

Appendix F: Meeting the lighting standards

General lighting in office, industrial and storage buildings

By selection of lamp and luminaire types

F1 The performance standard for the electric lighting system in these building types depends on the efficiencies of both the lamp/ballast combination and the luminaire. The recommendation in paragraph 1.43 is met if:

- a) the installed lighting capacity in circuit Watts comprises lighting fittings incorporating lamps of the type shown in Table F1, and
- b) all the luminaires have a light output ratio of at least 0.6.

F2 A maximum of 500W of installed lighting in the building is exempt from the above requirement (paragraph 1.46).

F5 The lighting controls therefore meet the requirements of paragraph 1.56 (for the office and storage areas) and paragraph 1.58 (for the production and circulation areas).

F6 Table F2 below shows a schedule of the light sources proposed, together with a calculation of the overall average luminaire efficacy. It incorporates the luminaire control factor, which allows for the reduced energy use due to lighting in daylit and rarely occupied spaces. The storage areas are occasionally visited and incorporate absence detection, so have a luminaire control factor of 0.8.

F7 The daylit office areas with local manual switching also have a luminaire control factor of 0.8. Note that if the office areas had tinted glazing, of transmittance 0.33, the equivalent area of glazing of transmittance 0.7 would need to be calculated. This is $30\% \times 0.33/0.7 = 14\%$ of the window wall area. As this area is less than 20% of the window wall, the office areas would not count as daylit if this type of glazing were used.

Table F1 Types of high efficacy lamps for non-daylit areas of offices, industrial and storage buildings

Light source	Types
High pressure sodium	All ratings above 70W
Metal halide	All ratings above 70W
Tubular fluorescent	All 26mm diameter (T8) lamps and 16mm diameter (T5) lamps rated above 11W, provided with low-loss or high frequency control gear.
Compact fluorescent	All ratings above 26W

F3 Otherwise, if the use of other types of lighting or less efficient luminaires is planned, a calculation of the average initial luminaire efficacy is required (paragraph 1.44).

Example calculation of average luminaire efficacy

F4 A small industrial unit is being constructed incorporating production, storage and office areas. Lighting in the production area (which is non-daylit) is to be controlled by staged time switching to coincide with shift patterns. The storage area is anticipated to be occasionally visited, and is to be controlled by local absence detection, where a sensor switches the lighting off if no one is present, but switching on is done manually. The office areas are daylit; the furthest luminaire is less than 6m from the window wall, which is 30% glazed with clear low emissivity double glazing. Lighting control in this area is by localised infra red switch. Lighting control in the non-daylit corridor, toilet and foyer areas is by full occupancy sensing with automatic on and off.

Table F2

Position	Number	Description	Circuit	Lamp lumen output Ø (lm) per fitting	Luminaire light output ratio LOR	Luminaire control factor C _L	Total corrected luminaire output =Nx Ø x LOR/C _L (lm)	Total circuit Watts (W)
Production	16	250W high bay metal halide	271	17000	0.8	1	217600	4336
Offices	12	4 x 18W fluorescent with aluminium Cat 2 louvres and high frequency control gear	73	4600	0.57	0.8	39330	876
Storage	16	58W fluorescent with aluminium louvres and mains frequency control gear	70	4600	0.6	0.8	55200	1120
Circulation, toilets and foyer	30	24W compact fluorescent mains frequency downlights	32	1800	0.4	1	21600	960
						Totals	333730	7292

F8 From Table F2, the total corrected lumen output of all the lamps in the installation is 333,730 lumens.

F9 The total circuit Watts of the installation is 7292 Watts. Therefore the average luminaire efficacy is $333,730/7292 = 45.8$ lumens/Watt. As this is greater than 40 lumens/Watt, the proposed lighting scheme therefore meets the requirements of this Approved Document. Note that up to 500W of any form of lighting, including lamps in luminaires for which light output ratios are unavailable, could also be installed in the building according to paragraph 1.46.

General lighting in other building types

Lighting calculation procedure to show average circuit efficacy is not less than 50 lumens/watt

F10 A lighting scheme is proposed for a new public house comprising a mixture of concealed perimeter lighting using high frequency fluorescent fittings and supplementary tungsten lamps in the dining area. Lights in the dining and lounge areas are to be switched locally from behind the bar. Lighting to kitchens and toilets is to be switched locally.

F11 Table F3 shows a schedule of the light sources proposed together with the calculation of the overall average circuit efficacy.

Table F3						
Position	Number	Description	Circuit Watts (W) per lamp	Lumen output (lm) per lamp	Total circuit Watts (W)	Total Lamp lumen output (lm)
Over tables	20	60W tungsten	60	710	1200	14,200
Concealed perimeter and bar lighting	24	32W T8 fluorescent high frequency ballast	36	3300	864	79,200
Toilets and circulation	6	18W compact fluorescent mains frequency ballast	23	1200	138	7,200
Kitchens	6	50W, T8 fluorescent high frequency ballast	56	5200	336	31,200
				Totals	2538	131,800

F12 From Table F3, the total lumen output of the lamps in the installation is 131,800 lumens.

F13 The total circuit Watts of the installation is 2538 Watts.

F14 Therefore, the average circuit efficacy is:

$$\frac{131800}{2538} = 51.9 \text{ lumens/Watt}$$

F15 The proposed lighting scheme therefore meets the requirements of this Approved Document.

F16 If 100W tungsten lamps were used in the dining area instead of the 60W lamps actually proposed, the average circuit efficacy would drop to 43.4 lumens/W, which is unsatisfactory. If, however, 11W compact fluorescent lamps, which have similar light output to 60W tungsten lamps, were used in the dining area the average circuit efficacy would be 83.2 lumens/W.

Lighting calculation procedure to show that 95% of installed circuit power is comprised of lamps listed in table 8 (paragraph 1.48)

F17 A new hall and changing rooms are to be added to an existing community centre. The proposed lighting scheme incorporates lamps that are listed in Table 8 except for some low voltage tungsten halogen downlighters which are to be installed in the entrance area with local controls. A check therefore has to be made to show that the low voltage tungsten halogen lamps comprise less than 5% of the overall installed capacity of the lighting installation.

Main hall

F18 Twenty wall mounted uplighters with 250W high pressure Sodium lamps are to provide general lighting needs. The uplighters are to be mounted 7m above the floor. On plan, the furthest light is 20.5m from its switch, which is less than three times the height of the light above the floor.

F19 It is also proposed to provide twenty 18W compact fluorescent lights as an additional system enabling instant background lighting whenever needed.

Changing rooms, corridors and entrance

F20 Ten 58W, high frequency fluorescent light fittings are to be provided in the changing rooms and controlled by occupancy detectors. Six more 58W fluorescent light fittings are to be located in the corridors and the entrance areas and switched locally. Additionally, in the entrance area there are to be the six 50W tungsten halogen downlighters noted above.

Calculation

F21 A schedule of light fittings is prepared as follows:

Position	Number	Description of light source	Circuit Watts per lamp	Total circuit Watts (W)
Main hall	20	250W SON	286W	5720
Main hall	20	18W compact fluorescent	23W	460
Entrance, changing rooms and corridors	16	58W HF fluorescent	64W	1024
Entrance	6	50W low voltage tungsten halogen	55W	330
Total =				7534W

F22 The percentage of circuit Watts consumed by lamps not listed in Table 8 is

$$\frac{330 \times 100}{7534} = 4.4 \%$$

F23 Therefore, more than 95% of the installed lighting capacity, in circuit Watts, is from light sources listed in Table 8. The switching arrangements comply with paragraph 1.58. The proposed lighting scheme therefore meets the requirements of the Regulations.