



Department
for Education

Further Education Output Specification

**Technical Annex 2E: Daylight and Electric
Lighting**

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Summary

Technical Annex 2E provides the minimum requirements for daylighting and electric lighting requirements. It is to be read in conjunction with the Generic Design Brief (GDB) and the College-specific Brief (CSB).

Review Date

Review dates for this document shall be at 6-month intervals.

Who is this publication for?

This document is for technical professionals involved in the design and construction of college premises, as part of the Employer's Requirements of the DfE Construction Frameworks (the DfE Construction Framework 2021 and the Offsite Schools Framework (incorporating Modular and MMC delivery) (MMC)). It may also be used as the basis of similar documentation for other procurement routes using the Further Education Output Specification.

Uniclass Codes

This document captures Uniclass codes for the management of exchange of information. To access all codes and associated titles reference should be made to [Uniclass 2015 | NBS \(thenbs.com\)](https://www.thenbs.com)

1. Introduction

1.1. Overview

1.1.1 This document is one of the Further Education Output Specification (FE-OS) Technical Annexes that forms part of the Generic Design Brief (GDB). [PM_10_20]

1.1.2 The definitions listed in the GDB shall apply to this Technical Annex and all other parts of the FE-OS. [PM_10_20]

1.1.3 This document shall be read in conjunction with the GDB and all other Technical Annexes as well as the College-specific Brief (CSB), including the College-specific Annexes. [PM_10_20]

1.1.4 This document sets out the required technical standards and performance criteria for daylight and electric lighting. [PM_10_20]

1.1.5 The information exchange required at each stage of the design, build and completion process is detailed in the DfE's Exchange Information Requirements (EIR). [PM_10_20_28]

1.1.6 The requirements in this Technical Annex shall apply to all parts of the works; New or Refurbished. [PM_10_20]

2. General Requirements

2.1. Area Definitions

2.1.1 The type and definition of spaces in College Buildings have been categorised and described in Technical Annexes 1A and 1B. These are used in the tables and text in this document. [PM_10_20_90]

2.2. Refurbishment

2.2.1 Work required to Refurbished Buildings shall be as defined in the Refurbishment Scope of Works (RSoW), under the headings of architectural elements (including FF&E), M&E elements and systems (including ICT Infrastructure). [Ac_10_70_70]

2.2.2 The work shall be categorised as Renewed, Replaced, Repaired, Retained or have 'No Work':

- a) Renewed electrical lighting element or system shall be designed to satisfy the relevant outputs of the GDB and this Technical Annex (and by the code in the ADS where relevant). [Ac_10_70_70]
- b) Replaced electrical lighting element or system shall satisfy the relevant outputs of the GDB and this Technical Annex (and by the code in the ADS where relevant), as far as possible within the constraints of the location, the adjacent elements and the sub-structure. [Ac_10_70_70]
- c) Repaired electrical lighting element or system shall comply to the specifications in any project-specific drawing issued as part of the CSB. The overall performance after repair shall be at least as good as that of the existing provision. [Ac_10_70_70]
- d) Retained electrical lighting element or system shall be left as existing, with minimal work required unless needed in order to complete other Works that form part of the Project, and the overall performance shall be no worse than the existing performance. [Ac_10_70_70]
- e) Elements requiring 'No Work' shall be left as existing. [Ac_10_70_70]

2.2.3 In respect of Refurbished Works, the required level of compliance with this Technical Annex is set out in the RSoW. [PM_10_20]

2.2.4 The requirements in this Technical Annex refer to all parts of the Works except any Building Elements or services that are designated Repaired, Retained or "No Work" in the RSoW, or spaces designated "Untouched" in Annex CS1. [PM_10_20_82]

2.2.5 In Refurbished Buildings, the requirements for daylight in this Technical Annex shall apply to any windows identified in the RSoW to be Renewed (typically as part of a renewed external facade). [Ac_10_70_70]

2.2.6 All refurbishment works shall be assessed to identify where retrospective legislation may apply and works shall be carried out to comply. [Ac_10_70_70]

2.2.7 Where the window layout is unchanged, daylight modelling is not required but any glare problems shall be addressed e.g., by provision of blinds. [PM_35_70_20]

2.2.8 If glazing is being Replaced in a Refurbished Building, the specification shall be met as far as possible, within the constraints of the location and opening, unless otherwise agreed by the Employer. Typically, the Contractor shall be required to supply glazing to an equivalent area (m²) as existing but with an upgraded specification. [PM_10_20_82]

3. Daylighting

3.1. Daylight Performance Criteria

3.1.1 The performance criteria for daylight, based on the types of space are defined in Annex 1A and 1B by the lighting ADS code. [PM_35_70_20]

3.1.2 Daylighting calculations are further defined in Section 8. [PM_35_70_20]

3.1.3 Percentages of spaces are defined by room quantities not area. For example, 80% of spaces for which ADS code L1 applies refers to 80% of the quantity of these spaces. [PM_35_70_20]

3.1.4 It is recognised that the primary performance criteria may not be able to be met in every space. [PM_35_70_20]

3.1.5 Where the primary performance criteria are not met, spaces are expected to be as close to full compliance as is feasible and daylight access is required in Basic Teaching Areas (excluding drama studios), large spaces, catering and sports spaces, libraries and permanently occupied administration offices. See Table 1. [PM_35_70_20]

3.1.6 Daylight access shall be demonstrated through spaces receiving daylight directly or indirectly that enhances the visual environment. [PM_35_70_20]

3.1.7 For Basic Teaching Areas (except drama studios), it should be as near the sDA and UDI levels quoted as possible. [PM_35_70_20]

3.1.8 For large spaces, catering and sport areas, LRCs, study spaces and circulation areas, a lower level of daylight is acceptable. See Table 1. [PM_35_70_20]

3.1.9 Daylight Autonomy (DA) is the percentage of time that a point in a space can expect to achieve or exceed an illuminance threshold (typically 300 lux) from daylight alone. [PM_35_70_20]

3.1.10 Spatial Daylight Autonomy sDA (300/50%) defines the percentage of the task plane which receives at least 300 lux, for at least 50% of the annual occupied hours i.e., the percentage of the task plane which can achieve a DA of 50%. [PM_35_70_20]

3.1.11 Useful Daylight Illuminance UDI-a (100~3000 lux) is the annual occurrence of illuminance, at a point in a space, within the range 100~3000 lux, measured across the task plane, during occupied hours. [PM_35_70_20]

3.1.12 Large spaces, except Lecture theatres, Drama studios and Media studios, shall be daylit. [PM_35_70_20]

3.1.13 The final UDI result is taken as an average of the results across the task plane. [PM_35_70_20]

| Types of space (as identified in Annex 1A and 1B) | ADS Code | Spaces requiring primary performance criteria | Primary performance criteria Spatial Daylight Autonomy (sDA (300/50%)) | Primary performance criteria Useful Daylight Illuminance (UDI- a (100~3000lux)) | Requirements for spaces that do not meet primary performance criteria |
|---|----------|---|---|--|--|
| Basic Teaching spaces ¹ (excluding Catering training kitchens, Teaching restaurants, Hair and beauty training salons, workshops); independent life skills rooms; science prep rooms; administration offices; staff rooms | L1 | 80% of spaces | sDA (300/50%) shall be 50% | UDI-a (100~3000lux) shall be 80% | Daylight access required to achieve levels as near to those for compliant spaces as possible and visual connection to adjoining daylit spaces to provide visual comfort. |
| Hair and beauty training salons; Catering training kitchens, Teaching restaurants; Large spaces, excluding Drama and Media studios (including Auditoriums and Indoor sports spaces): Dining and social areas; LRCs | L2 | 65% of spaces | No requirement | UDI-a (100~3000lux) shall be 80% | Daylight access ² unless there are specialist activities requiring no daylight: see CSB. |

| Types of space (as identified in Annex 1A and 1B) | ADS Code | Spaces requiring primary performance criteria | Primary performance criteria Spatial Daylight Autonomy (sDA (300/50%)) | Primary performance criteria Useful Daylight Illuminance (UDI- a (100~3000lux)) | Requirements for spaces that do not meet primary performance criteria |
|--|----------|---|---|--|---|
| Engineering workshops; Construction workshops; Faith spaces ² ; SEN and support spaces; Arts learning resources and study areas; staff areas | L3 | 50% of spaces | No requirement | UDI-a (100~3000lux) shall be 80% | None |
| Vehicle workshops ³ , Circulation areas; DT preparation room; kitchen preparation areas; changing rooms | L4 | Stairwells, and wherever possible elsewhere | Daylight access required | Daylight access required | None |
| Storage (excluding preparation); toilets and hygiene rooms; other kitchen areas; plant areas; kiln room | L5 | 100% of spaces | No requirement | No requirement | N/A |
| Drama studios, Media studios, Lecture theatres, dark room, control room, sensory room | L6 | 100% of spaces | Daylight to be excluded or blinds provided | Daylight to be excluded or blinds provided | N/A |

Notes:

1. Note some specialised labs may require no daylight see CSB
2. Daylight and windows to be coordinated with the interior design
3. Daylight to be coordinated with specialised lighting for painting and body repairs: see CSB for defined requirements.

Table 1 Daylight Performance Criteria by Area Type

3.2. Shading Devices

3.2.1 Passive shading devices

3.2.1.1 As part of the overall façade design strategy the contractor shall consider the use of passive internal and external shading devices such as extended eaves, overhangs verandas, brise soleil to overcome both solar gain and solar glare. These methods should be investigated first, and the remaining glare and overheating dealt with via blinds. [Pr_30_59_07]

3.2.2 Blinds

3.2.2.1 Blinds or other means of solar glare and daylight control shall be provided to all exterior glazing (including rooflights) in Basic Teaching Areas, learning resource areas and staff areas (L1, L2 & L3), except within 15 degrees of absolute North where the Contractor proves the visual environment is adequate without blinds. [Pr_30_59_07]

3.2.2.2 The type of blind(s) or shading employed shall be dependent on factors such as window orientation, daylight performance and visual environment requirements of each space. [Pr_30_59_07]

3.2.2.3 The blinds shall not adversely affect the ventilation of the space. See Technical Annex 2F for the operability of the openable windows or glazed doors. [Pr_30_59_07]

3.2.2.4 Vertical blinds shall not be used in teaching areas as they can be easily damaged. [Pr_30_59_07]

3.2.2.5 Where roller blinds are used, the material shall be a screen (dim-out) type with a total visible light transmittance of 5-7%. The exception to this requirement is given in paragraph 3.2.2.7. [Pr_30_59_07]

3.2.2.6 In rooms where the blinds are for solar glare control i.e., not north facing classrooms, the openness of the weave of the material shall not be greater than 3%. [Pr_30_59_07]

3.2.2.7 Blinds can have a higher overall transmission and a higher openness or can be excluded, if the Contractor can demonstrate that the visual environment shall be adequate. The primary method of demonstration is by showing that the glazing orientation is within 15 degrees of absolute North and all visual display equipment in the space can achieve a contrast ratio of at least 3000:1. Alternatively, the Contractor may provide a disability glare analysis to justify the choice of blinds with a higher transmission or the exclusion of blinds on a particular facade. [Pr_30_59_07]

3.2.2.8 Blinds shall be provided in all science spaces, and these shall provide glare reduction whilst maintaining daylight and ensuring adequate ventilation at all times. One in three science spaces shall also need to provide blackout for specific physics and biology experiments. In these cases, it is acceptable for the required summertime ventilation to be temporarily obstructed during the experiments. A low level of lighting is needed for safety during these experiments which can be provided by desk lights. [Pr_30_59_07]

3.2.2.9 Sports halls require solar glare control. Where rooflights are employed, the use of a diffusing material, such as frosted/fritted/prismatic glass or plastics is an acceptable alternative to blinds so long as the Contractor coordinates the rooflight layout with the layout of the sports courts (e.g., they are located between badminton courts) and provides a disability glare analysis to show that the rooflights are positioned to avoid solar glare. [Pr_30_59_07]

3.2.2.10 In large spaces, particular vocational curriculum spaces and drama studios blackout blinds or curtains may be required for audio visual purposes as confirmed within the CSB. Low level background lighting is required for safety purposes. [Pr_30_59_07]

3.2.2.11 Requirements for blinds and curtains are also included in Technical Annex 2D Section 4 and Technical Annex 3 Section 5. [Pr_30_59_07]

4. Electric Lighting

4.1. Interior Lighting

4.1.1 An interior lighting system shall be provided in accordance with BS EN 12464 Part 1 and CIBSE/SLL LG5. The performance criteria are covered by [BS EN 12464 Part 1](#). Education spaces are defined in table 5.36. These criteria shall be taken as the baseline, with additional criteria from the other BS [EN 12464 criteria](#) tables or from the CSB for specialised spaces. [PM_35_70_46]

4.1.2 Where Unified Glare Rating Limit (UGRL) calculations are not possible, compliance shall be demonstrated through luminaire intensity being limited to 3000 cd/m² above 65 degrees from a downward vertical for general office spaces. In IT /computer teaching spaces where specialised computer software is utilised then the luminaire intensity shall be limited to 1500 cd/m² above 65 degrees from a downward vertical. A review of specialised IT/computer tasks shall be undertaken as part of the CSB for any software/IT equipment that requires tighter glare control such as 1000 cd/m² or specialised screen shading. Further information is contained with CIBSE LG05 Clause 5.10.1. [PM_35_70_46]

4.1.3 In Basic Teaching spaces walls shall have 30% of horizontal task illuminance or $E_{h \min} > 50 \text{ lx}$. [PM_35_70_46]

4.1.4 In Basic Teaching spaces: ceilings shall have 30% of horizontal task illuminance or $E_{h \min} > 50 \text{ lx}$. [PM_35_70_46]

4.2. Exterior Lighting

4.2.1 Site Lighting and Sports Lighting

4.2.1.1 The external lighting design criteria shall be based upon the lighting criteria within BS EN 12464 pt 2, BS EN 12193 and CIBSE/SLL lighting guides LG5 and LG4. [PM_35_70_46]

4.2.1.2 All external lighting shall be controlled from a lighting control system (for example the internal lighting control system). [PM_35_70_46]

4.2.1.3 Colour rendering and colour temperature shall be in accordance with Section 6. [PM_35_70_46]

4.2.1.4 The contractor and the College should agree appropriate night set-back levels to reduce energy usage and obtrusive lighting. The use of a central time signal from the BMS shall be utilised by the lighting control system to ensure a consistent time basis. [PM_35_70_46]

4.2.1.5 Sports lighting shall be designed to Class II lighting as defined by BS EN 12193. [PM_10_20_90]

4.2.1.6 If required in the College-specific Brief, underground ducts to MUGAs shall be provided to enable future provision of lighting by the College at a later date. [PM_10_20_82]

4.2.1.7 The sports lighting shall be identified within the CSB to establish that there are no exceptions to the general clauses above. [PM_10_20_90]

4.2.1.8 Appropriate external lighting systems for safe pedestrian and user access shall be provided. [PM_35_70_46]

4.2.1.9 Security lighting to temporary and permanent buildings shall be provided if required in the CSB following the Access and Security Strategy and the Risk Assessment as detailed in the CSB. All as defined within the GBD Section 2.14 Safety and Security. [PM_10_20_90]

4.2.1.10 Where electrical charger points are provided the design should be coordinated to provide 50lux locally to the charger. [PM_35_70_46]

4.2.1.11 For car parking where there is deemed to be a high level of vehicle movement the design shall consider the higher level of 20lux. [PM_35_70_46]

4.3. Obtrusive Light

4.3.1 Light spill shall be controlled to a level appropriate to the surrounding environment. This is demonstrated through compliance with ILP guide GN01 - Guidance Notes for the Reduction of Obtrusive Light. The foundation of this method is to agree an environmental zone with the local planning authority. [PM_35_70_46]

4.3.2 The zoning definitions and performance criteria are covered in ILP guide GN01 - Guidance Notes for the Reduction of Obtrusive Light. [PM_35_70_46]

4.4. Reference Standards

4.4.1 Ensure that the design and installation of electric lighting takes account of the relevant parts of the following standards (or updated documents if relevant). Where criteria are conflicting, precedence shall be given to the most recent publication. [PM_10_20_90]

- a) SLL Lighting Guide 5: Lighting for Education. [FI_70]
- b) BS EN 12464-1: Light and lighting. Lighting of workplaces. Indoor workplaces. [FI_70_85]
- c) BS EN 12464-2: Light and lighting. Lighting of workplaces. Outdoor workplaces. [FI_70_85]
- d) ILP GN01 Guidance. [FI_70]

e) ILP GN08 Bats and artificial lighting. [FI_70]

f) SLL Fact file 07 Design and assessment of exterior lighting schemes. [FI_70]

4.5. Interior Luminaires and Lamps

4.5.1 Lighting equipment for interior environments shall be provided in accordance with the criteria given in Table 10. [Ss_70_80_33]

4.5.2 Lamp technologies shall only be utilised on refurbishment projects where lighting is not due to be replaced totally and the scheme has to align with existing luminaires. [Ss_70_80_33]

| Criteria | LED | Non-LED For refurbishment only |
|--|--|---|
| Colour | CCT: 3500-4000K CRI: >=80 MCAD: 3 | CCT: 3500-4000K CRI: >=80 MCAD: 4 |
| Efficacy | In accordance with AD L | |
| Design Life | All spaces ⁽¹⁾ L80, B50 @ >= 50,000 hours, 25C ambient | Rated life: 12-20,000 hours min (dependant on lamp with electronic HF ballast) Lamp survival factor: 80% Lamp lumen maintenance factor: 80% |
| Diffusers and prismatic controllers | All plastic optics shall be TP(a) fire rated | All plastic optics shall be TP(a) fire rated |
| Driver/ HF Ballast | Power Factor: 0.9 min Flicker factor: < 15% Dimming range: 1-100% of measured output | Power Factor: 0.9 min Frequency: 16,000Hz min Dimming range: 1-100% |

| Criteria | LED | Non-LED For refurbishment only |
|---------------------------|---|---|
| IP | General Areas: IP2X WCs, science areas: IP44 Plants Space: IP65 | General Areas: IP2X WCs, science areas: IP44 Plants Space: IP65 |
| Luminaire Warranty Period | 5 years ⁽¹⁾ | 5 years ⁽²⁾ |

Table 2 Light Source Criteria for Interior Environments

1 For luminaires using LED sources the warranty shall include all LEDs, componentry, optics and body.

2 For luminaires to include all major componentry.

4.5.3 All luminaires shall be capable of having their componentry upgraded/replaced. The Contractor shall indicate with his submission how replacement or upgrade of componentry is to be achieved. The use of standardised form factors and componentry is recommended. [PM_10_20_82]

4.5.4 Indicate the maintainability of luminaires specified and the degree to which components can be replaced by skilled or unskilled labour. [PM_10_20_82]

4.6. Exterior Luminaires and Lamps

4.6.1 Ensure that the design and installation of lighting equipment takes account of the relevant parts of the following standards (or updated documents if relevant). Where criteria are conflicting, precedence shall be given to the most recent publication. [PM_10_20_90]

- a) BS EN 60598 Luminaires (and all relevant subsections). [FI_70_85]
- b) IEC 62717 LED-modules for general lighting - Performance requirements. [FI_70_85]
- c) IEC 62722-2-1 Particular requirements for LED luminaires. [FI_70_85]

4.7. Lighting Equipment

4.7.1 Lighting equipment for exterior environments shall be provided in accordance with the criteria given in Table 11. [Ss_70_80_25]

| Criteria | LED |
|-----------------|--|
| Colour | CCT: 3000-4000K CRI: 60 MCAD: 5 |
| Efficacy | In accordance with AD L |
| Design Life | Rated life: 100,000 hours L80, B10 @ >= 100,000 hours, 15C ambient |
| Driver | Power Factor: 0.9 Flicker factor: < 15% Dimming range: 10-100% of measured output |
| IP | Exterior Areas: IP65 |
| Warranty Period | 5 years ⁽¹⁾ |

Table 3 Light Source Criteria for Exterior Environments

¹ LED sources the warranty to include all LEDs, componentry, optics and body.

4.8. Reference Standards

4.8.1 Ensure that the design and installation of lighting equipment takes account of the relevant parts of the following standards (or updated documents if relevant). Where criteria are conflicting, precedence shall be given to the most recent publication. [PM_10_20_90]

- a) BS EN 60598 Luminaires (and all relevant subsections). [FI_70_85]
- b) IEC 62717 LED-modules for general lighting - Performance requirements. [FI_70_85]
- c) IEC 62722-2-1 Particular requirements for LED luminaires. [FI_70_85]

4.8.2 Ensure that the design and installation of electric lighting takes account of the relevant parts of the following standards (or updated documents if relevant). Where criteria are conflicting, precedence shall be given to the most recent publication. [PM_10_20_90]

- a) SLL Lighting Guide 5: Lighting for Education. [FI_70]
- b) BS EN 12464-1: Light and lighting. Lighting of workplaces. Indoor workplaces. [FI_70_85]
- c) BS EN 12464-2: Light and lighting. Lighting of workplaces. Outdoor workplaces. [FI_70_85]
- d) ILP GN01 Guidance. [FI_70]
- e) SLL Fact file 07 Design and assessment of exterior lighting schemes. [FI_70]

5. Emergency Lighting

5.1. Performance Criteria

5.1.1 Emergency lighting systems shall meet the requirements of BS5266 Pt 1 and the project specific requirements outlined in the Emergency Lighting Risk Assessment and the reference standards outlined at the end of this section. [PM_70_95_70]

5.1.2 The College is required to undertake an emergency lighting risk assessment with the support of the relevant members of the design team to inform the emergency lighting designer of the project specific requirements of the emergency lighting. The emergency lighting designer shall act as the coordinator of the emergency lighting information from all other parties. [PM_70_95_70]

5.2. Equipment

5.2.1 All emergency luminaires shall comply with the BS EN 60598-2-22 and safety signs to BS 5499-4. [PM_10_20_90]

5.2.2 Emergency battery packs shall be internal or external to luminaires. [Ss_70_80_33]

5.2.3 All exit signs shall be internally illuminated and of maintained design and shall comply with BS 5499-4. [PM_10_20_90]

5.2.4 Photoluminescent safety signs shall not be used. [PM_10_20]

5.2.5 Adhesive legends mounted on luminaires are not acceptable for exit signs. [PM_10_20]

5.2.6 Conversions of general luminaires to emergency lighting must not be undertaken and only catalogue quoted emergency luminaires from the general luminaire manufacturer shall be installed. [PM_10_20]

5.2.7 All safety signs other than internally illuminated exit signs shall be illuminated to 100 lux on the vertical plane during normal conditions and 5 lux on the vertical plane in emergency lighting scenarios as in BS 5499-4. [PM_10_20_90]

5.2.8 The contractor shall undertake exit sign viewing distance calculations and include documentation on the calculations and position of all signs in the O&M manuals. [PM_10_20_82]

5.2.9 Distributed or central battery systems must be used rather than self-contained luminaires when the number of emergency luminaires and signs exceeds 100 units. [Ss_70_80_33]

5.2.10 All emergency lighting systems shall not utilise Ni-Cd batteries. NI-mH can be used. [Ss_70_80_33]

5.2.11 All centralised systems shall utilise low maintenance batteries such as sealed Lead Acid VRLA batteries with a guaranteed lifetime of 10 years. [Ss_70_80_33]

5.2.12 All centralised systems shall utilise batteries with a guaranteed life of 10 years and shall be contained within ventilated cabinets that ensure the correct ambient temperature for the batteries under both normal and charge conditions. [Ss_70_80_33]

5.2.13 Central or distributed batteries shall be located in environments with a maximum ambient temperature of 20°C, where possible. [Ss_70_80_33]

5.2.14 All centralised systems shall be accommodated within a dedicated emergency lighting switch room with appropriate fire compartmentation. Distributed low energy battery systems of less than 500w can be installed within fire rated cupboards or enclosures. [Ss_70_80_33]

5.2.15 All battery rooms shall be provided with adequate ventilation to prevent the build-up of hydrogen and other gases. [PM_35_70_94]

5.2.16 Battery duration shall be at least 3 hours. [Ss_70_80_33]

5.2.17 The Contractor shall identify whether he is providing an emergency lighting automatic testing and monitoring system. All emergency lighting systems over 50 emergency luminaires and signs shall be provided with an automatic testing system. [PM_10_20_82]

5.2.18 Details shall be provided of the College's responsibilities for testing the emergency lighting system aligned with the emergency lighting risk assessment, Fire Regulation Reform Order 2005, BS5266 pt1 and BS EN 50172. The details shall be included in the O&M Manuals. [PM_10_20_90]

5.2.19 The emergency lighting, testing and monitoring system shall consist of one of the following options.

a) A proprietary luminaire self-test system based upon individual luminaires. [Pr_70_70_47_02]

b) A centralised dedicated proprietary emergency lighting test and monitoring system to BS EN 62034. [Pr_70_70_47_02]

- c) Emergency lighting test and monitoring control algorithms as part of a centralised lighting control system to BS EN 62034. [Pr_70_70_47_02]

5.2.20 All systems shall comply with the testing and monitoring requirements of BS 5266 for self-contained or centralised power supply systems and provide auditable test results in both hard and soft copy formats to BS EN 62034. [PM_35_30_20]

5.3. Reference Standards

5.3.1 Ensure that the design and installation of emergency lighting takes account of the relevant parts of the following standards (or updated BS EN 62034 documents if relevant). Where criteria are conflicting, precedence shall be given to the most recent publication. [PM_10_20_90]

- a) SLL Lighting Guide 12: Emergency Lighting. [FI_70]
- b) BS 5266 Emergency lighting (all relevant parts). [FI_70_85]
- c) BS EN 1838:2013 Emergency lighting. [FI_70_85]
- d) BS 5499-4 Safety Signs. [FI_70_85]
- e) BS EN 50171 Central supply systems. [FI_70_85]
- f) BS EN 50172 Emergency Escape Lighting Systems. [FI_70_85]
- g) BS EN 50172-2 Battery Requirements. [FI_70_85]
- h) BS EN 60598-2-22 Luminaire Particulars - Emergency Lighting. [FI_70_85]
- i) BS EN 62034 Automatic test systems for battery powered emergency escape lighting. [FI_70_85]

6. Lighting Controls

6.1. System Functionality

6.1.1 Automatic lighting controls shall be provided to all spaces in order to facilitate control of the visual environment and energy savings. [Pr_70_70_47]

6.1.2 The contractor shall engage a lighting control specialist to support and develop the lighting control system in line with the specific needs of the college. [PM_10_20_82]

6.1.3 The contractor shall liaise with the College about the lighting control system that they are offering. This should include a presentation/demonstration of the extent and functionality of the lighting control system. The college's operational requirements must be considered in the design of the system and specific requirements incorporated. Regular liaison meetings shall be held. [PM_10_20_82]

6.1.4 Control devices shall be simple and intuitive with clear and robust labelling of the lighting switches showing the function of each input. [Pr_70_70_47]

6.1.5 All spaces shall have an adequate number of sensors to enable the geometrical coverage of the working plane of each space. The number of sensors should also follow the control philosophy enabling control regimes to optimise energy to be implemented i.e., row by row control from windows. [Pr_70_70_47]

6.1.6 All sensors shall have a computer programmable delay between 10-60mins. DIP switches on the sensors shall not be used. [Pr_75_50_76]

6.1.7 Building spaces shall be categorised and controlled based on the definitions in Table 12. See Technical Annex 1A and 1B for detailed definitions of types of spaces. [PM_10_20_90]

6.1.8 Constant illuminance sensors in the form of combined motion and illuminance sensors shall be provided for all spaces. The constant illuminance sensors shall be set to the maintained illuminance levels contained within the lighting criteria standards mentioned within the reference standards referred to in this Annex. [Pr_75_50_76]

6.1.9 The control system shall monitor the exact number of hours that each luminaire has been energised and at what % output. System alarms and reports shall be produced when the luminaires get within 1000 hrs of their rated life for the LEDs. [PM_10_20_82]

6.1.10 In temporarily and permanently owned spaces of up to 35m² (L0.1), automatic controls shall deactivate, but not activate the lighting system. The lighting system shall include motion sensors to switch the lighting in response to space vacancy. Manual controls shall override the automatic controls for a period of 40 minutes. [Ss_70_80_33]

6.1.11 In temporarily and permanently owned spaces of over 35m² (L0.2), automatic controls shall deactivate, but not activate the lighting system. The lighting system shall include motion and constant illuminance sensors to switch and dim the lighting in response to space vacancy, daylight and initial over-lighting (resulting from maintenance factors used in calculations). Manual controls shall override the automatic controls for a period of 40 minutes. [Ss_70_80_33]

6.1.12 In daylit corridors, stairs and lobbies which are classified as unowned transient spaces (L0.3), automatic controls shall activate and deactivate the lighting system. The lighting system shall include motion and illuminance sensors to switch the lighting in response to space vacancy and daylight level. Manual local controls shall be provided to override automatic controls. [Ss_70_80_33]

6.1.13 In unowned transient spaces (L0.4) including corridors, stairs and lobbies which are not daylit, toilets, hygiene rooms and changing rooms, automatic controls shall activate and deactivate the lighting system. The lighting system shall include motion sensors to switch the lighting in response to space vacancy. Spaces should have a 30min delay in switching from absence detected. Manual local controls shall be provided to override automatic controls. [Ss_70_80_33]

| Types of Space | Description | CIBSE category reference | Control method | ADS code |
|--|---|--------------------------|---|----------|
| Administration offices; staff areas; SEN and support spaces; arts learning resources; preparation rooms | Temporary or permanently owned rooms for individuals and small groups | Owned spaces | Manual on, absence off | L0.1 |
| Basic Teaching spaces (including: Art Rooms, ICT-rich Classrooms and Science labs ¹ ; Hair and beauty training salons ² ; workshops ³); staff rooms; independent life skills rooms | Temporary or permanently owned rooms for larger groups | Owned spaces | Manual on, absence off, daylight/constant illuminance dimmed (only in a daylit space) | L0.2 |

| Types of Space | Description | CIBSE category reference | Control method | ADS code |
|---|--|--------------------------------------|---|-----------------|
| Daylit circulation areas (including corridors, stairs and lobbies) | Transient spaces | Un-owned spaces | Presence on, absence off, Constant illuminance (only in a daylit space) | L0.3 |
| Toilets and hygiene rooms; changing rooms; non-daylit circulation areas | Transient spaces | Un-owned spaces | Presence on, absence off | L0.4 |
| Storage (excluding preparation); dark rooms; control rooms; sensory rooms; kiln rooms; kitchen preparation areas; other kitchen areas; plant area | Infrequently used areas or temporarily owned spaces | Un-owned or temporarily owned spaces | Manual on, automatic off | L0.5 |
| Indoor sports spaces; Dining and social areas; Libraries and study areas ⁴ ; Faith spaces | Spaces where individuals do not expect to control the lighting | Managed spaces | Manual control to be provided in a restricted access space such as a cupboard; presence on, daylight dimming (only in a daylit space) and absence off | L0.6 |
| Performance spaces (Drama studios; Media studios (film or TV); Auditoriums and Lecture theatres) | Temporary or permanently owned rooms for larger groups | Owned spaces | Lighting control system to be limited to house lighting systems with interface to Theatrical lighting system (i.e., to take control of house lighting. House lighting to have Manual on, absence off, daylight/constant | L0.7 |

| Types of Space | Description | CIBSE category reference | Control method | ADS code |
|--|-------------|--------------------------|--|----------|
| | | | illuminance dimmed from local wall plates. | |
| <p>Notes:</p> <ol style="list-style-type: none"> 1. specialised task lighting local control 2. As (1) plus local switching and dimming for task lighting for each work position 3. Specialised local control of task lighting to provide for machine lighting 4. Local sensor control within bookshelves areas in LRCs | | | | |

Table 4 Lighting Control Categories

Note 1. Spaces for SEND students require particular care. 'Absence off' should not be used where there are non-ambulant students or where required in the CSB.

6.1.14 In storerooms that are occasionally visited, dark rooms, control rooms and sensory rooms for SEND students, (L0.5), the automatic controls shall ensure that:

- a) automatic controls activate and deactivate the lighting system [Pr_70_70_47]
- b) the lighting system includes motion sensors to switch lighting in response to space vacancy after a minimum period of 30 minutes [Ss_70_80_33]
- c) manual controls override the automatic controls for a period of 30 minutes. [Pr_70_70_47]

6.1.15 In managed spaces (L0.6) the lighting system shall be fully controllable by a member of staff, but controls shall not be accessible to students. Automatic controls shall deactivate, but not activate the lighting system. The lighting system shall include motion and constant illuminance sensors to switch and dim the lighting in response to space vacancy, daylight and initial over lighting (resulting from maintenance factors used in calculations). Manual controls shall override the automatic controls for a period of 40 minutes. Where exams take place, it should be possible to override the automatic control for a longer period. [Ss_70_80_33]

6.1.16 In Basic Teaching spaces, manual control shall override automatic control and facilitate group switching. [Ss_70_80_33]

6.1.17 Each luminaire row shall be independently controllable via manual inputs and the automatic system. A sensor device shall cover approximately 30m². A 55m² or 62m² classroom shall include at least 2 sensor devices located within 3.9m from the main window wall. Where a sensor controls multiple rows, dimming shall be algorithmic in order to factor the rows distances from the window. [Ss_70_80_33]

6.1.18 Luminaire switching shall be designed to prevent glare to any A/V installation.
[Ss_70_80_33]

6.2. Reference Standards

6.2.1 Ensure that the design and installation of lighting controls takes account of the relevant parts of the following standards (or updated documents if relevant). Where criteria are conflicting, precedence shall be given to the most recent publication. [PM_10_20_90]

- a) SLL/CIBSE - LG14 Controls for Electric Lighting. [FI_70_85]
- b) IEC 62386 Pts 101-209 Digital Addressable Lighting Interface (DALI). [FI_70_85]
- c) IEC 60929 Technical Annex E 0-10v. [FI_70_85]
- d) CIBSE Commissioning Code L: Lighting. [FI_70_85]

7. Specific Requirements

7.1. Lighting in Colleges with SEND provision

7.1.1 Ensure that the lighting design in Special Colleges, Designated Units and Specially Resourced Provision meets the requirements of the College-specific Brief, which takes account of students' individual needs, such as:

- a) students with a hearing impairment needing higher light levels/clear visibility for lip-reading and signing [PM_35_50_01]
- b) students with a visual impairment needing higher light levels to facilitate wayfinding and minimise the risk of accidents [PM_35_50_01]
- c) students being very sensitive to glare from direct or reflected sunlight [PM_35_50_01]
- d) automatic sensors that switch off lighting when no movement is detected not being suitable for children with limited mobility. [PM_35_50_01]

7.1.2 Luminaires shall be low glare, avoiding any flicker and unwanted noise. [PM_35_50_01]

7.1.3 Light sources shall not give off any disabling glare over changing beds or therapy couches. [PM_35_50_01]

7.1.4 Ensure that the guidance on design of lighting for SEND in CIBSE LG05 Sections 3.8 and 5.17 is followed, and that advice from a lighting specialist is taken for spaces for students with hearing impairments, visual impairments and complex visual needs. In particular, modelling index and visual contrast shall be increased to suit their needs. [PM_10_20_90]

7.1.5 The lighting strategy and luminaires chosen shall be agreed with the College. [PM_35_70_46]

7.2. Reference Standards

7.2.1 Ensure that the design and installation of electric lighting takes account of the relevant parts of the following standard: CIBSE LG05 (or updated document if relevant). [PM_35_70_46]

7.2.2 Where criteria are conflicting, precedence shall be given to the most recent publication. [PM_35_70_46]

7.2.3 The Royal National Institute for the Blind (RNIB) or similar organisation can advise on specialist environments for children with visual or multiple impairments. [PM_10_20_82]

7.3. Specialist Lighting (performance)

7.3.1 The clauses below identify the methodology and minimum requirements regarding theatre lighting. [PM_10_20_90]

7.3.2 The Contractor shall employ a specialist to provide elements of the lighting (such as theatre lights), the Contractor shall:

- a) provide infrastructure as required by the specialist [PM_10_20_82]
- b) provide general lighting to the entire space in accordance with the Technical Annex 2E [PM_10_20_90]
- c) ensure the Contractors' design is fully co-ordinated with specialist lighting equipment. [PM_10_20_82]

7.3.3 Provide a stage lighting system in any performance space or drama studio. [Ss_70_80_33_88]

7.3.4 Unless otherwise stated in the CSB, these stage lighting systems shall use Digital Multiplex (DMX 512 Standard) controlled LED lights appropriate for the purpose. [Ss_70_80_33_88]

- a) For a college performance space:
 - i) Three internally wired lighting bars with power and control outlets to support at least 36 DMX controlled LED lights [Ss_70_80_33_88]
 - ii) Twenty-four (24) DMX controlled LED lights. [Ss_70_80_33_88]
- b) For a drama studio:
 - i) Four internally wired lighting bars with power and control outlets to support at least 3 DMX controlled LED lights on each. Bars shall be capable of being positioned in a T, + or double X shape [Ss_70_80_33_88]
 - ii) 12 DMX controlled LED lights. [Ss_70_80_33_88]

7.3.5 All stage lighting systems shall be capable of being connected to a mobile lighting control system that can be used by students and teachers for educational purposes. [PM_10_20_82]

7.3.6 The position of the lighting bars and the selection of the lights should be carried out in such a way as to provide the College with the ability to cast light from a range of physical positions, change colours without need for working at height and use differing types of luminaires for creative effect, for example wash lights, profile lights and special effect lights. [PM_10_20_82]

7.3.7 The lighting and audio control room shall have a control to enable the house lights to be dimmed or turned on/off at the start and end of a performance. [PM_10_20_82]

8. Demonstrating Compliance

8.1. Overview

8.1.1 The Contractor shall demonstrate compliance with the Employer's Requirements by use of protocols detailed in the Contractor's Quality Assurance procedures capturing evidence of both coordinated design and its implementation into the construction of the College Building(s) with photographic evidence and/or third-party accreditation. [PM_70_15]

8.2. Calculation Specifications

8.2.1 Daylighting calculations shall be in accordance with the following Tables. [PM_40_30_20]

8.2.2 Minimum surface reflectance's are provided in Technical Annex 2D. [PM_10_20_90]

| Criteria | Description | Notes |
|--------------------------|---|----------|
| Calculation Method | Radiosity, raytracing | (1), (2) |
| Daylight Analysis Method | Climate based daylight modelling | (2) |
| Weather file | EPW climate-based file, nearest to College Site | (2), (3) |
| Occupied hours | Typically, 08:00- 22:00 | (2) |
| Maximum Time Increments | <15 minutes | (2) |

Table 5 Calculation Specifications

¹ Raytraced calculations require at least 5 light bounces.

² Applicable to daylighting calculations only.

³ There are five EPW weather files for England. These are Gatwick (south), Birmingham (westmid), Hembsy (east coast Norfolk), Finningley (Yorkshire) and Aughton (northwest coast Lancashire).

| Criteria | Description | Notes |
|-----------------------|---|----------|
| Model geometry detail | Main structural elements, window fenestration, window reveals, external surface reflections and external obstructions shall be included in the calculations | (1) |
| Wall reflectance | Wall reflectance to be area-weighted, to allow for the fact that 20% of the surface shall be covered with items at 0.2 reflectance | (2), (3) |

Table 6 Model Geometry and Surface Specifications

¹ Examples include pillars, beams, window reveals, window frames, overhangs etc.

² For example, if a paint finish is 0.7 reflective, factoring 20% of this area is covered with items 0.2 reflective results in a weighted average of 0.6 reflectance ($0.7 \times 0.8 + 0.2 \times 0.2 = 0.6$).

³ 20% of the area at 0.2 reflectance allows for the impact of posters, student work etc., on the walls.

| Criteria | Value | Notes |
|--|------------------------------------|-------|
| Maximum point offset from wall | 500 mm | (1) |
| Distance between calculation points | 250 to 500 mm | N/A |
| Height of working plane above finished floor level | All spaces - according to Table 2. | N/A |

Table 7 Calculation Grid Specifications

¹ The offset can include large, fixed pieces of furniture such as cupboards.

| Criteria | Description | Notes |
|--|---|---|
| Lamp survival factor (LSF) | Calculations for LED systems shall include LSF based upon the F factor of the LEDs quoted by the luminaire manufacturer this shall be >1% | For lamps LSF is considered 1 as all failed lamps should be spot replaced |
| Lamp Lumen Maintenance Factor (LLMF) | Calculations shall include a reduction factor to allow for a reduced light output resulting from lamp depreciation and failure rates | (1) |
| Luminaire Maintenance Factor (LMF) | Calculations shall include a reduction factor to allow for a reduced light output resulting from dirt build-up on luminaires | N/A |
| Room Surface Maintenance Factor (RSMF) | The RSMF should be calculated in accordance with SLL Code for Lighting | (2), (3) |
| Glazing Maintenance Factor | Calculations shall allow a 5% reduction to manufacturers' surface transmissivity specifications to factor impact of dirt build up | (4) |

Table 8 Maintenance Factors

¹ LLMF: Use manufacturers' depreciation figures at 50,000 hours for proposed LED equipment.

² Applicable to daylight calculations only.

³ For example: 0.8 reflectance with a 10% maintenance factor is 0.72 reflectance ($0.8 \times 0.9 = 0.72$)

⁴ For example: 0.7 transmittance with a 5% maintenance factor is 0.67 transmittance ($0.7 \times 0.95 = 0.67$)

For further information consult SLL fact-file LED Metrics

8.3. Calculation Reports

8.3.1 As detailed in the DfE's EIR, an electric lighting and daylighting calculation report/drawing shall be provided in order to demonstrate compliance with the performance criteria for all spaces. [PM_10_20_28]

8.3.2 A single calculation can be used to validate multiple spaces where the results can be meaningfully extrapolated. [PM_40_30_20]

8.3.3 Calculation reports shall include the data as listed in Table below. [PM_40_30_20]

| Criteria | Notes |
|--|-------|
| Software and calculation method used (raytracing or radiosity) | N/A |
| Data sheets for luminaires included in calculation. To show product reference, luminaire lumen output, polar curve (in 5 deg increments) and luminaire wattage | (1) |
| Room name (as shown in the project drawings) that the calculation is simulating and additional rooms the calculation is validating | N/A |
| Dimensioned luminaire layout in space | N/A |
| Type and location of weather file used | (2) |
| Results for horizontal, vertical and cylindrical illuminance and for glare calculations | (1) |
| Space geometry and surface properties | N/A |
| Calculation summary figures including the calculation grid average, minimum, maximum task illuminance and task uniformity | (1) |
| Iso-contour or pseudo-colour diagram of the results | N/A |
| Maintenance factors applied to calculation | (3) |
| Specification of the calculation grid | N/A |

Table 9 Required Data in Calculation Reports

¹ Electrical lighting calculations only.

² Daylight calculations only.

³ In accordance with Table 16.

8.4. Equipment Submittals

8.4.1 As detailed in the DfE's EIR, a datasheet or schedule shall be submitted in order to demonstrate compliance with the performance criteria for all proposed lighting equipment. [PM_10_20_28]

8.4.2 The datasheet/schedule shall clearly show the information in Table below. [PM_10_20_82]

| Criteria | Data |
|--------------|---|
| Luminaire | Reference as shown on drawings |
| Luminaire | Manufacturer and model |
| Luminaire | Image of product |
| Luminaire | Dimension of product |
| Luminaire | Mounting type (surface/recessed/suspended) |
| Luminaire | Material and finish (including colour) |
| Luminaire | Test sheet to BS EN- 60598 appropriate to luminaire type. |
| Luminaire | Optics (louvre, lens, diffuser) |
| Luminaire | IP/IK (where appropriate) |
| Luminaire | Median rated useful life |
| Luminaire | Warranty ⁽¹⁾ |
| Light Source | Correlated Colour Temperature |
| Light Source | Colour Rendering Index |
| Light Source | Macadam Ellipse |
| Light Source | Luminaire Lumens/Circuit Watt |

| Criteria | Data |
|------------------|--|
| Light Source | L, B & F values ⁽²⁾ |
| Light Source | Lamp depreciation and failure percentage at lamp design life |
| Driver /Ballast | Rated life of components |
| Driver / Ballast | Power Factor |
| Driver / Ballast | Frequency |
| Driver / Ballast | Driver DC Ripple Current |
| Driver / Ballast | Dimming range |

Table 10 Required Data in Luminaire Submittals

¹ For luminaires using LED sources the warranty to include all LEDs, componentry and luminaire.

² Applicable to LEDs only.



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