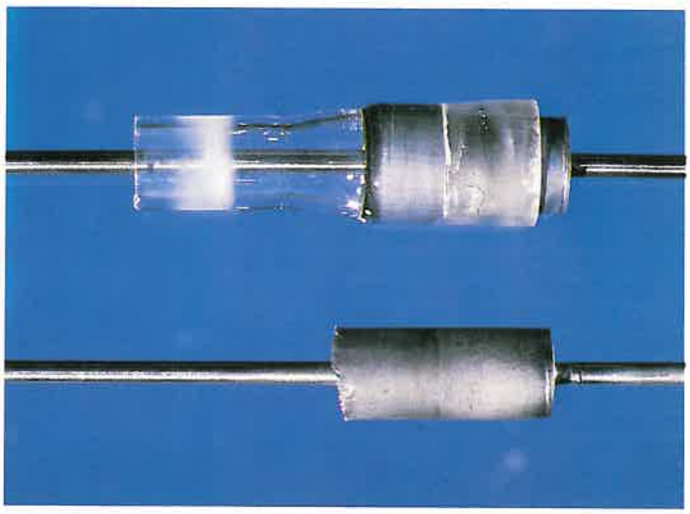
Bulb

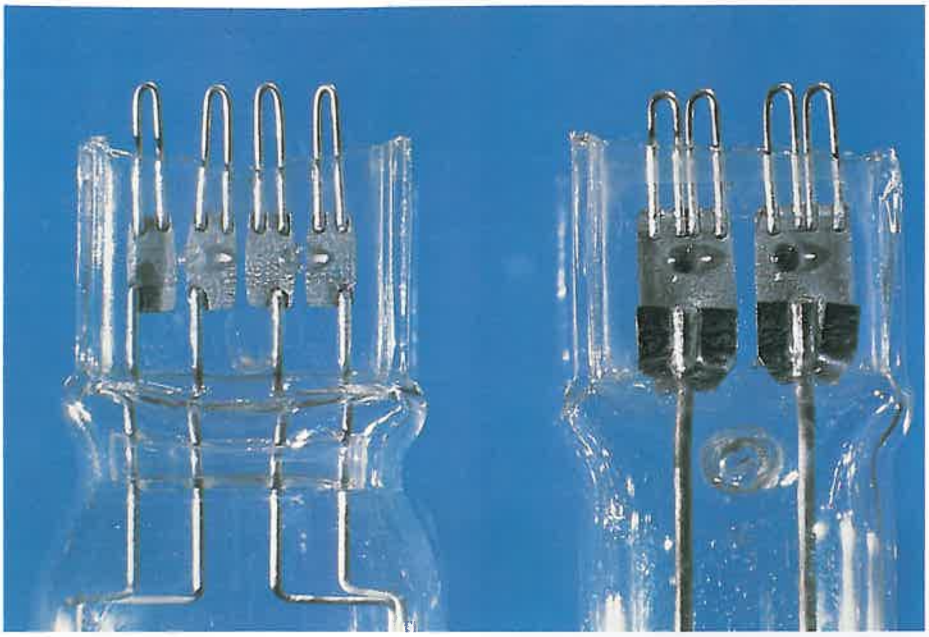
The fused silica envelope is one of the major cost components in the lamp and since costs increase with diameter it is essential to keep the latter to the minimum possible. This class of lamp usually has large planar filaments and a useful technique to achieve this is to choose a diameter close to the filament width but include a blown larger diameter portion to give the necessary operational clearance around the filament. Because of the reduced clearances, the construction often needs to be modified to bring the support in front of the filament but the obscuration caused is very small and virtually eliminated by the luminaire optics. The bulb moulding amounts to only a few seconds extra in the processing time.

Exhaust

Halogens are very active compounds and the additives used in practical lamps are not usually the elemental halogens but are compounds with some other inert material. Hydrogen bromide (HBr), methyl bromide (CH_3Br), methylene bromide (Ch_2Br_2) and bromoform ($CHBr_3$) are all used in various lamp types, the varying activity of these compounds being chosen to match the evaporation rate of the lamp. The halogen is often introduced in the gas phase, normally via a carrier gas through the exhaust bench manifold, but the corrosive nature of these halides requires special handling and materials if they are not to cause production problems. Considerable research into alternative methods of dosing has led to the use of materials in solid form, introduced by a liquid





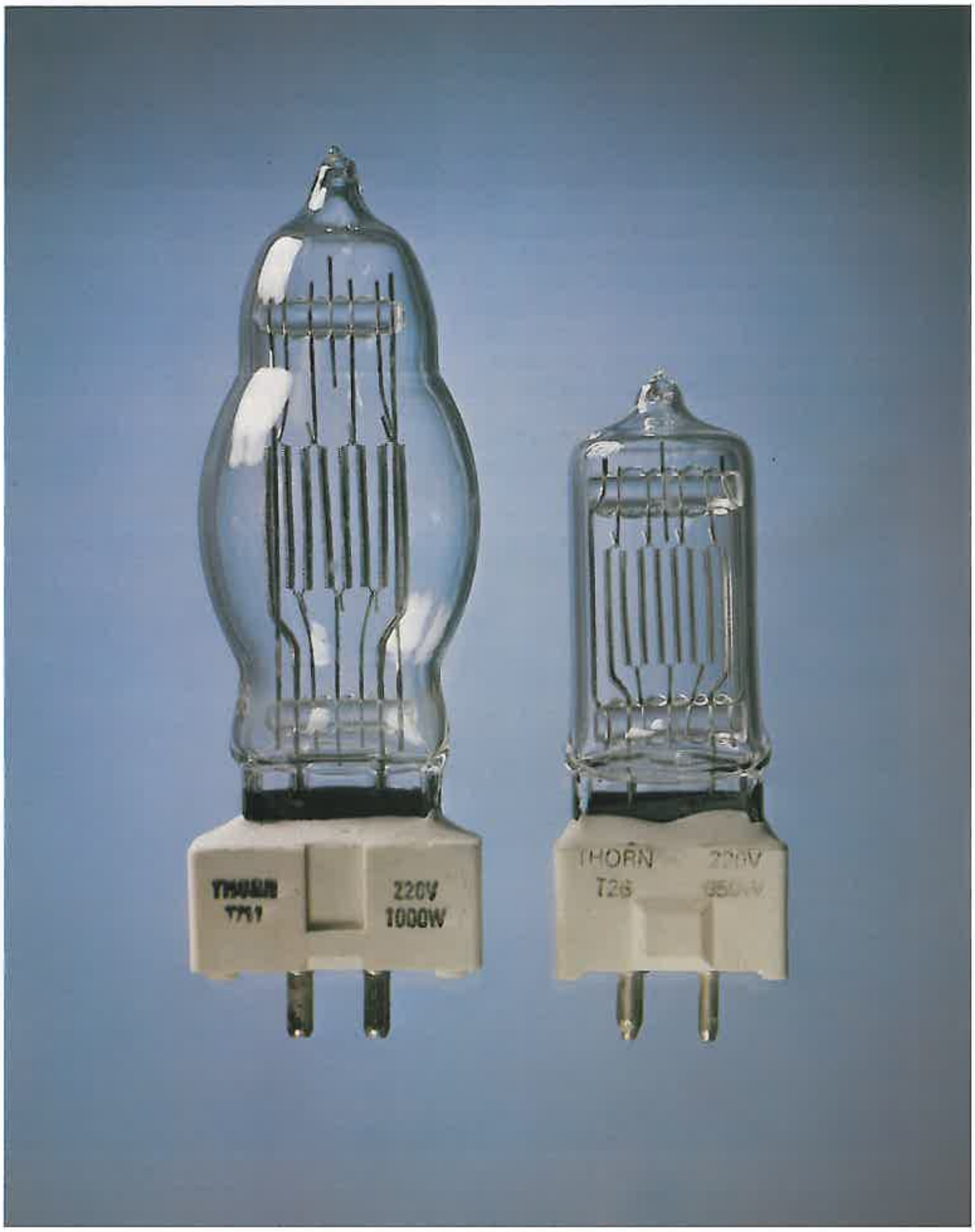


Top left shows quartz-metal seals of the 'pinch' type used by Thorn. On the left is a 220V 10kW lamp and to its right a 240V 2½/2½kW twin filament lamp. The lamp shown top right is a twin filament TV studio lamp, (CP58) with one 2½ kW and one 1¼kW filament. At the foot of the page, two tungsten-halogen lamps are compared. The larger one, (a T12) was introduced in 1976, the smaller (a T26) in 1981.

carrier such as hexane, which is evaporated before processing. An interesting example of this technique is the use of bromophosphonitrile, a compound of bromine, phosphorous and nitrogen, which allows a completely cold exhaust. The phosphor released on decomposition acts as a "getter" for any traces of oxygen or water not fully removed in the processing or subsequently diffusing from the lamp components. This technique makes the use of special exhaust equipment unnecessary and increases the rate of production in a very labour intensive process.

Twin filament lamps

Normally, operation of twin filament lamps is restricted to one or other of the two coils present, as for example, either main beam or dip beam in an auto lamp application. In TV applications, however, this has been developed to allow additional operation of both filaments together. In the most recent introduction (CP58), a lamp having 2½kW and 1¼kW filaments may be used at either 3¾kW (two filaments), or 2½kW or 1¼kW nominal ratings using the filaments separately, and dimming is possible on all these settings to 60% light output within the 250K permissible spread of the TV colour



camera. This gives a total of 6:1 variation in light output from one luminaire. Since the luminaire is designed to give beam spreads from spot to flood and sometimes also a softlight option through the rear, virtually any lighting requirement needed is available from it. Such luminaires may be permanently fixed in the studio on pneumatic hoists and called down as required, eliminating the considerable setting up time otherwise necessary and giving very good studio productivity.

The complexities involved in maintaining an adequate halogen cycle over a 6:1 power range with additional problems caused by a cold "off" filament, testify to the design problems to be overcome in the manufacture of these modern light sources.

Sealed beam lamps

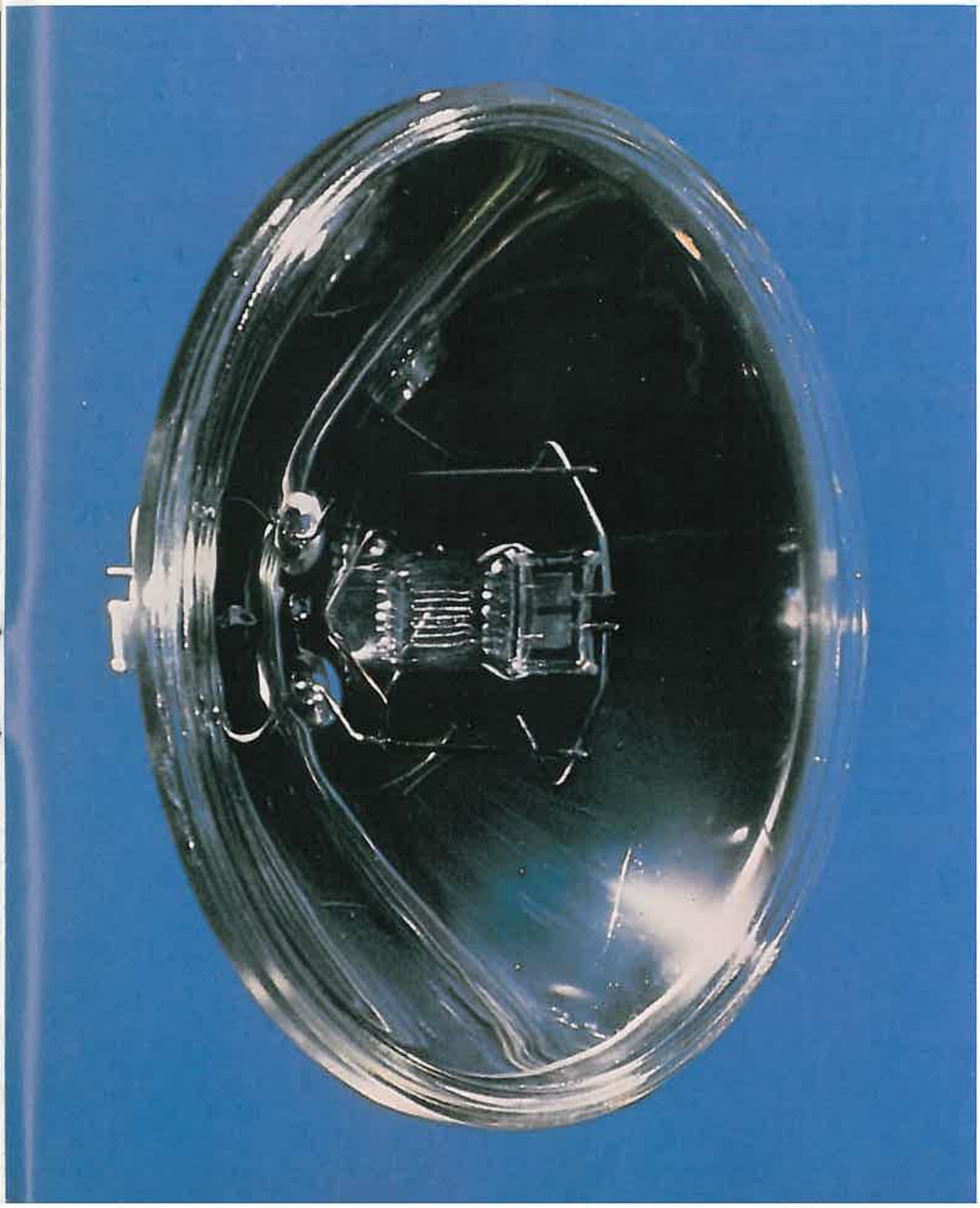
The advent of the pop group and their one night 'spectaculars' has produced a demand for stage lighting with cheap luminaires and a rapid set-up time. This is met by the PAR type of lamp which is a complete lighting system incorporating its own optics. Various beam angles are possible by using alternative front lens and the fitting itself needs to be little more than a simple 'biscuit tin' to house the lamp. These lamps are now available in mains voltage ratings up to 1000W. An indication of their popularity is that many of the big band touring shows rely on them, often several hundred lamps being used in the stage set.

The lack of a bulky luminaire and rapidity of 'setting' make for an ideal outside broadcast unit. The lighting of St. Paul's for the Royal Wedding is described elsewhere in this issue and whilst the 'key' lighting was provided by CSI and CID discharge sources, the general TV lighting within the cathedral itself was provided from the galleries by multiple arrays of incandescent PAR floodlights, totalling over 200 1kW units.

Future possibilities

Although discharge lighting is beginning to enter these traditionally incandescent markets, the higher cost per lumen, the inconvenience of control gear and difficulties of dimming have tended to limit application to areas where their advantage of high light output from low energy input outweighs these considerations e.g. outside broadcast and follow spots. Technological advances in TV camera design and film speeds are steadily bringing down the light levels required for adequate working, so that modelling and special effects have become more prominent factors for consideration in studio lighting than light output alone and will ensure a continuing demand for filament lamps.

The smaller lamps arising from the use of the halogen cycle are creating a miniaturisation of luminaire design, for example, 5kW fixtures are appearing in what used to be 2kW outline, and result in considerable reductions in the weight to be supported by the studio gantry. Miniaturisation of the halogen lamp itself continues and the recent introduction of a miniature 650W (T26) and a range of small axial coiled coil types could develop similar trends in theatre luminaires.



A PAR tungsten halogen sealed beam spotlight operating at 240V and giving a narrow beam. This is the type of lamp described in the article on the Royal Wedding. Its designation is a CP60.

Dans cette édition

Pour le mariage royal, la Cathédrale St. Paul a dû être éclairée à un niveau d'au moins 1.700 lux pour permettre des réglages d'ouverture des caméras d'environ 4 à 5,6 f. L'éclairage a été orgnaisé par la BBC, et la participation financiere de la soirété ITV. Douze caméras ont été utilisées par la BBC et neuf par ITV.

Des lampes Thorn CID ont été utilisées près de la porte ouest pour produire une lumière d'une température de couleur de 5500K. A l'intérieur de la cathédrale, on a utilisé des lampes CSI de 1 kW sous logements Lee Electric fonctionnant à 4300 et des lampes tungstène-halogenes à correction de couleur. Des filtres orange/.6ND en châssis ont été utilisés pour corriger la lumiere du jour à travers les fenêtres du choeur.

La plupart des projecteurs étaient montés sur les galeries du triforium dans la nef et dans le choeur, mais il a fallu en positionner certains dans les 'quarts de dôme' supportant le dôme principal, ce qui a nécessité des 'projections' allant jusqu'a 200 m. Ces projecteurs étaient complétés par des batteries de lampes halogéniques au tungstène PAR 64 de 1 kW, à correction de couleur pour harmonisation avec les lampes CSI. Des lampes similaires ont été utilisées pour éclairer les mosaïques sur les voûtes du choeur.

L'emploi de lampes CSI a réduit la charge d'éclairage d'un total calculé de 1,6mW à 690kW et le poids de l'équipment a été divisé par trois. Les petites lampes de faible encombrement ont été cachées aisément et la chaleur rayonnante a été fortement réduite.

L'alimentation a été dérivée du secteur par trois sous-stations, chacune fournissant 400 Ampères par phase sur une alimentation d'une capacité de 1500 Ampères. Des alimentations de secours avaient été prevues, mais n'ont pas été nécessaires. L'installation complète a été montée en cinq nuits et deux jours; la mise au point des projecteurs a dû être effectuée de nuit, car la cathédrale était ouverte au public et les services étaient célébrés normalement deux jours encore avant l'évènment. Le mariage a été célébré un mercredi; tout l'équipement était enlevé à 8 heures 30 le vendredi suivant.

Il y a deux formes d'éclairage d'urgence, 'l'éclairage de réserve' et 'l'éclairage de sauvegarde'. Le premier type est employé pour produire assez de lumière, en cas d'urgence, pour que les tâches essentielles puissent être poursuivies ou complétées, le second est employé seulement pour éclairer les voies de sauvetage afin d'assurer la sécurité de l'evacuation d'un bâtiment. C'est de cette forme dont traite cet article.

La première législation sur l'éclairage de sauvegarde était contenue dans les 'Règlements brittaniques de 1955 sur le cinématographe (sécurité)'; ceci fut suivi de la 'Loi sur la protection contre le feu de 1971' qui stipulait que "des moyens d'évacuation doivent être aménagés à tous moments" et la loi plus spécifique de 1974 sur la Santé et la Sécurité au Travail qui stipule où l'éclairage de sauvegarde doit être installé.

Une norme britannique (BS 5266) présente des spécifications pour un certain nombre de types de systèmes d'éclairage d'urgence et la Commission Industrielle pour l'éclairage d'urgence (ICEL) définit des normes strictes de construction et de performances conformes à celles de la CEE.

La norme BS 5266 établit que l'éclairage minimum le long d'une voie d'évacuation doit être constamment de 0,2 lux pendant la période de fonctionnement du système d'éclairage d'évacuation et donne des conseils quant au positionnement des appareils d'éclairage et des indicateurs de direction. Elle donne egalement un programme d'entretien et d'essais.

Les équipements autonomes d'éclairage d'urgence sont recommandés dans la plupart des cas, car ils sont plus faciles à installer, à essayer et à entretenir que les appareils d'éclairage asservis commandés par une batterie contrale et évitent la nécessité d'une salle de batteries séparée et d'un système de câblage compliqué. Des tubes fluorescents miniaturisés ou des lampes incadescentes krypton sont utilisés sur ces appareils d'éclairage et indicateurs de direction, les premiers étant recommandés du fait de leur production de lumière plus élevée et de leur plus longe durée de vie.

THORN EMI Lighting attache une importance considérable aux affaires contractuelles dans lesquelles les architectes et les ingenieurs-conseils travaillent en collaboration étroite avec les techniciens de l'éclairage et pour lesquelles des essais de milieu sont parfois nécessaires dans les laboratoires d'Enfield. Ces essais sont généralement facturés séparément quand ceci se produit. L'un des plus grands projets de cette nature a porté sur l'étude et la fourniture de systèmes d'éclairage pour certaines parties du grand Palais de la Culture à Prague.

La prise de contact avec la société fut effectuée par Exico, la failiale à Londres de l'agence d'importation/exportation tchecoslovaque, Transekta, pendant l'été 1978. Des rencontres ont eu lieu à Londres et à Prague et des suggestions ont été formulées pour les traitements des plafonds, des salles pour le public, et des salles de reunions et de conférences.

Un plafond spécial fait de coffrages de forme cônique supportés par un bâti lourd en aluminium extrudé supportant également les appareils d'éclairage a été conçu pour le hall d'entrée principal et on a largement utilisé le systèm de plafond du Programme 2 et les plafonds "Magnagrid", "Leaf-Lite" et "Can-can" dans d'autres endroits.

Des maquettes grandeur nature de tous ces systèmes ont été mises en place à Enfield et des essais approfondis des systèmes d'éclairage et de climatisation ont été effectués. De plus, l'équipement a été essayé et homologué par l'Institut Tchecoslovaque de Normalisation.

L'installation a été supervisée sur place par les techniciens de la société, celle-ci fournissant l'équipement d'entretien et assurant la formation des techniciens locaux. Les projets de plafonds ont été terminés en Novembre 1980 à temps pour l'inauguration officielle par le Président Brezhnev en Février 1981.

Le coût de l'éclairage au Royaume Uni a dépassé un milliard de livres Sterling l'an dernier. Une bonne gestion pourrait réduire ce coût de £300 millions. Bien que l'éclairage industriel et domestique constitue une petite partie de la charge totale, dans les locaux commerciaux, il est de l'ordre de 45%, mais ceci ne représente que 5% des frais totaux de gestion, 84% étant dépensés pour les salaires.

La réduction de la qualité de l'éclairage économise un très faible pourcentage du coût et réduit le rendement; il est préférable d'installer un système d'éclairage parfaitement efficace.

Pour ce faire, il est essentiel d'analyser les avantages et les inconvénients de divers systèmes d'éclairage et de définir des objectifs d'éclairage. On peut les définir comme suit: (1) Permettre aux occupants de travailler et de se déplacer en toute sécurité, (2) permettre aux tâches d'être exécutées promptement, précisément et facilement et (3) obtenir les conditions visuelles voulues à l'intérieur du bâtiment.

La phase suivante consiste à déterminer les critères de construction, bien qu'ils ne puissent pas tous être quantifiés. Les facteurs principaux à considérer consistent à déterminer le taux de rendement lumineux recommandé pour les tâches d'après le Code IES, à contrôler l'éblouissement en utilisant les indices de limitation de l'éblouissement du code et à s'assurer que la direction et la couleur de la lumière aident la perception et offrent ainsi une visualisation précise et facile.

Il peut être nécessaire de parvenir à un équilibre entre la lumière du jour et l'éclairage artificiel. L'aménagement de grandes surfaces vitrées pour admettre la lumière du jour peut résulter en un surchauffage en été et en une perte de chaleur excessive en hiver. Un rapport de 5-15% de la surface vitrée à la surface de plancher s'avérera généralement satisfaisant et réduira la nécessité d'un éclairage artificiel supplémentaire qui est susceptible d'être nécessaire si le rapport est inférieur à 5%.

Les plans d'éclairage général sont encore les plus courants. Ce système permet une souplesse totale dans la localisation des postes de travail, mais peut gaspiller de l'énergie dans les sections où l'on n'exécute pas de tâches critiques du point de vue visuel.

La mise en relation de la répartition des appareils d'éclairage et des zones de travail (c'est-à-dire l'éclairage localisé) consomme moins d'énergie. Si l'on utilise des lampes à décharge, il peut en résulter une grande souplesse.

L'éclairage local par des appareils montés sur bureaux ou machines assurera l'éclairage des tâches là où celà sera nécessaire, mais pourra donner lieu à un effet d'éblouissement pour les personnes qui travaillent à d'autres postes et il devra être complété par un bas niveau d'éclairage général.

Le choix des lampes et des appareils d'éclairage est important et peut conduire à des aménagements inhabituels comme, par exemple, l'emploi de lampes de luxe SON dans les bureaux et les locaux commerciaux. Les types les plus récents de tubes fluorescents donnent un bon rendement chromatique sans perte d'efficacité.

La régulation des heures d'emploi par commutation individuelle, par commutation automatique et par d'autres moyens est de plus en plus utilisée. Le positionnement des interrupteurs est important, mais est largement négligé.

En un mot, une bonne gestion de l'énergie est synonyme d'une bonne conception de l'éclairage.

Etant donné que les lampes studio doivent fonctionner à températures proches du point de fusion du tungstène pour être compatibles avec les caméras cinématographiques ou électroniques réglées pour 3200K, il faut s'en servir avec grand soin pour éviter des pannes prématurées. Le cycle halogénique du tungstène permet de plus petites enveloppes avec une pression de gaz accrue sans noircissement des surfaces intérieures et les dimensions réduites de l'ampoule nécessitent l'emploi de silices de quartz fondu pour supporter les températures plus élevées. Le problème du scellement des fils entrants a été résolu par l'emploi d'un simple joint d'étanchéité à pince et d'ampoules de coupe elliptique pour offrir la place nécessaire à un filament planaire. L'halogène est souvent introduit dans la phase gazeuse, mais les autres méthodes offertes comprennent l'emploi de matières sous forme solide introduites par un support liquide comme, par exemple, l'hexane. L'emploi de bromophosphonitrile, qui permet un échappement complètement froid, rend inutile l'emploi d'équipements d'échappement spéciaux et, par conséquent, réduit le coût.

Les lampes à filaments en jumelage et les lampes à faisceaux scellés sont venues recemment compléter la gamme; la tendance à la miniaturisation continue. Les progrès techniques réalisés dans la contruction des caméras de télévision et dans les vitesses des films réduisent les niveaux d'éclairment nécessaires et, en conséquence, l'emploi de grosses lampes comme le type à 20 kW a été interrompu. Cette tendance a également affecté la construction des logements qui sont de plus en plus petits.

In dieser Ausgabe

BELEUCHTUNG AUF DER KÖNIGLICHEN HOCHZEIT 2
Bryan Wilkes
(Leiter für Beleuchtung, BBC-Außensendungen)

Im Zusammenhang mit der königlichen Hochzeit mußte St. Pauls Kathedrale von 1700 lux ausbeleuchtet werden, Kamerablendeneinstellung von 4 - 5,6 zu gestatten. Die Beleuchtung wurde von der BBC und der ITV gemeinsam organisiert, und die Kosten wurden geteilt. Die BBC setze zwölf Kamerastationen ein, die ITV von neun.

Im Bereiche des westlichen Eingangs wurden Thorn CID-Lampen stationiert, die Licht mit einer Farbtemperatur von 5500 K lieferten. Im Inneren der Kathedrale wurde von 1 kW CSI-Lampen mit einer Farbtemperatur von 4300 K in Lee Electric-Gehäusen-farbberichtigten Halogenlampen Gebrauch gemacht. Zur Korrektur des durch die Chorfenster entfalenden Tageslichts dienten .6 ND/Orangefilter in Filterrahmen.

Die Flutscheinwerfer waren zum größten Teil an den Triforiumgalerien im Mittelschiff und Chor angeordnet, doch einige mußten unter den "Viertelkuppeln", die die Hauptkuppel abstützen, angebracht werden. Bei diesen Leuchten waren "Reichweiten" bis 200 m erforderlich. Sie wurden durch Gruppen von PAR 64 1 kW Halogenlampen erganst, mit entsprechender Farbberichtigung zur Anpassung an die CSI-Lampen, beleuchten ähnliche Lampen die Mosaike an den Chorgewölben.

Durch den Einsatz von CSI-Lampen wurde die Lichtnetzbelastung von geplanten 1,6 MW, auf 690 kW reduziert, und das Gewicht der Ausrüstung betrug nur ein Drittel dessen, was es bei Gebrauch anderer Leuchter ließen wäre. Die kleinen, kompakten Lampen ließen sich leicht verbergen und die Strahlungshitze war bedeutend geringer.

Der nötige Strom wurde über drei Umspannstationen vom Netz bezogen. Bei einer Stromfur Umspannstation von 1500A liefert jede 400 A je Phase. Bereitschaftsstromquellen waren vorgesehen, wurden aber nicht benötigt. Die ganze Anlage wurde im Laufe von fünf Nächten und zwei Tagen fertiggestellt. Die Flutleuchten mußten bei Nacht eingestellt werden, da Kathedrale für die Öffentlichkeit offenstand und zwei Tage vor dem Ereignis normale Gottesdienste abgehalten wurden. Die Eheschließung fand am Mittwoch statt, und bis 08.30 Uhr am folgenden Freitag war die gesamte Ausrüstung wieder entfernt.

ERFORDERNISSE UND VERFAHREN DER NOTBELEUCHTUNG 9
Brian Jones

Es gibt zwei Arten der Notbeleuchtung: "Behelfsbeleuchtung" und "Fluchtbeleuchtung". Behelfsbeleuchtung soll in einer Notlage genügend Licht liefern, damit unerläßliche Aufgaben fortgesetzt bzw. vollendet werden können, während Fluchtbeleuchtung nur für Fluchtwege gedacht ist und sichere Evakuierung von Gebäuden gewährleisten soll. Dies ist die Beleuchtungsform, über die in diesem Artikel berichtet wird.

Im Vereinigten Königreich sind die ersten gesetzlichen Vorschriften in bezug auf Notbeleuchtung in den britischen "Cinematograph (Safety) Regulations" von 1955 enthalten. Darauf folgten der "Fire Protection Act" von 1971, in dem es hieß, daß "jederzeit Mittel zur Flucht vorgesehen sein müssen" und der ausführlichere "Health and Safety at Work Act" von 1974, der vorschreibt, wo Fluchtbeleuchtung vorgesehen werden muß.

Eine britische Norm (BS 5266) spezifiziert verschiedene Formen der Notbeleuchtung, und das Industrial Committee for Emergency Lighting (ICEL) setzt stenge Bau- und Leistungsnormen, die denen der EWG entsprechen.

Gemäß der Norm BS 5266 muß eine im Einsatz befindliche Fluchtbeleuchtungsanlage entlang eines Fluchtweges stets mindestens 0,2 lux liefern, und es werden Richtlinien hinsichtlich der Anordnung von Leuchten und Wegweisern erteilt. Diese Urkunde enthält auch einen Wartungs- und Prüfplan.

In den meisten Fällen empfiehlt es sich selbständige Notleuchten vorzusehen, da sich diese leichter einrichten, prüfen und warten lassen, als durch eine Zentralbatterie mit Strom versorgte Nebenleuchten. Auch erübrigt sich der Bedarf an einem getrennten Batterieraum und komplizierter Verdrahtung. Solche Leuchten und Wegweiser sind oft mit Miniatur-Leuchtstofflampe oder kryptongefüllten Fadenlampen ausgerüstet. Miniatur-Leuchtstofflampen sind besonders zu empfehlen, da bei ihnen die Lichtausbeute und die Lebensdauer länger sind.

BELEUCHTUNG DES KULTURPALASTES IN PRAG 13
Iain Maclean und John Clarke

THORN EMI Lighting legt erheblichen Wert auf Aufträge, bei denen Architekten und Berater eng mit Beleuchtungsingenieuren zusammenarbeiten und die Enfield-Laboratorien der Firma gelegentlich Umweltversuche ausführen müssen. Solche Versuche werden in der Regel getrennt in Rechnung gestellt, wenn immer sie nötig sind. Eines der größten Vorhaben dieser Art bildete die Entwicklung und Lieferung von Leuchten für Teile des großen Kulturpalastes in Prag.

Im Sommer 1978 wandte sich Exico, die Londoner Vertretung der tschechoslowakischen Ein- und Ausfuhrorganisation Transekta, an unsere Firma. Besprechungen wurden in London und Prag abgehalten, und es wurden Empfehlungen für die Behandlung von Decken in Bereichen wie dem Foyer, Foyerbars sowie Ausschuß- und Konferenzräumen erteilt.

Für die Hauptempfangshalle wurde eine besondere Decke mit keilförmigen Kassetten entwickelt, die ebenso wie die Beleuchtungsanlage auf einem massiven Strangpreßrahmen aus Aluminium ruhte. Es wurde weitgehender Gebrauch von dem "Programme Two"-Deckensystem und, in anderen Bereichen, von "Magnagrid", "Leaf-lite" und "Can-can"-Decken gemacht.

In normaler Größe ausgeführte "Attrappen" aller dieser Systeme wurden in Enfield errichtet und die Beleuchtungs- und Luftförderanlagen eingehend geprüft. Außerdem wurden die Geräte von dem tchechoslowakischen Normungsausschuß geprüft und zugelassen.

Die Installierungsarbeiten wurden an Ort und Stelle von den Technikern unserer Firma überwachen, und es wurden Wartungsvorrichtungen vorgesehen und ortsansässiger Techniker ausgebildet. Das Deckenvorhaben wurde im November 1980 fertiggestellt, rechtzeitig für die offizielle Eröffnung durch den Präsidenten Breschnew im Februar 1981.

ENERGIEBEWIRTSCHAFTUNG UND GEPLANTE INNENBELEUCHTUNG 17
R. Bell

Letztes Jahr beliefen sich die Beleuchtungskosten im Vereinigten Königreich auf mehr als £ 1 Milliarde. Durch gute Bewirtschaftung könnte dieser betrag um £ 300 Millionen reduziert werden. Obgleich nur ein kleiner Teil der Gesamtbelastung auf industrielle und häusliche Beleuchtung entfällt, ist ihr Anteil in kommerziellen Bereichen etwa 45%, was aber nur 5% der gesamten Betriebskosten entspricht (84% enfallen auf Löhne).

Weniger gute Beleuchtung bedingt zwar sehr geringe Kostensenkungen, reduziert aber auch die Leistungsfähigkeit. Ein besserer Weg besteht darin, eine durchaus effiziente Beleuchtungsanlage einzurichten.

Zu diesem Zweck müssen wir die Vor- und Nachteile wahlweiser Beleuchtungssysteme analysieren und Beleuchtungsziele festlegen. Diese lassen sich wie folgt zusammenfassen: (1) Die Benutzer müssen sicher arbeiten und sich sicher von Raum zu Raum bewegen können; (2) es muß möglich sein, Aufgaben schnell, genau und leicht auszuführen; (3) es müssen die gewünschten visuellen Bedingungen innerhalb des Gebäudes erzielt werden.

Der nächste Schritt besteht darin, Planungskriterien auszuarbeiten, obgleich diese nicht immer zahlenmäßig ausgedrückt werden können. Besonders wichtig ist es die gemäß dem IES Code empfohlene Arbeitsplatz-Beleuchtungsstärke festzustellen, anhand der Blendungsgrenzwerte im Code Blendeffekte auszuschalten und dafür zu sorgen, daß die Richtung und Farbe des Lichtes wahrnehmungsfreundlich sind und somit genaues, bequemes Sehen gestatten.

Es mag nötig sein, einen Ausgleich zwischen Tageslicht und künstlicher Beleuchtung zu schaffen. Die Anordnung großer verglaster Flächen, durch die Tageslicht einströmen kann, mag im Sommer zu Überwärmung und im Winter zu übermäßigem Wärmeverlust führen. Ein Verhältnis von 5-15/100 zwischen der verglasten und der Bodenfläche ist in der Regel ausreichend und bedeutet, daß weniger künstliche Zusatzbeleuchtung erforderlich ist, als wenn das Verhältnis geringer ist als 5/100.

Gleichmäßige hote Werte der Allgemeinbeleuchtung sind nach wie vor am Häufigsten. Bei diesem System können die Artbeitsstationen beliebig ausgelegt werden, doch wird unter Umständen Energie in Bereichen verschwendet, in denen keine Aufgaben ausgeführt werden, bei denen gute Sicht unerläßlich ist.

Werden die Leuchten an die einzelnen Arbeitsstationen angepaßt (örtliche Beleuchtung) so wird weniger Energie verbraucht. Durch Einsatz von "Aufwärtsstrahlern" mit Hochleistungs-Entladungslampen läßt sich erhebliche Flexibilität erzielen.

Örtliche Beleuchtung mit Hilfe von Tisch- oder Maschinenleuchten lenkt das Licht an die gewünschten Punkte, kann jedoch Blendung von Arbeitern an anderen Stationen zur Folge haben und muß durch schwache Allgemeinbeleuchtung ergänzt werden.

Die Lampen- bzw. Leuchtenwahl ist wichtig und kann zu ungewöhnlichen Lösungen führen, wie 3 dem Einsatz von SON Deluxe-Lampen in Büros und anderen kommerziellen Räumlichkeiten. Die neueren Leuchtstoffröhren erbringen gute Farbwiederabe ohne Einbuße des Wirkungsgrads.

In immer höherem Maße wird die Beleuchtungszeit durch individuelle Schalter, Schaltautomaten usw. eingeschränkt. Die Anordnung der Schalter ist wichtig, doch ist dies ein stark vernachlässigter Aspekt.

Kurz gesagt ist gute Energiebewirtschaftung mit guter Beleuchtungsplanung gleichbedeutend.

HALOGENLAMPEN FÜR STUDIO UND BÜHNE 24
K.R.Wolfe und K.B. Robinson

Für auf 3200 K eingestellte Film- bzw. Elektronikkameras sind Aufnahmelampen erforderlich, die bei Temperaturen im Bereiche des Schmelzpunkts von Wolfram arbeiten. Es ist daher große Sorgfalt geboten, um vorzeitige Ausfälle zu vermeiden. Der Halogenzyklus gestattet es von kleineren Lampen und entsprechend erhöhten Gasdrücken Gebrauch zu machen, ohne daß die innenflächen geschwärzt werden. Da die Lampen kleiner sind, müssen sie aus Quarzglas gefertigt werden, das den höheren Temperaturen standhält. Die durch das Abdichten der Einführungsdrähte bedingten Probleme wurden mit Hilfe einger einfachen Quetschdichtung gelöst, und es sind Lampen mit elliptischem Querschnitt vorgesehen, in denen ein Planarwendel Platz hat. Das Halogen wird oft in Gasform eingeführt, doch besteht auch die Möglichkeit zum Einsatz fester Materialien, die mit Hilfe eines flüssigen Mediums wie Hexan eingeführt werden. Da Bromphosphornitril vollkommen kaltes Auspumpen gestattet, ist die Verwendung spezieller Auspumpgeräte unnötig und die Kosten sind daher geringer.

Die Reihe wurde vor kurzem durch Zweifadenlampen und "Sealed-Beam"-Lampen vervollständigt, und der Trend zur Miniaturisierung hält an. Technische Vorstöße im Zusammenhang mit der Bauweise von Fernsehkameras und der Filmempfindlichkeit bedingen, daß weniger intensive Beleuchtung nötig ist. Von großen lampen wie der 20 kW wird daher nicht mehr Gebrauch gemacht. Die gleiche Tendenz zeigt sich auch bei der Konstruktion der Gehäuse, die immer kleiner werden.

En esta edición

ILUMINACIÓN DE LA BODA REAL 2
Bryan Wilkes
Jefe de iluminación de las transmissiones externas de la BBC

Para la Boda Real, la Catedral de San Pablo tuvo que ser iluminada a un nivel mínimo de 1.700 lux a fin de permitir el ajuste de las aberturas de cámaras en cerca de f4 -5,6. La iluminación fue organizada por la BBC compartiendo los gastos con ITV. La BBC usó doce posiciones de cámara y ITV nueve.

Se usaron lámparas Thron CID cerca de la puerta Occidental a fin de suministrar luz a una temperatura de color de 5500K. Dentro de la Catedral, se usaron lámparas CSI de 1kw en alojamientos Lee Electric trabajando a 4300K, y tabién lámparas de tungsteno/halógeno para correción cromática. A través de las ventanas del Coro se usaron filtros naranja/.6ND en armazones de filtro para corregir la luz del día.

La mayor parte de los proyectores se montaron en las galerías del triforium en la nave y el Coro, sin embargo algunos tuvieron que colorcarse en las "cuartas cúpulas" que sujetan la cúpula principal, lo que exigió alcances de hasta 200m. Fueron suplementados por bancos de lámparas de tungsteno/halógeno PAR 64 1kW con corrección cromática de acuerdo con las lámparas CSI. Se usaron lámparas similares para iluminar los mosaicos de las bóvedas del Coro.

El uso de lámparas CSI redujo la carga de iluminación de 1,6 mW a 690 kW y el peso del equipo fue un tercio de lo que podría haber sido. Las pequeñas y compactas lámparas se escondieron con facilidad y el calor irradiado se redujo considerablemente.

La energía se retiró de la red tres subestaciones, cada una con un suministro de 400 amp. por fase de una entrega con capacidad de 1500 amp. Se suministraron elementos de reserva pero no se hicieron necesarios. Toda la instalación se preparó en cinco noches y dos días. La instalación de los focos se tuvo que hacer de noche ya que la Catedral se encontraba abierta al público con servicios religiosos normales hasta dos días antes del evento. La boda tuvo lugar en un miércoles. Todo el equipo se había retirado para las 8.30 del viernes siguiente.

REQUISITOS Y TÉCNICOS PARA LA ILUMINACIÓN DE EMERGENCIA 9
Brian Jones

Existen dos formas de iluminación de emergencia; Iluminación "de reserva" e Iluminación "de escape". La primera se diseña a fin de suministrar suficiente luz, en caso de emergencia, para permitir la continuación o terminación de tareas esenciales. La segunda se diseña solamente para iluminar rutas de escape a fin de asegurar la evacuación de edificios. En este artículo vamos a tratar de esta última.

Las primeras leyes en el G.B. sobre iluminación de escape se encuentran en los "Reglamentos Cinematográficos (seguridad) de 1955 que fueron seguido por el "Decreto de Portección contra el Fuego de 1971" en el que se estipulaba que "se deben proporcionar siempre medios de escape a todo momento", y por el más específico "Decreto de Salud y Seguridad en el Trabajo de 1974", que especifica dónde se debe suministrar iluminación de escape.

Una Norma Británica (BS 5266) suminstra especificaciones para un número de tipos de sistemas de iluminación de emergencia y el Comité Industrial para Iluminación de Emergencia (ICEL) indica severas normas de contrucción y desempeño de acuerdo con las de la CEE.

BS 5266 establece la iluminación mínima en una ruta de escape en o,2 lux constantes durante el período de operación del sistema de iluminación de escape y suminstra orientación sobre la colocación de luminarias y letreros de dirección. Tabién suministra un programa de mantenimiento y prueba. Se recomienda equipo de iluminación de emergencia autosuficiente en la mayoría de los casos ya que es más fácil de instaler, probar y matener que las luminarias esclavas operadas por un acumulador central y evita la necesidad de tener una sala de acumuladores separada y un sistema complicado de cableado. Se usan tubos fluorescentes en miniatura o lámparas de filamento, relleno de Kripton en estos luminarias y letreros; estos últimos se recomiendan debido a su mayor rendimiento y vid útil más larga.

ILUMINACIÓN DEL PALACIO DE LA CULTURA, PRAGA 13
Iain Maclean y John Clarke

THORN EMI Lighting considera los negocios de proyectos como siendo de extrema importancia por los que arquitectos y consultores trabajan estrechamente con ingenieros de iluminación y para los que las pruebas ambientales en los laboratorios de Enfield son de vez en cuando necesarias. Estas pruebas pueden estan objectos de cobras en separado. Uno de los mayores proyectos de esta naturaleza fue el diseño y suministro de iluminación para partes del gran Palacio de Cultura en Praga.

La Compañía fue contactada por Exico, firma con base en Londres y asociada a la agencia checoslovaca de importaciones/exportacions Transakta, en el verano de 1978. Se celebraron reuniones en Londres y Praga y se hicieron sugerencias para el tratemiento del techo en áreas como el foyer, bares y salas de comités y conferencias.

Se diseño un techo especial de encofrados en forma de cuña sobre un armazón pesado de aluminio extruido, el cual también soportaba la iluminación, para el salón de entrada principal y se hizo uso extensivo del sistema de Techos Programme 2 y de techos "Magnagrid", "Leaf-lite" y "Can-can" en otras areas.

Se establecieron modelos a escala total de todos estos sistemas en Enfield y se llevaron a cabo pruebas extensas de los sistemas de iluminación y control de aire. Además el equipo fue probado y aprobado por el Instituto Checoslovaco de Normas.

La instalación fue supervisada en el emplazamiento por los ingenieros de la Compañía y se suministró de mantenimiento como también el entrenamiento de ingenieros locales. Los proyectos del techo se terminaron en noviembre de 1980 a tiempo para la inauguración oficial por el Presidente Brezhnev en febrero de 1981.

ADMINSTRACIÓN DE ENERGÍA Y DISEÑO DE ILUMINACIÓN INTERIOR 17
R. Bell

El coste de la iluminación del RU fue superior a los 1000 milliones de libras el año pasado. Una buena adminstración prodría reducir esto en 300 milliones de libras. A pesar de que la iluminación idustrial y doméstica forma una pequeña parte de la carga total, en edificios comerciales esto es del orden de un 45%, siendo esto solamente 5% de los costes operacionales totales mientras que los salarios son responsibales por 84%.

La reducción de las normas de iluminación ahorra un pequeño porcentaje del coste y reduce la eficiencia. Una mejor alternativa es instalar un sistema de iluminación totalmente eficiente.

Para hacer esto es esencial analizar los méritos de sistemas alternativos de iluminación y establecer objectivos para lo mismo. Estos puden describirse de la siguiente manera (1) permitir que los ocupantes se muevan y trabajen con seguridad; (2) permitir que las tareas se efectúen rápida, exacta y fácilmente y (3) obtener las condiciones visuales deseada dentro del edificio. La etapa siguiente es determinar los criterios del diseño, a pesar de que no todos pueden cuantificarse. Los factores principales a ser considerados determinarán las tareas de iluminación recomendadas de Código IES, el control del deslumbramiento, haciendo uso de los índices de deslumbramiento del código, y asegurarse que la dirección y el color de la luz ayuda a la percepción y permite así una visión exacta y fácil.

Se debe obtener un equilibrio entre la luz natural y la artificial. El suministro de grandes áreas envidriadas para admitir la luz natural podrá resultar en un sobrecalentamiento en el verano y grandes pérdidas de calor en el invierno. Una relación de 5-15% vidrio a área de suelo será normalmente satisfactoria y reducirá la necesidad de iluminación artificial suplementaria, que sería necesaria si la relación fuese interior a 5%.

Les esquemas de iluminación general son todavía los más comunes. Este sistema permite completa flexibilidad en la localización de tareas pero podrá desperdiciar energía en áreas en las qu no se llevan a cabo tareas visuales críticas.

La relación entre el padrón de luminarias y las áreas de trabajo (iluminación localizada) consume menos energía. Si se usan "uplighters" con lámparas de descarga luminosa de alta eficiencia se podrá obtener gran flexibilidad. La iluminación local por medio de guarniciones montadas en pupitres o máquinas suministrará iluminación para tareas donde fuere necesaria pero podrá traer como resultado el deslumbramiento de los obreros en otras posiciones y tendrá que ser suplementado por iluminación general de bajo nível. La alternativa de lámpara y luminaria es importante y podrá llevar a disposiciones poco usuales como el uso de lámparas SON deluxe en oficinas y edificios comerciales. Los nuevos tipos de tubos fluorescentes suministran buena definición de color sin pérdida de eficiencia.

Está aumentando el control de las horas por conmutación individual, conmutación automática y otras. La posición de los interruptores es importante pero con frecuencia se deja de lado.

En pocas palabras, la buena adminstración de la iluminación es sinónima de un buen diseño de iluminación.

LÁMPARAS DE TUNGSTENO-HALÓGENO PARA ESTUDIOS Y TEATROS 24
K.R. Wolfe y K.B. Robinson

Debido al hecho de que las lámparas para estudios tienen que funcionar a temperaturas cerca del punto de fusión del volframio a fin de seren compatibles con film o cámeras electrónicas ajustadas a 3200K, se ha de tener mucho cuidado para evitar los fallos prematuros.

El ciclo halógeno volframio permite el uso de envolturas más pequeñas con el consiguiente aumento de la presión del gas son energecer las superficies internas, y el tamaño reducido de la bombilla hace necesario el uso de silicio de cuarzo fundido a fin de soportar las altas temperaturas. Los problemas de hermetización de los cables de entrada se han resuelto a través del uso de una simple junta constrictora y bombillas de forma elíptica a fin de suministrar espacio para un filamento planar. El halógeno se introduce a menudo en su fase gaseosa, pero existen métodos alternativos que incluyen el uso do materiales en forma sólida introducida por un vehículo sólido como la hexana. El uso de bromo fosfonitrilo, que permite una exhaustación completamente fría, dispensa la utilización del equipo de exhaustación reduciendo de esta forma los costes.

Las lámparas de filamento doble y los reflectores haz-sellados son adiciones recientes a la gama. Contínua la tendencia hacia la miniaturización. Los adelantes técnicos en el diseño de cámaras de TV y velocidades de films están reduciendo los níveles necesarios de iluminación. Como consecuencia se han descontinuado lámparas grandes como las del tipo de 20kW. Esta tendencia ha afectuado también el diseño de los proyectores que se tornan cada ves más pequeños.

Nel questa edizione

L'ILLUMINAZIONE PER LE NOZZE REALI 2
Brian Wilkes
Capo della sezione luci per le riprese in esterni della BBC

Per le nozze reali, la Cattedrale di San Paolo doveva essere illuminata a un livello di almeno 1.700 lux per consentire aperture di obiettivo delle telecamere di circa f4 -5,6. L'illuminazione è stata predispota dalla BBC e il costo è stato diviso con la ITV. Dodici postazioni di telecamere sono state usate dalla BBC e nove dalla ITV.

Sono state usate lampade CID THORN vicino alla porta sul lato ovest per fornire luce di una temperatura di colore di 5500K. All'interno della Cattedrale sono state impiegate lampade CSI da 1 kW in apparecchi Lee Electric fun-zionanti a 4300K e lampade alogene al tungsteno con colore corretto. Per correggere la luce diurna piovente dalle finestre del Coro sono stati usati filtri .6ND/
arancione in appositi supporti.

Quasi tutti i proiettori erano montati sulle gallerie del triforio nella navata e nel coro, ma alcuni dovettero essere posizionati nei "quarti di cupola" che sorreggono la cupola maggiore e pertanto sono state necessarie delle "campate" di luce fino 200 m. Questi proiettori sono stati integrati con batterie di lampade alogene al tungsteno PAR 64 da 1 kW con color corretto per adattarle alle lampade CSI. Per illuminare i mosaici nelle volte del coro sono state adottate lampade simili.

L'impiego delle lampade CSI ha ridotto il carico luce da 1600 kW calcolati a 690 kW, e il peso dell'apparecchiatura a un terzo di quello che sarebbe stato necessario. Le lampade, piccole e compatte, sono state nascoste facilmente e il calore radiante è stato molto ridotto.

L'energia è stata prelevata dalla rete principale da tre sottostazioni, ciascuna delle quali forniva 400 amp per fase da un'alimentazione di capacità 1500 amp. Sono state fornite anche alimentazioni di riserva che però non sono risultate necessarie. L'installazione completa ha richiesto cinque notti e due giorni di lavoro; la regolazione dei proiettori è stata fatta durante la notte perché durante il giorno la Cattedrale era aperta al pubblico e fino a due giorni prima della cerimonia nuziale vi si sono svolti i servizi religiosi. La cerimonia ha avuto luogo il mercoledì; alle ore 8,30 del venerdì successivo tutte le apparecchiature erano già state rimosse.

TECNICHE E REQUISITI DELL'ILLUMINAZIONE DI EMERGENZA 9
Brian Jones

Vi sono due forme di illuminazione di emergenza: l'illuninazione di emergenza vera e propria e l'illuminazione di 'uscite di sicurezza'. Il primo tipo è progettato per fornire luce sufficiente per svolgere o completare compiti essenziali in caso di emergenza; il secondo e studiato soltanto per illuminare percorsi di sicurezza onde assicurare l'evacuazione di un edificio. Nel presente articolo verrà trattato quest'ultimo tipo.

Le prime norme di legge relative all'illuminazione di uscite di sicurezza erano contenute nelle "Norme di sicurezza per cinematografi" del 1955 (Cinematograph (safety) Regulations of 1955) a cui ha fatto seguito la "Legge di tutela contro gli incendi" del 1971 (Fire Protection Act of 1971), nella quale si stabiliva che "devono essere forniti mezzi di sicurezza in qualsiasi momento". Questa legge è stata seguita a sua volta dalla più specifica Legge sulla "salute e sicurezza sul lavoro" del 1974 (Health and Safety Act of 1974) nella quale viene stabilito dove devono essere installate le luci di sicurezza.

Una norma delle British Standard (BS 5266) fornisce le specifiche circa alcuni sistemi di illuminazione d'emergenza e l'ICEL (Comitato Industriale per l'Illuminazione di sicurezza) formula severe norme di costruzione e prestazioni allineate con quelle della CEE.

La norma BS 5266 prescrive che l'illuminamento minimo lungo un percorso di sicurezza deve essere 0,2 lux in qualsiasi momento durante il periodo di funzionamento del sistema di illuminazione ed offre delle indicazioni circa la posizione delle apparecchiature di illuminazione e della segnaletica, oltre a un programma di manutenzione e prove.

Nella maggior parte dei casi si consigliano apparecchiature di illuminazione di emergenza autonome, perché sono più facili da installare, provare e mantenere che non le apparecchiature dipendenti da una batteria centrale e si evita la necessità di una sala batterie separata e di complicati sistemi di cablaggio. In queste apparecchiature, come pure nella segnaletica, vengono usati tubi fluorescenti miniatura oppure lampade a filamento riempite di Kripton i tubi fluorescenti sono raccomandati perché hanno una maggiore emissione di luce e durano più a lungo.

ILLUMINAZIONE DEL PALAZZO DELLA CULTURA, PRAGA 13
Iain Maclean e John Clark

La Thorn Lighting dà una notevole importanza ai capitolati che richiedono una stretta collaborazione tra architetti, consulenti e tecnici del'illumazine e che a volte richiedono delle prove ambientali nei laboratori di Enfield. Queste prove vengono di solito addebitate separatamente. Uno dei maggiori progetti di questo genere è stato lo studio e fornitura dell'illuminazione per alcune parti del grande Palazzo della Cultura a Praga.

Nell'estate del 1978, la società è stata contattata da Exico, la società associata con sede a Londra dell'agenzia cecoslovacca di importazione/esportazione Transekta. Durante gli incontri svoltisi a Londra e a Praga, sono stati dati suggerimenti per il trattamento dei soffitti in aree quali foyer, bar, sale di riunione e di conferenze.

Per il salone d'ingresso principale è stato progettato un soffitto speciale a cassettoni cuneiformi sostenuti da una pesante intelaiatura di alluminio estruso che supportava anche le apparecchiature di illuminazione. Sono stati anche ampiamente utilizzati il sistema di soffitto 'Programma due', e i soffitti 'Magnagrid', 'Leaf-lite' e 'Can-can' in altre aree.

Modelli a grandezza naturale di questi sistemi sono stati costruiti a Enfield e sono state eseguite prove esaurienti dei sistemi di illuminazione e condizionamento dell'aria. Le apparecchiature sono anche state sottoposte a prove ed accettate da parte dell'Istituto cecoslovacco per la Normativa.

L'installazione è stata effettuata sotto la supervisione dei tecnici della Societa che ha fornito le apparecchiature di manutenzione e l'addrestramento dei tecnici locali. I progetti dei soffitti sono stati completati nel novembre 1980, in tempo utile per l'inaugurazione da parte del Presidente Brezhnev nel febbraio 1982.

GESTIONE DELL'ENERGIA E DESIGN PER L'ILLUMINAZIONE DI INTERNI 17
R. Bell

Il costo dell'energia ellettrica in Gran Bretagna è ammontato o scorso anno a più di 1000 milioni di sterline. Una buona gestione potrebbe ridurlo di 300 milioni di sterline. Benché l'illuminazione industriale e domestica rappresenti una piccola parte del carico totale, negli immobili commerciali è nell'ordine del 45%, ma questa percentuale è solo il 5% dei costi operativi totali, essendo l'84% speso in retribuzioni.

La riduzione dell'illuminazione fa rispamiare solo una piccola percentuale delle spese e riduce l'efficeinza lavorativa; l'alternativa miglior è l'installazione di sistemi di illuminazione particolarmente efficienti.

Per poterlo fare, è essenziale analizzare i meriti dei sistemi alternativi e di determinare gli obiettivi che si vogliono raggiungere. Questi possono essere descritti come segue: (1) Consentire algi occupanti di lavorare e di muoversi in tutta sicurezza; (2) Consentire di svolgere i compiti in modo rapido, preciso e facile e (3) ottenere le condizioni visive desiderate all'interno dell'edificio.

Lo stadio successivo sarà di stabilire i criteri del progetto, anche se non tutti possono essere quantificati. I fattori principali da prendere in considerazione sono: stabilire la luminanza raccomandata dal Codice IES per un determinato lavoro, controllare l'abbagliamento, fare uso degli indici di limitazione dell'abbagliamento riportati nel codice ed assicurarsi che la direzione ed il colore della luce aiutino la percezione e consentano di vedere con precisione e facilità.

Forse sarà necessario raggiungere l'equilibrio tra la luce del giorno e la luce artificiale. Le grandi vetrate che lascino passare la luce del giorno possono provocare surriscaldamento in estate e troppa perdita di calore in inverno. Un rapporto del 5-15% di vetrate per area di pavimento è di solito soddisfacente e riduce la necessità di luce artificiale supplementare, che invece potrebbe essere necessaria se il rapporto fosse inferiore al 5%.

Gli schemi di illuminazione generale sono ancora i più comuni. Questo sistema offre una flessibilità completa per la posizione di lavoro, ma può sprecare energia nelle aree dove non vengono svolti lavori visivi critici.

Mettando in relazione la configurazione delle sorgenti di luce con la zona di lavoro (illuminazion localizzata), si consuma meno energia. Se si usano apparecchi con lampade a scarica ad alta efficienze si otterrà una maggiore flessibilità.

L'illuminazione locale con lampade montate su tavoli o macchine fornisce l'illuminazione nel punto in cui occorre, ma può provocare abbagliamento per altri operatori in altri posti e deve essere integrata da illuminazione generale a basso livello.

La scelta della lampade e dell'apparecchio d'illuminazione è importante e può portare a combinazioni poco comuni quale l'uso di lampade SON Deluxe in uffici ed edifici commerciali. I tipi più nuovi di tubi fluorescenti danno una buona resa cromatica senza perdita di efficienza.

Il controllo delle ore di utilizzazione mediante interruttori individuali, interruttori automatici ed altri mezzi è in continuo aumento. Anche la posizione degli interruttori è un fattore importante, ma purtroppo ancora trascurato.

In poche parole, una buona gestione dell'energia è sinonimo di buon progetto di illuminazione.

LAMPADE AL TUNGSTENO-ALOGENO PER STUDI TELEVISIVI E TEATRI 24
K.R. Wolfe e K.B. Robinson

Poichè le lampade negli studi devono funzionare a temperature vicine al punto di fusione del tungsteno per essere compatibili con cinecamere o camere elettroniche regolate per 3200K, occorre avere molta cura per impedire che si esauriscano prematuramente. Il ciclo tungsteno-alogeno permette di usare involucri più piccoli con conseguente maggiore pressine del gas senza annerimento delle superfici interne; inoltre la misura ridotta del bulbo richiede l'uso di quarzo fuso per sopportare le temperature più alte. I problemi di tenuta nel punto di entrata degli elettrodi nel bulbo sono stati risolti mediante una semplice schiacciatura del quarzo e sono stati usati bulbi con sizione trasversale ellittica per offrire spazio per un filamento planare. L'alogeno viene spesso introdotto nella forma gassosa, ma altri metodi comprendono l'uso di materiali in forma solida introdotti da un veicolo liquido quale l'esano. L'impiego del bromofosfonitrile, che permette uno svuotamento del bulbo a freddo, rende superfluo l'uso di speciali macchinari, riducendo di conseguenza i costi.

Le lampade a doppio filamento e le lampade con riflettore incorporato sono state aggiunte di recente alla gamma e la tendenza verso la miniaturizzazione continua. I progressi tecnici nella progettazione delle telecamere e la sensibilità delle pellicole riducono i livelli di luce necessari e di conseguenza è cessata la produzione di lampade grandi come il tipo da 20 kW. Questa tendenza ha anche influenzato il design dei proiettori che continuano a diventare più piccoli.

i detta nummer

BELYSNING AV DET KUNGLIGA BRÖLLOPET 2
Bryan Wilkes
Belysnigschef, BBC Utomhusupptagning

St. Paul's Cathedral måste belysas till en nivå på minst 1,700 lux vid det kungliga bröllopet, för att tillåta kamerapländarinställning på omkring f4-5,6. Belysningen organiserades av BBC och ITV som delade på kostnaderna. Tolv kamerapositioner användes av BBC och nio av ITV.

Thorn CID-lampor användes nära den västra dörren för att ge ljus med en färgtemperatur på 5500 K. Inne i katedralen användes 1 kW CSI-lampor i "Lee Electric"-hus med arbetstemperaturer på 4300 K och färgkorrigerade volframhalogenlampor. .6ND/ orangefärgade filter i filterramar användes för att korrigera dagsljuset genom fönstren i koret.

De flesta av strålkastarna monterades på triforiegallerierna i långskeppet och koret, men några måste monteras i 'kvartskupolerna' som bar upp huvudkupolen, vilket krävde 'kast' på upp till 200 m. Dessa utökades med grupper av PAR 64 1 kW volframhalogenlampor, färgkorrigerade för att passa ihop med CSI-lamporna. Liknande lampor användes för att belysa mosaikerna på korvalven.

Användning av CSI-lampor reducerade belysningsbelastningen från det beräknade 1,6 mW till 690 kW, och utrustningens vikt minskades till en tredjedel. De små, kompakta lamporna doldes lätt, och strålvärmen reducerades i hög grad.

Elförsörjningen skedde från tre omformarstationer, som var och en matade 400 ampere per fas från en spänningskälla med en kapacitet på 1500 ampere. Reservkällor anskaffades men behövdes inte. Hela systemet installerades på fem nätter och två dagar. Inställning av strålkastarna måste göras på natten, efersom katedralen var öppen för allmänheten, och normala förrättningar hölls fram til två dagar före händelsen. Bröllopet ägde rum på en onsdag, och all utrustning var utburen kl. 8.30 följande fredag.

RESERVBELYSNINGS BESTÄMMELSER OCH -TEKNIK 9
Brian Jones

Det finns två typer av reservbelysning, 'extra belysning' och 'nödbelysning'. Den första är till för att ge tillräckligt med ljus vid kritiska tillfällen, så att väsentliga arbeten kan fortsätta eller fullföjas. Den andra typen är till för att belysa nödutgångar för att tillförsäkra snabb evakuering av en byggnad. Det är denna typ artikeln skall behandla.

Den första lagstiftningen vad gäller nödbelysning innefattades i Biograf säkerhets föreskrifterna år 1955. Dessa uppföljdes med Brandskyddslagen år 1971, i vilken stipulerades att "nödutgångar alltid måste tillhandahållas", och den uttryckligare lagen om Hälsa och Säkerhet på Arbetsplatsen år 1974 specificerar var nödbelysning skall placeras.

En brittisk standardspecifikation (BS 5266) ger specifikationer för ett antal typer nödbelysningssystem och det Industriella Utskottet för Nödbelysning (ICEL) fastställer stränga norma för konstrucktion och prestanda i enlighet med EEC-bestämmelserna.

BS 5266 stipulerar att den minimala belysningsnivån i en reservutgång alltid skall vara 0,2 lux under den period nödbelysningssystemet är i funktion och ger anvisningar för placering av lampor och skyltar samt underhålls- och provningsanvisningar.

Nödbelysningsutrustning som utgör en sluten enhet rekommenderas för det mesta, eftersom den är enklare att installera, prova och under-hålla än sekundär belysning som drivs från ett centralbatteri, som kräver ett seperat ackumulatorrum och ett komplicerat installationssystem. Miniatyrlysrör eller kryptonfyllda glödlampor används i sådana belysningar och skyltar, de förstnämnda rekommenderas på grund av högre verkningsgrad och langre livslängd.

BELYSNING AV KULTURPALATSET, PRAG 13
Iain Maclean och John Clarke

Thorn Lighting lägger stor vikt vid specifikationsarbeten, där arkitekter och konsulter samarbetar med belysningsingen-jörer, och praktiska prov med modeller är nödvändiga i Enfield-laboratorierna. Sådana undersökningar debiteras vanligtvis separat allteftersom de utförs. Ett av de större projekten av detta slag var konstruktionen och leveransen av belyning för delar av Kulturpalatset i Prag.

Företaget kontaktades av Exico, ett London-baserat företag associerat med den tjeckoslovakiska import/ export-agenturen Transekta, på sommaren 1978. Möten hölls i London och Prag, och förslag framlades om innertakskonstruktioner i foajé, barer, styrelse- och konferensrum.

Ett specialinnertak av kilformade kassetter uppburna på en kraftig sprutad aluminiumram, som även bar upp belysningsutrustningen, konstruerades för den stora hallen, medan innertaksystem av typ "Magnagrid", "Leaf-lite" och "Can-can" användes i övriga utrymmen.

Modeller i naturlig skala av alla dessa system uppställdes i Enfield, och utprovades båda vadarsen belysnings- och lufthanteringssystem. Dessutom provades och godkändes utrustningen av den tjeckoslovakiska Standardiseringskommissionen.

Installationen övervakades på platsen av företagets ingenjörer, och underhållsutrustning ställdes till förfogande liksom utbildning av lokala ingenjörer. Takprojecktet fullbordades i november 1980, i god tid före den officiella invigningen av president Brezhnev i februari 1981.

ENERGIPLANERING OCH KONSTRUKTION AV INOMHUSBELYSNING 17
R. Bell

Belysningskostnadrna i Storbritannien överskred 1000 miljoner engelska pund förra året. God planering och förutseende företagsledning skulle kunna reducera dessa med 300 miljoner. Industri- och hushållsbelysningen är en mindre del av den totala hostnaden. För kommersiella byggnader är andelen omkring 45%. Men ädnå utgör energin bara 5% av ett Foretags totalhostmader medam 84% är toner.

Reducering av belysningsstandarden insparar en mycket liten del av kostnaderna och reducerar effektiviteten. Ett bättre alternativ är at installer ett effektivare belysningssystem.

För att kunna göra detta är det väsentligt att analysera värdet av alternativa belysningssystem och bestämma belysningskraven. Dessa kan beskrivas som (1) att göra det möjligt för personerna i byggnaden att arbeta och röra sig fritt i full sakerhet, (2) att kunna utföra arbetsuppgifterna snabbt, noggrant och lätt och (3) att uppfylla de önskvärda synförhållandena inne i byggnaden.

Nästa steg är att bestämma konstruktionsnormer, även om all dessa inte kan kvantifieras. De huvudsakliga faktorerna i detta sammanhang är att bestämma rekommenderad arbetsbelysning enligt i IES-koden, kontrollera bländningen, samt att tillförsäkra att ljusets riktning och färg förbättrar iakttagelseförmågan och sålunda bidrar till rätt synförmåga.

En balans mellan dagsljus och konstgjord belysning bör eftersträvas. Stora fönsterytor som släpper in dagsljuset kan resultera i över-hettning under sommaren och för hög värmeförlust under vintern. Förhållandet 5-15% fönsteryta till golvytan är vanligtvis tillfreds-ställande och reducerar omfatlingen är belysning.

Allmänna belysning är fortfarande de hvanligaste. Detta system tilläter fullständig flexibilitet när det gäller arbetslokalisering, men kan vara energislösande på platser med arbetsmoment som kräver lite ljus.

Mindre energi konsumeras då belysningsen står i relation till arbetsytan (platsanpassad belysning). Hög flexibilitet kan ändå om allmänljus med effektiva urladdnings-lampor dessutom utnyttjas.

Plats-belysning med armaturer monterade på skrivbord eller maskiner ger god arbetsbelysning där sårdan erfordras, men kan blända arbetare vid andra stationer.

Val av lampa och belysning är viktiga och kan leda till okonventionella arrangemang, såsom användning av SON deluxe-lampor på kontor och i affärslokaler. De nya lysrörstyperna ger god färgåtergivning och nög effektivitet.

Kontroll av brinn-timmar genom individuella brytare, automatiska ljusreglering och andra hjälpmedel ökar. Rätt placering av strrибrytare är viktig men förbises ofta.

God energiplanering är alltså liktydig med god belysningplanerung.

VOLFRAMHALOGENLAMPOR FÖR STUDIO OCH TEATER 24
K.R. Wolfe och K.B. Robinson

Stor försiktighet måste vidtas för att undvika för tidiga avbrott, eftersom studiolampor måste fungera vid temperaturer nära volframets smältpunkt för att passa till film- eller elektroniska kameror inställda på 3200 K. Volframhalogencykeln tillåter användning av mindre rörkolvar med ökat gastryck utan svärtning av de inre ytorna. Den reducerade lampstorleken kräver användning av smält kvartsglas för att motstå de högre temperaturerna. Problem med att täta anslutningarna har lösts genom att använda en enkel klämtätning. Elliptiska tvärsnittslampor används för att ge utrymme för en planarglödtråd. Halogenen tillföres ofta vid gasfyllningen men alternativa metoder förekommer, såsom användning av material i fast form som införes med hjälp av en vätskebarare, t.ex. hexan. Användning av bromfosfonitril, som tillåter en helt kall evakuering, gör användning av särskild evakueringsutrustning obödig och reducerar sålunda kostnaderna.

Lampor med två glödtrådar och tätstrållampor är nya tillskott i serien och trenden mot miniatyrisering fortsätter. Tekniska framsteg inom TV-kamerakonstrucktion och filmkänslighet reducerar nödvändiga belysningsnivåer, och följaktligen har stora lampor såsom 20 kW-typen försvunnit från marknaden. Denna trend har även påverkat konstruktionen av armaturhusen som blir indre och mindre.

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