ES04A Internal Lighting Systems

UNIVERSITY OF LEICESTER

Document Control

Rev	Date	By	Comments
A	Jun 16	L. Davies	Technical update review
B	Oct 17	L. Davies	Technical update review
C	Dec 17	UOL	Sign off for release
D	Apr 19	L. Davies	Technical update review
E	Mar 20	J.Thrupp	March 2020 Issue
F	Dec 20	M.Boylan	Re-Draft of Whole Document and re-title to ES04A
G	Jan 21	M.Boylan	Continued works to document to allow for release
H	Jan 21	UOL	Sign off for release

Design Guidance

1. This document shall be read in conjunction with the University Guidance Document "GD" series of guides which give greater information regarding the philosophies of low carbon design and the need to try to minimise the services plant carbon footprint.

2. The University has declared a Climate Emergency and needs to reduce its carbon footprint. Buildings should be designed with a view to greatly reducing the electrical demands of the services installations wherever possible and where economic in overall life cycle terms taking into account all factors including carbon costs and reduction of carbon emissions. This is to be achieved by a combination of good design, intelligent controls and adequate metering.

3. Reference should be made to the detailed University's electrical technical specification. Where there are discrepancies between this document and the University standards clarification shall be obtained from the University before proceeding.

4. Life cycle cost appraisals must be undertaken at early design stages in respect of the preferred electrical design solutions, especially lighting systems and intelligent controls, to the same to allow decisions to be taken as to the best overall choice in life cycle terms. This is to include energy, carbon, capital and maintenance costs. Refer to GD series for further Guidance.

5. This design guide outlines the requirements of the University for Internal Lighting systems. This design guide does not cover the requirements for emergency lighting systems or external lighting systems. Please refer to ES05 "Emergency Lighting Systems" and ES04B "External Lighting Systems" respectively.

6. Lighting shall be designed in accordance with the relevant requirements of the below documents

    - The Society of light and lighting (CIBSE) LG02 (Lighting for healthcare premises)
    - The Society of light and lighting (CIBSE) LG04 (Sports)
    - The Society of light and lighting (CIBSE) LG05 (Lighting for education)
    - The Society of light and lighting (CIBSE) LG07 (Office Lighting)
    - The Society of light and lighting (CIBSE) LG08 (Museums and Art galleries)
    - The Society of light and lighting (CIBSE) LG09 (Lighting for communal residential buildings)
    - The Society of light and lighting (CIBSE) LG13 (Lighting for places of worship)
    - The Society of light and lighting (CIBSE) LG14 (Control of electric lighting)
    - The Society of light and lighting (CIBSE) LG16 (Lighting for stairs)
    - The Society of light and lighting (CIBSE) LG17 (Lighting for retail premises)
    - The Society of light and lighting (CIBSE) LG18 (Lighting for licensed premises)
    - The Society of light and lighting (CIBSE) LG19 (Lighting for extreme conditions)
    - BS EN 12464 Light and lighting
    - Sport England (Design Guidance Note)

7. ALL proposed luminaire styles shall be approved by the Project Architect / UOL Estates including the provision of samples where required. All luminaire proposals are to meet or exceed the minimum requirements of this design guide.

8. Lighting systems shall be designed to reduce future high risk maintenance activities such as working at height. It is foreseeable that working at height will be required to maintain lighting installations however, steps must be taken to reduce this risk such as specifying luminaires that allow drivers to be maintained at low level. Such design features will ensure the 'designer's responsibilities within the Construction Design Management regulations 2015 are met with regards: "eliminate reduce or control foreseeable risks that may happen during construction or maintenance and use of a building once it has been built".

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9. All lighting control systems shall be commissioned with attendance from the respective specialist within UOL Estates maintenance for witnessing and demonstration purposes.

10. All addressable lighting control systems, including wireless systems, shall be commissioned in line with a drawing that should contain the following information as a minimum. Luminaire type, Luminaire address, Sensor type, Sensor address. The drawing should be part of the O&M package supplied on handover. Any changes made to the layout of the system during construction or refurbishment should be incorporated onto a new drawing and re-issued. An additional copy of the drawing should be provided within the control panel utilising a sufficient document holder, or mounted locally to the system within a sufficient document holder.

11. The type of lighting control system will be dependent on the size and type of project. The University are looking for cost effective solutions. Costings shall be undertaken on a project by project basis to determine the best overall solution but:

- On small scale type refurbishment projects it is felt that wireless solutions may have some merit
- On larger scale or new build projects it is felt that a KNX hardwired solution would be appropriate

12. All small lighting and general circuit wiring must be routed and contained within the floor served by the respective circuit.

13. Emergency lighting is covered within ES05. It is important to note that we do not allow the installation of "combined" emergency luminaires for either internal or external installations. Please do not use ES04A and or ES04B for any specification related to emergency luminaires or emergency lighting controls.

14. Where an addressable DALI system is required the KNX automation protocol shall be utilised. No proprietary control protocols are permitted. Digital KNX project files are to be issued for storage by UOL on completion of the project. The project file should be compatible with the drawings issued within the O&M package.

15. Consideration should be made as to the provision of "Standby Lighting" within an installation. Sound reasoning should be established for the inclusion of such a lighting system. A "Standby Lighting" installation would enable normal working activates to continue within the space served upon a mains power failure. Generally this would be achieved by the utilisation of a UPS on the lighting distribution board, and connection to the buildings essential services power distribution. The lighting must continue to meet the minimum lighting levels required for the type of space being served. This type of installation is not common for the University, and should be agreed with Estates prior to inclusion.

16. POE (power over Ethernet) lighting systems are not permitted at this moment in time by the University as they are deemed to be specialist and limiting in available hardware.

17. Where "HCL" (human centric lighting) is recommended for use, the colour temperature should fade between a maximum of 6000K and a minimum of 3000K. A lighting system that contains "HCL" components shall be cost appraised as to ensure value is achieved. Over complication shall be avoided as to ensure system simplicity and ease of future maintainability.

18. Where "DDL" (Double Dynamic Lighting) is recommended for use, the relevant lighting specialists within Estates should approve the proposal prior to installation. Careful planning should be undertaken for such a scheme with the view to office furniture being moved and affecting the functionality of the system.

19. Driver/Control gear protocols should be standardised as per the below list:

- Switched Mains Feed – (Utilised with simple lighting controls that require an on/off function at a fixed output)
- Phase Control – Not permitted
- DALI – (Utilised for all applications that require output regulation of a luminaire)
- DSI – Not permitted
- 0-10v – Not permitted
- 1-10v – Not permitted
- POE – Not permitted
- DMX – (only permitted for RGB and RGBW luminaires)

20. Driver/Control gear operating on the DALI protocol should contain integral permanent memory.

21. All luminaire types shall be cooled passively. Active cooling is not permitted under any circumstances.

22. All components should be installed in line with the requirements of BS7671 and the manufacturer's installation literature.

23. All lighting systems should be part L compliant, and meet the minimum requirements of this design guide.

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Design Components – Isolation Equipment

Item	Manufacturer	Comments
Luminaire plugs and sockets	CP Electronics Flex7 Hager	Each luminaire shall have an outlet socket with removable plug within 2M of the final luminaire position. The outlet socket shall be mounted on the lighting circuit containment, generally steel trunking or conduit. The luminaire plug lead shall not exceed 2M total length. Separate power and data plugs are not permitted. The plugs and sockets should contain a sufficient number of poles to connect both power and data. Additionally should be manufactured in such a way as to not allow the plug to be inserted into the socket the wrong way. If the positioning of the luminaire does not allow for a plug and socket to be installed locally, the circuit protective device shall be the point of isolation for the luminaire. Generally this would only be allowed for smaller student accommodation type buildings. Clarification should be obtained from Estates prior to installation without local isolation.

Design Components - Controls

Item	Manufacturer	Comments
Simple lighting control devices	CP Electronics (Sensors) Ex-Or (Sensors) MK (Manual Light Switch)	Assessment to be undertaken to ensure correct application of PIR or microwave detection devices are proposed. Over-engineering shall be avoided at all costs. “Simple lighting control devices” should not be addressable, and should work independent to any other lighting control system. If “Simple lighting control devices” are to control DALI lighting, they should operate in “DALI Broadcast”. Sensors utilised for motion detection where required should have integral photocell devices for light level measurement.
Wireless lighting control devices	Casambi Danlers Tridonic Osram Dalcnet Helvar Techonex CP Electronics Ansell Lighting	All wireless controls to operate on the Casambi protocol. Assessment to be undertaken to ensure correct application of PIR or microwave detection devices are proposed. All products on the Casambi protocol shall use BLE to communicate. (Bluetooth Low Energy). For large scale projects or refurbishments “wireless lighting control devices” are not to be utilised and rather “Hardwired addressable lighting devices” should be used. “Wireless lighting control devices” are not to be connected to the university IT network unless prior approval is given by Estates. If approval is given by Estates for this, then it should be evidenced in the O&Ms. Casambi BLE control modules should be installed within the respective luminaire by the lighting manufacturer. Retro fitting of devices on-site is not permitted for general lighting applications. It is however noted that for some architectural luminaries this may be required, and as such should be approved by Estates prior to installation. Sensors utilised for motion detection where required should have integral photocell devices for light level measurement.

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Design Components - Controls

Item	Manufacturer	Comments
hardwired addressable lighting control devices	ABB Bes – Ingenium CP Electronics Lunatone Osram Schneider Electric Siemens Theben	All "hardwired addressable lighting control devices" should operate on the KNX automation protocol. Assessment to be undertaken to ensure correct application of PIR or microwave detection devices are proposed. Lighting should operate on the DALI protocol and in turn communicate back to the KNX system via a respective gateway. Lighting control sensors must utilise either the DALI protocol via the respective gateway, or the KNX protocol via the respective KNX line. "Hardwired addressable lighting control devices" shall generally be installed in large projects/refurbishments where it is anticipated that complex lighting automations shall be required, or a high volume of lighting automation is required. This type of installation should be connected to the University IT network as to feed information to the BMS system. Generally the required protocol for this would be BACNET, and as such a suitable gateway would be required. Each KNX/DALI line should have a minimum of 20% additional capacity, to allow for future expansion. KNX installations on the same project/building should be networked together as to ensure data can be transferred to and from any point on the system. This can be achieved by utilising a suitable KNX IP router along with an IP backbone. The University IT department must be informed about the requirement of an IP backbone prior to installation as to approve the networked equipment and provide networking information required for commissioning. Sensors utilised for motion detection where required should have integral photocell devices for light level measurement.

Design Components - Luminaires

Type	Manufacturer	Comments
Downlight -Recessed -Surface -Suspended -Wall Mounted	Venture Lighting Ansell Lighting Thorn Lighting Iguzzini Zumtobel Regent Lighting Thorlux Dextra	All selected luminaires should conform to the below minimum performance specifications: • LED Light Source • 50,000 h • L70 • B50 • CRI – 80 • CCT – (select correct CCT for area type / If HCL lighting is required the CCT should regulate between 3000K – 6000K) • UGR – (Select sufficient UGR for application) • Macadam Step – 3 • Lm/W – 100 • IP – (Select sufficient for environment) • IK – (Select sufficient for environment) • Passive cooling only. Active cooling not permitted.

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Panel Recessed -Surface -Suspended -Wall Mounted	Venture Lighting Ansell Lighting Thorn Lighting Iguzzini Zumtobel Regent Lighting Thorlux Dextra	All selected luminaires should conform to the below minimum performance specifications: • LED Light Source • 50,000 h • L70 • B50 • CRI – 80 • CCT – (select correct CCT for area type / If HCL lighting is required the CCT should regulate between 3000K – 6000K) • UGR – (Select sufficient UGR for application) • Macadam Step – 3 • Lm/W – 100 • IP – (Select sufficient for environment) • IK – (Select sufficient for environment) • Passive cooling only. Active cooling not permitted.
Linear -Recessed -Surface -Suspended -Wall Mounted -Continuous	Venture Lighting Ansell Lighting Thorn Lighting Iguzzini Zumtobel Regent Lighting Thorlux Dextra	All selected luminaires should conform to the below minimum performance specifications: • LED Light Source • 50,000 h • L70 • B20 • CRI – 80 • CCT – (select correct CCT for area type / If HCL lighting is required the CCT should regulate between 3000K – 6000K) • UGR – (Select sufficient UGR for application) • Macadam Step – 2 • Lm/W – 100 • IP – (Select sufficient for environment) • IK – (Select sufficient for environment) • Passive cooling only. Active cooling not permitted.
Bulkhead -Surface -Wall Mounted	Venture Lighting Ansell Lighting Thorn Lighting Iguzzini Zumtobel Thorlux Dextra	All selected luminaires should conform to the below minimum performance specifications: • LED Light Source • 50,000 h • L70 • B50 • CRI – 80 • CCT – (select correct CCT for area type / If HCL lighting is required the CCT should regulate between 3000K – 6000K) • UGR – (Select sufficient UGR for application) • Macadam Step – 3 • Lm/W – 100 • IP – (Select sufficient for environment) • IK – (Select sufficient for environment) • Passive cooling only. Active cooling not permitted.
Track -Recessed -Surface -Suspended -Wall Mounted -Continuous	Ansell Lighting Erco Baro Iguzzini Zumtobel Thorlux	All selected luminaires should conform to the below minimum performance specifications: • LED Light Source • 50,000 h • L70 • B50 • CRI – 80 • CCT – (select correct CCT for area type / If HCL lighting is required the CCT should regulate between 3000K – 6000K) • UGR – (Select sufficient UGR for application)

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	Dextra	• Macadam Step – 3 • Lm/W – 100 • IP – (Select sufficient for environment) • IK – (Select sufficient for environment) • Passive cooling only. Active cooling not permitted.
High/Low Bay -Surface -Suspended	Venture Lighting Ansell Lighting Zumtobel Regent Lighting Thorlux Dextra	All selected luminaires should conform to the below minimum performance specifications: • LED Light Source • 80,000 h • L70 • B20 • CRI – 80 • CCT – 4000K • UGR – (Select sufficient UGR for application) • Macadam Step – 4 • Lm/W – 100 • IP – (Select sufficient for environment) • IK – (Select sufficient for environment) • Passive cooling only. Active cooling not permitted.
Specialist Sports -Recessed -Surface -Suspended -Wall Mounted -Continuous	Venture Lighting Ansell Lighting Thorn Lighting Zumtobel Thorlux Dextra	All selected luminaires should conform to the below minimum performance specifications: • LED Light Source • 80,000 h • L70 • B20 • CRI – 80 • CCT – (select correct CCT for application / reference Sports England) • UGR – (Select sufficient UGR for application) • Macadam Step – 4 • Lm/W – 100 • IP – (Select sufficient for environment) • IK – (Select sufficient for environment) • Passive cooling only. Active cooling not permitted.
Specialist Architectural -Recessed -Surface -Suspended -Wall Mounted -Continuous	Iguzzini Zumtobel Regent Lighting Flos Tunto Baro Regent Lighting Essenzialed Optaled Tagra Lighting	All selected luminaires should conform to the below minimum performance specifications: • LED Light Source • 50,000 h • L70 • B10 • CRI – 80 • CCT – (select correct CCT for area type / If HCL lighting is required the CCT should regulate between 3000K – 6000K) • UGR – (Select sufficient UGR for application) • Macadam Step – 3 • Lm/W – 100 • IP – (Select sufficient for environment) • IK – (Select sufficient for environment) • Passive cooling only. Active cooling not permitted.
Colour Changing -Recessed -Surface	Dextra Tagra Lighting Iguzzini	All selected luminaires should conform to the below minimum performance specifications: • LED Light Source

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-Suspended -Wall Mounted -Continuous		• 50,000 h • L70 • B50 • CRI – 80 • UGR – (Select sufficient UGR for application) • Macadam Step – 4 • Lm/W – 100 • IP – (Select sufficient for environment) • IK – (Select sufficient for environment) • Passive cooling only. Active cooling not permitted.

Design Components - Lamps

Item	Manufacturer	Comments
Screw in / plug in lamps	Casambi Philips / Signify Ansell Lighting Osram	All selected lamps should conform to the below minimum performance specifications: • LED Light Source • 25,000 h • Switching Cycles – 50,000 • CCT - (select correct CCT for area type / If HCL lighting is required the CCT should regulate between 3000K – 6000K) • L70 • lm/W – 75 • Passive cooling only. Active cooling not permitted. • Lamps must not have a circuit wattage of over 15W.

Design Considerations – Area Requirements

Area Type	Comments
Switch rooms, Plant areas & Risers	A manual light switch shall be located at each point of access/egress from the space and shall be rated suitably for the environment. Luminaires shall operate at a fixed output. Generally injection moulded polycarbonate and or acrylic “Anti-Corrosive” style luminaires shall be utilised for this application. Stainless steel diffuser clips are required. Lighting levels shall achieve maintained “average” illumination levels of 200lux min at a horizontal working plane of 0m (floor level) without exclusion of the perimeter 500mm zone. Manufacturers recommended maximum SHR will be adhered to in order to maximise uniformity of light distribution. Plant layout shall be considered within calculations to avoid shadowing. 4000K CCT <u>Control Strategy:</u>

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Design Considerations – Area Requirements

Area Type	Comments
	• Manual on / off switch
Offices – Suspended Ceiling Areas	Consideration shall be given to limiting of lighting uniformity to the vertical plane and avoidance of shadows through excessive scalloping. The use of architectural luminaires should be considered as to promote a more interesting and appealing work environment for staff. Office spaces should include indirect lighting as part of the overall scheme, however this should be minimal. Generally recessed and linear style luminaires should be utilised in this type of space. Lighting levels shall achieve maintained "average" illumination levels of 400lux with (min/average uniformity) across the horizontal working plane (desk @ 0.75m) of 0.6 or greater. Consideration to be given to sensing devices built into the luminaire as to ensure a better overall aesthetic. Upon activation/deactivation the luminaires should fade up and down respectively. The minimum fade time shall be 2 seconds, while the maximum should be 5 seconds. 4000K CCT / If HCL lighting is utilised then the CCT should regulate between 3000K and 6000K. <u>Control Strategy: (Small enclosed offices)</u> • Presence Detection. • Constant Light Control active to achieve the required lux level. (CLC) should be activated automatically upon entering the space. • Ability to override the (CLC) and regulate the lighting manually via a user interface. • Ability to manually turn lighting on and off via a user interface. • Consider the inclusion of human centric lighting (HCL) with automatic regulation of colour temperature. If included, the user should have the ability to manually regulate the colour temperature and output via a user interface. (HCL) should be automatic in operation and started upon entering the space. • Consider the inclusion of double dynamic lighting (DDL) with automatic regulation. If included the user should have the ability to manually regulate the colour temperature and output via a user interface. (DDL) should be automatic in operation and started upon entering the space. • The programmed off delay should be as short as possible as to reduce energy usage from vacated space, while ensuring false triggering is avoided. A fixed lengthy time should be avoided, and an extended off delay to work around poor sensor detection should be avoided. • If the light level in the space is above the required lux level, the presence sensor shall not trigger the lighting to turn on, until a time where the level is below the required lux level. • The lighting system shall have the ability to turn off the luminaires if the CLC system has regulated the lighting to a minimum and the space is still above the required lux level.

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Design Considerations – Area Requirements

Area Type	Comments
	Control Strategy: (Large open offices) • Absence detection • Constant Light Control active to achieve the required lux level. (CLC) should be activated automatically upon triggering the lighting via the user interface. • Ability to override the (CLC) and regulate the lighting manually via a user interface. • Ability to manually turn lighting on and off via a user interface. • Consider the inclusion of human centric lighting (HCL) with automatic regulation of colour temperature. If included, the user should have the ability to manually regulate the colour temperature and output via a user interface. (HCL) should be automatic in operation and started upon triggering the lighting system on via the user interface. • Consider the inclusion of double dynamic lighting (DDL) with automatic regulation. If included the user should have the ability to manually regulate the colour temperature and output via a user interface. (DDL) should be automatic in operation and be started upon triggering the lighting system on via the user interface. • The programmed off delay should be as short as possible as to reduce energy usage from vacated space, while ensuring false triggering is avoided. A fixed lengthy time should be avoided, and an extended off delay to work around poor sensor detection should be avoided. • The lighting system shall have the ability to turn off the luminaires if the CLC system has regulated the lighting to a minimum and the space is still above the required lux level.
Offices – Surface Ceiling Areas	Consideration shall be given to limiting of lighting uniformity to the vertical plane and avoidance of shadows through excessive scalloping. The use of architectural luminaires should be considered as to promote a more interesting and appealing work environment for staff. Office spaces should include indirect lighting as part of the overall scheme, however this should be minimal. Generally surface and linear style luminaires should be utilised in this type of space. Lighting levels shall achieve maintained “average” illumination levels of 400lux with (min/average uniformity) across the horizontal working plane (desk @ 0.75m) of 0.6 or greater. Consideration to be given to sensing devices built into the luminaire as to ensure a better overall aesthetic. Upon activation/deactivation the luminaires should fade up and down respectively. The minimum fade time shall be 2 seconds, while the maximum should be 5 seconds. 4000K CCT / If HCL lighting is utilised then the CCT should regulate between 3000K and 6000K. Control Strategy: (Small enclosed offices) • Presence Detection. • Constant Light Control active to achieve the required lux level. (CLC) should be activated automatically upon entering the space. • Ability to override the (CLC) and regulate the lighting manually via a user interface. • Ability to manually turn lighting on and off via a user interface. • Consider the inclusion of human centric lighting (HCL) with automatic

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Design Considerations – Area Requirements

Area Type	Comments
	regulation of colour temperature. If included, the user should have the ability to manually regulate the colour temperature and output via a user interface. (HCL) should be automatic in operation and started upon entering the space. • Consider the inclusion of double dynamic lighting (DDL) with automatic regulation. If included the user should have the ability to manually regulate the colour temperature and output via a user interface. (DDL) should be automatic in operation and started upon entering the space. • The programmed off delay should be as short as possible as to reduce energy usage from vacated space, while ensuring false triggering is avoided. A fixed lengthy time should be avoided, and an extended off delay to work around poor sensor detection should be avoided. • If the light level in the space is above the required lux level, the presence sensor shall not trigger the lighting to turn on, until a time where the level is below the required lux level. • The lighting system shall have the ability to turn off the luminaires if the CLC system has regulated the lighting to a minimum and the space is still above the required lux level. <u>Control Strategy: (Large open offices)</u> • Absence detection • Constant Light Control active to achieve the required lux level. (CLC) should be activated automatically upon triggering the lighting via the user interface. • Ability to override the (CLC) and regulate the lighting manually via a user interface. • Ability to manually turn lighting on and off via a user interface. • Consider the inclusion of human centric lighting (HCL) with automatic regulation of colour temperature. If included, the user should have the ability to manually regulate the colour temperature and output via a user interface. (HCL) should be automatic in operation and started upon triggering the lighting system on via the user interface. • Consider the inclusion of double dynamic lighting (DDL) with automatic regulation. If included the user should have the ability to manually regulate the colour temperature and output via a user interface. (DDL) should be automatic in operation and be started upon triggering the lighting system on via the user interface. • The programmed off delay should be as short as possible as to reduce energy usage from vacated space, while ensuring false triggering is avoided. A fixed lengthy time should be avoided, and an extended off delay to work around poor sensor detection should be avoided. • The lighting system shall have the ability to turn off the luminaires if the (CLC) system has regulated the lighting to a minimum and the space is still above the required lux level.
Circulation Areas	Lighting control within corridors to be presence controlled with consideration being given to daylight linking where appropriate. Consideration to be given to sensing devices built into the luminaire as to ensure a better overall aesthetic. The use of architectural luminaires should be considered as to promote a more interesting and appealing work environment for staff. Generally surface mounted or recessed linear / downlight luminaires should be utilised for this area type. Wall mounted luminaires can be utilised where appropriate. Lighting levels shall achieve maintained “average” illumination levels of 100lux MIN at a horizontal working plane of 0m (floor level). Manufacturers maximum SHR shall be adhered to maximise light distribution uniformity.

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Design Considerations – Area Requirements

Area Type	Comments
	Consideration shall be given to limiting of lighting uniformity to the vertical plane and avoidance of shadows through excessive scalloping. Upon activation/deactivation the luminaires should fade up and down respectively. The minimum fade time shall be 2 seconds, while the maximum should be 5 seconds. 4000K CCT Luminaires to have a minimum of 90% CRI in this space. <u>Control Strategy:</u> • Presence detection • Constant Light Control active to achieve the required lux level. (CLC) should be activated automatically upon entering the space. • The programmed off delay should be as short as possible as to reduce energy usage from vacated space, while ensuring false triggering is avoided. A fixed lengthy time should be avoided, and an extended off delay to work around poor sensor detection should be avoided. • No user interface is required in this type of space unless specifically requested for. Estates should be informed of such an inclusion prior to installation.
Laboratory	Generally recessed / surface mounted 600x600 style luminaires shall be utilised. Dependant on the ceiling type the use of linear, or continuous style luminaires may also be appropriate. The type of the lab should be assessed as to ascertain the environmental factors which may change the required specifications of the related lighting system components. For example a wet lab may require higher IP and IK ratings. Consideration should be made as to the type of lab activities likely to be performed in the proposed lab. Dependant on the type of activities it may be preferable to change the specification of the colour temperature and the colour rendering of the lighting system, as to enable specific scientific activity's to be undertaken without supplementary lighting. Consultation should be evidenced between the lighting designer and the respective department on this subject, of which Estates should have an overview. A cost/benefit analysis should be performed with the feedback of the consultation as to evidence an appropriate solution. Lighting levels shall achieve maintained "average" illumination levels of 500lux with (min/average uniformity) across the horizontal working plane (benching @ 0.75m) of 0.6 or greater without exclusion of the perimeter 500mm zone. Upon activation/deactivation the luminaires should fade up and down respectively. The minimum fade time shall be 2 seconds, while the maximum should be 5 seconds. Consideration to be given to sensing devices built into the luminaire as to ensure a better overall aesthetic. Dependant on the type of activities undertaken in the lab, it may be appropriate to have various selectable lighting scenes for specific activities. This should be identified during the consultation with the respective department who will occupy the lab. The below control strategies are indicative, and may change dependant on the type of activity's to be carried out in the lab. Generally 4000K CCT However the requirements of the lab may require this be adjustable, or fixed at another level.

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Design Considerations – Area Requirements

Area Type	Comments
	Control Strategy: (Small enclosed labs) • Presence Detection. • Constant Light Control active to achieve the required lux level. (CLC) should be activated automatically upon entering the space. • Ability to override the (CLC) and regulate the lighting manually via a user interface. • Ability to manually turn lighting on and off via a user interface. • The programmed off delay should be as short as possible as to reduce energy usage from vacated space, while ensuring false triggering is avoided. A fixed lengthy time should be avoided, and an extended off delay to work around poor sensor detection should be avoided. • If the light level in the space is above the required lux level, the presence sensor shall not trigger the lighting to turn on, until a time where the level is below the required lux level. • The lighting system shall have the ability to turn off the luminaires if the (CLC) system has regulated the lighting to a minimum and the space is still above the required lux level. Control Strategy: (Large open labs) • Absence detection • Constant Light Control active to achieve the required lux level. (CLC) should be activated automatically upon triggering the lighting via the user interface. • Ability to override the (CLC) and regulate the lighting manually via a user interface. • Ability to manually turn lighting on and off via a user interface. • The programmed off delay should be as short as possible as to reduce energy usage from vacated space, while ensuring false triggering is avoided. A fixed lengthy time should be avoided, and an extended off delay to work around poor sensor detection should be avoided. • The lighting system shall have the ability to turn off the luminaires if the CLC system has regulated the lighting to a minimum and the space is still above the required lux level.
WC's	Lighting setting out shall utilise a greater quantity of low output luminaires to align with the partitioning design to ensure each cubicle achieves the same lux level and uniformity ratios Generally recessed downlights or recessed linear luminaries shall be utilised. Lighting levels to general circulation areas shall achieve maintained "average" illumination levels of 150lux MIN at a horizontal working plane of 0m (floor level). Manufacturers maximum SHR shall be adhered to maximise light distribution uniformity. Upon activation/deactivation the luminaires should fade up and down respectively. The minimum fade time shall be 2 seconds, while the maximum should be 5 seconds. Consideration to be given to sensing devices built into the luminaire as to ensure a better overall aesthetic. 3000K CCT Control Strategy: • Presence detection • Sensors be to be mounted within each cubicle in addition to the circulation space. • Lighting to be grouped into respective zones. Each cubicle shall be a separate

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Design Considerations – Area Requirements

Area Type	Comments
	zone. • Lighting to operate at a fixed output. • No user interface is required in this type of space unless specifically requested for. Estates should be informed of such an inclusion prior to installation.
Stores	Lighting levels shall achieve maintained "average" illumination levels of 100lux min at a horizontal working plane of 0m (floor level). Manufacturers maximum SHR shall be adhered to maximise light distribution uniformity. Generally linear injection moulded polycarbonate "Anti-Corrosive" style, and/or high/low bay style luminaires shall be utilised dependant on the type of store. Upon activation/deactivation the luminaires should fade up and down respectively. The minimum fade time shall be 2 seconds, while the maximum should be 5 seconds. Consideration to be given to sensing devices built into the luminaire as to ensure a better overall aesthetic. Large store areas should if possible utilise high levels of natural daylight, which will enable energy savings when used alongside a lighting system with active (CLC). 4000K CCT Control Strategy: • Presence detection. • Constant Light Control active to achieve the required lux level. (CLC) should be activated automatically upon entering the space. • The programmed off delay should be as short as possible as to reduce energy usage from vacated space, while ensuring false triggering is avoided. A fixed lengthy time should be avoided, and an extended off delay to work around poor sensor detection should be avoided. • No user interface is required in this type of space unless specifically requested for. Estates should be informed of such an inclusion prior to installation.
Reception	Lighting levels shall achieve maintained "average" illumination levels of 300lux MIN at a horizontal working plane of 0m (floor level). Lighting levels of 500lux to Reception desk shall be achieved with (min/average uniformity) across the horizontal working plane (desk @ 0.75m) of 0.6 or greater. Manufacturers maximum SHR shall be adhered to maximise light distribution uniformity. Generally recessed downlights shall be utilised along with continuous linear style luminaires. The use of architectural luminaires should be considered as to promote a more interesting and appealing work environment for staff. Feature or effect lighting shall be controlled via a time schedule on the associated lighting control system, or via the BMS. 3000K CCT Luminaires to have a minimum of 90% CRI in this space. Control Strategy: • Presence detection • Constant Light Control active to achieve the required lux level. (CLC) should be activated automatically upon entering the space.

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Design Considerations – Area Requirements

Area Type	Comments
	• The programmed off delay should be as short as possible as to reduce energy usage from vacated space, while ensuring false triggering is avoided. A fixed lengthy time should be avoided, and an extended off delay to work around poor sensor detection should be avoided. • A user interface should be provided on or next to the reception desk, and accessible from the secure side of the desk. The user interface should allow for on/off, and regulating control of the luminaires including feature or effect lighting.
Meeting Rooms	Lighting shall be presented using a mix of luminaire types dependent upon the meeting room size Generally surface, recessed, and suspended types would be applicable. The use of continuous linear style luminaries has been made to great effect previously with perimeter downlights. The use of architectural luminaires should be considered as to promote a more interesting and appealing work environment for staff. Where downlights are required these shall be positioned to supplement the general lighting for functional use of presentation such as highlighting lectern and wall displays where required. General luminaire style to optimise side / upward light distribution onto ceiling & walls in line with BS12464. Lighting levels shall achieve maintained “average” illumination levels of 500lux with (min/average uniformity) across the horizontal working plane (Desk @ 0.75m) of 0.6 or greater. If an AV touch screen system is installed within the room, the lighting system should be controllable via this interface additionally. All of the functions available on the dedicated lighting user interface should be available on the AV touch screen system for convenience. 4000K CCT / If HCL lighting is utilised then the CCT should regulate between 3000K and 6000K. Control Strategy: • Absence detection • Luminaires should be zoned as to allow for the room to be set up for a presentation. Each zone should be controllable via the user interface and pre-set scenes should be selectable via the user interface. • Minimum of 3 scenes should be selectable. • Ability to manually turn lighting on and off via a user interface. • Ability to regulate each zone independently via the user interface. • If the lighting is switched on via the user interface, but without a pre-set scene selected, the Constant Light Control (CLC) system shall be active. Upon selecting a scene the (CLC) System shall be deactivated. • Consider the inclusion of human centric lighting (HCL) with automatic regulation of colour temperature. If included, the user should have the ability to manually regulate the colour temperature and output via a user interface. (HCL) should be automatic in operation and started upon triggering the lighting system on via the user interface. • The programmed off delay should be as short as possible as to reduce energy usage from vacated space, while ensuring false triggering is avoided. A fixed lengthy time should be avoided, and an extended off delay to work around poor sensor detection should be avoided.

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Design Considerations – Area Requirements

Area Type	Comments
Seminar / Lecture Rooms	Lighting shall be presented using a mix of luminaire types dependent upon the seminar room / lecture theatre size. Generally surface, recessed, and suspended types would be applicable. The use of continuous linear style luminaries has been made to great effect previously with perimeter downlights. Where downlights are required these shall be positioned to supplement the general lighting for functional use of presentation such as highlighting lectern and wall displays where Required. The use of architectural luminaires should be considered as to promote a more interesting and appealing work environment for staff. General luminaire style to optimise side / upward light distribution onto ceiling & walls in line with BS12464. Lighting levels shall achieve maintained “average” illumination levels of 500lux with (min/average uniformity) across the horizontal working plane (Desk @ 0.75m) of 0.6 or greater. If an AV touch screen system is installed within the lectern, the lighting system should be controllable via this interface additionally. All of the functions available on the dedicated lighting user interface should be available on the AV touch screen system for convenience. Due to the working at height requirements of a lecture theatre installation, the use of long life luminaires should be incorporated into the design for the high level luminaires. 4000K CCT / If HCL lighting is utilised then the CCT should regulate between 3000K and 6000K. Control Strategy: (Seminar rooms) • Absence detection • Luminaires should be zoned as to allow for the room to be set up for a presentation. Each zone should be controllable via the user interface and pre-set scenes should be selectable via the user interface. • Minimum of 3 scenes should be selectable. • Ability to manually turn lighting on and off via a user interface. • Ability to regulate each zone independently via the user interface. • Consider the inclusion of human centric lighting (HCL) with automatic regulation of colour temperature. If included, the user should have the ability to manually regulate the colour temperature and output via a user interface. (HCL) should be automatic in operation and started upon triggering the lighting system on via the user interface. • If the lighting is switched on via the user interface, but without a pre-set scene selected, the Constant Light Control (CLC) system shall be active. Upon selecting a scene the (CLC) System shall be deactivated. • The programmed off delay should be as short as possible as to reduce energy usage from vacated space, while ensuring false triggering is avoided. A fixed lengthy time should be avoided, and an extended off delay to work around poor sensor detection should be avoided. Control Strategy: (Lecture theatre) • Absence detection • Luminaires should be zoned as to allow for the room to be set up for a presentation. Each zone should be controllable via the user interface and pre-

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Design Considerations – Area Requirements

Area Type	Comments
	set scenes should be selectable via the user interface. • Minimum of 3 scenes should be selectable. • Ability to manually turn lighting on and off via a user interface. • Ability to regulate each zone independently via the user interface. • Consider the inclusion of human centric lighting (HCL) with automatic regulation of colour temperature. If included, the user should have the ability to manually regulate the colour temperature and output via a user interface. (HCL) should be automatic in operation and started upon triggering the lighting system on via the user interface. • If the lighting is switched on via the user interface, but without a pre-set scene selected, the Constant Light Control (CLC) system shall be active. Upon selecting a scene the (CLC) System shall be deactivated. • The programmed off delay should be as short as possible as to reduce energy usage from vacated space, while ensuring false triggering is avoided. A fixed lengthy time should be avoided, and an extended off delay to work around poor sensor detection should be avoided.
Specialist Sports Facilities	Consultation should be arranged between the designer and the proposed users as to ascertain the performance requirements of the lighting system. This communication should be evidenced to support the final design of the system. Lighting systems shall achieve correct vertical and cylindrical illuminance in line with Sports England guidance. If multiple types of competition sports are to be played in the facility, then the lighting system should have user selectable performance modes as to achieve the recommended lighting levels as provided by sports England. This should be achieved by the use of DALI dimming luminaires and a user interface. The number of scenes selectable should be determined by the differing number of sports for which the system has been designed to accommodate, however should not be lower than 3 scenes. If the user interface is inside of the sports hall or sports facility, it must have appropriate protection from impact. As each type of sports facility is very differing in the lighting requirements, the design should be made in accordance to the requirements of (CIBSE LG04) and (Sports England's artificial lighting guide). All lighting systems within specialist sports facilities shall have automatic lighting control that is controlled via presence detection. The inclusion of a user interface, and the exact workings of the system should be tailored around the requirements of the users and the guidance from Sports England. Energy saving control techniques should be incorporated where possible, without affecting the usability of the space. CCT should be selected in line with Sports England guidance.

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