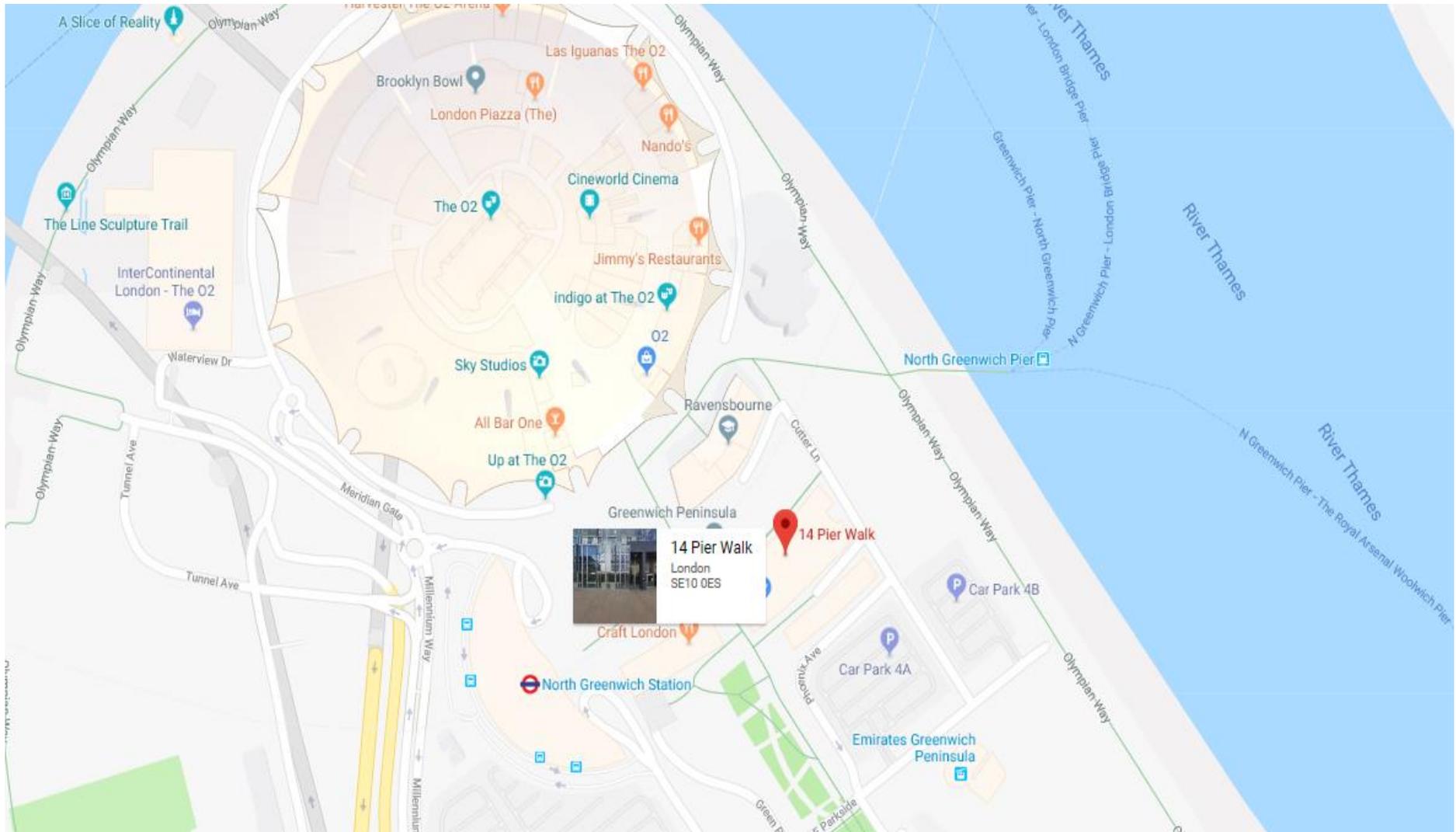
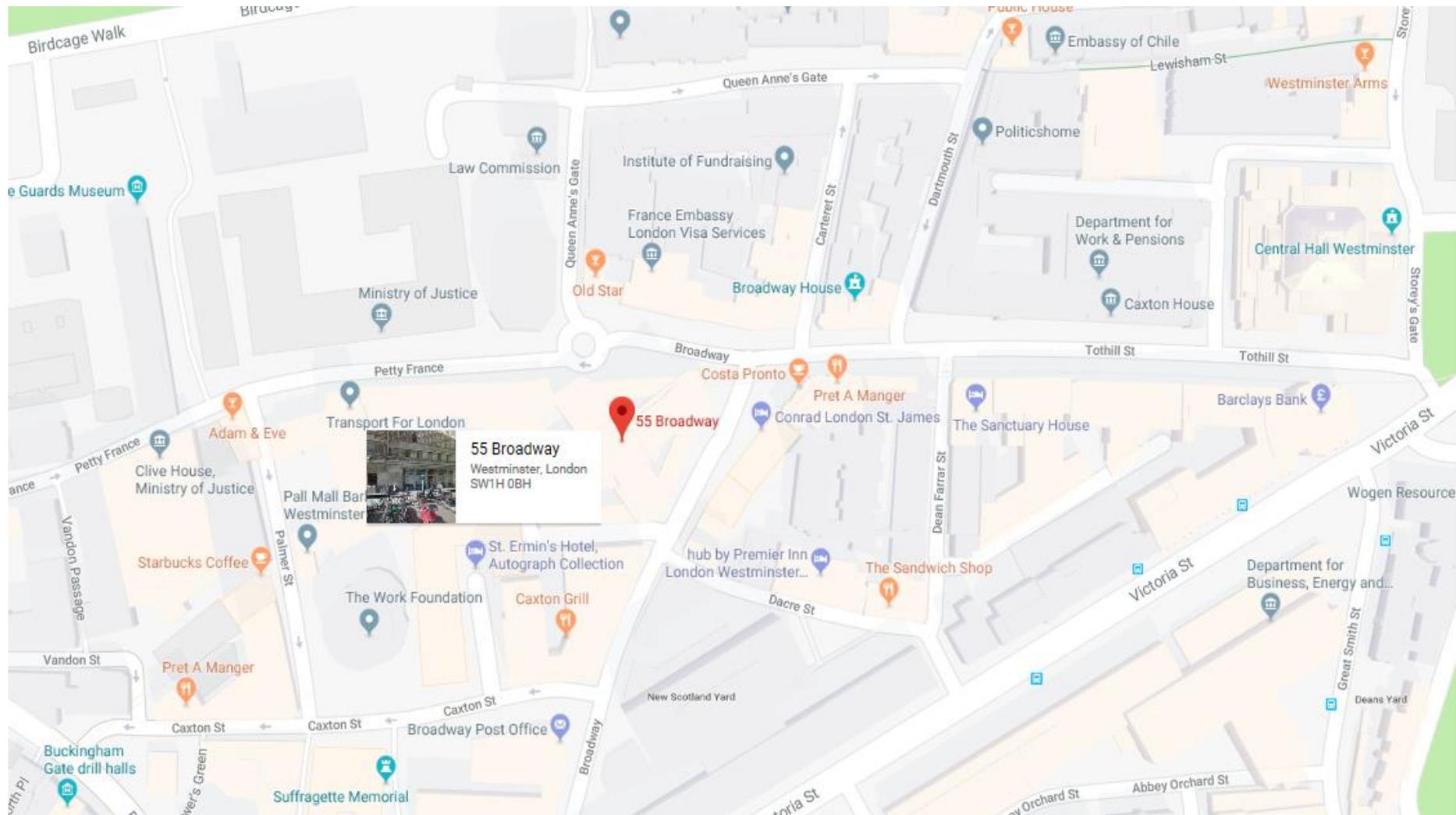


5 Endeavour Square, Stratford

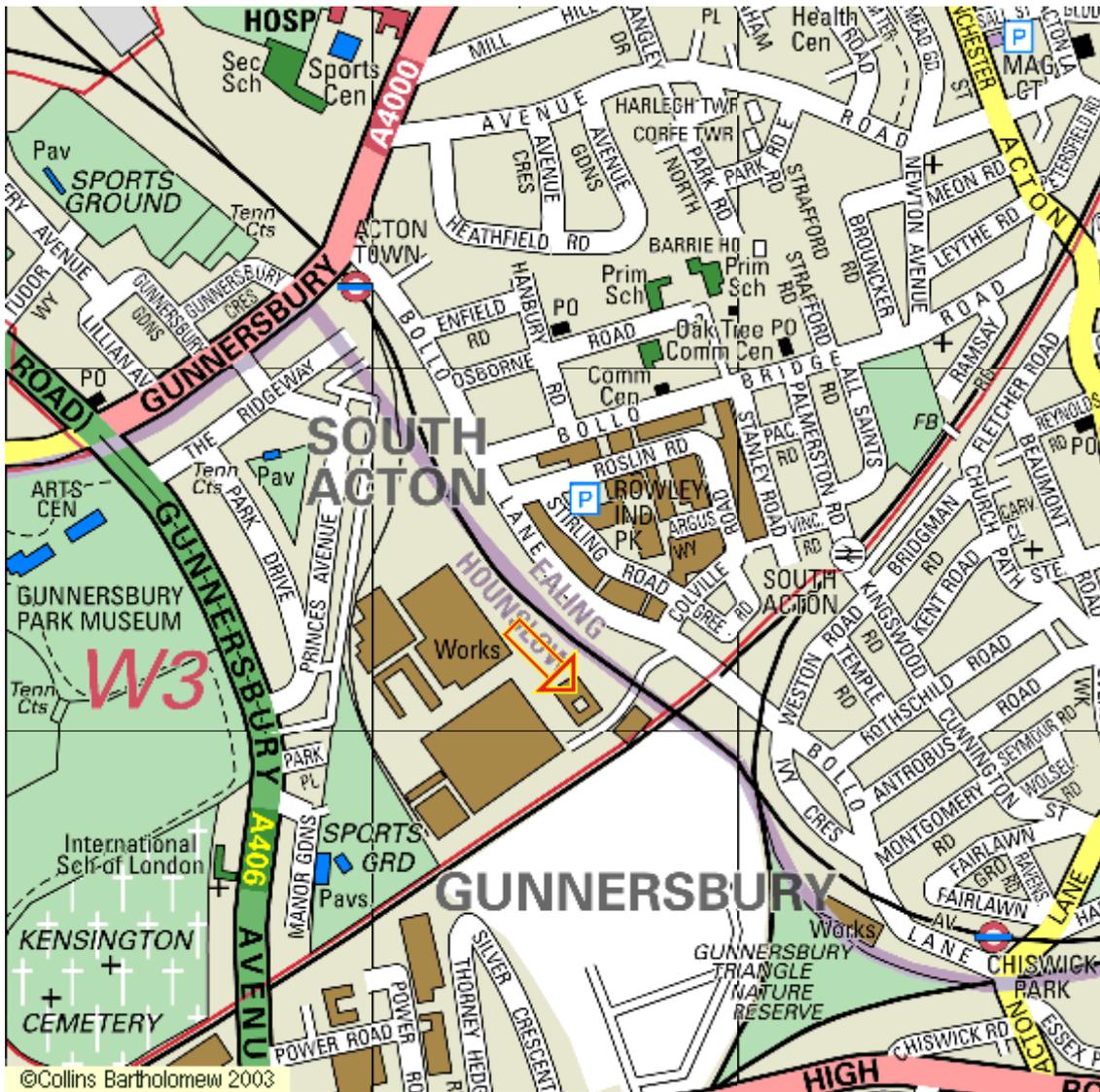


14 Pier Walk, North Greenwich



55 Broadway, St James Park

ACTON REW (RAIL ENGINEERING WORKS)



Acton REW (Rail Engineering Works)

130 Bollo Lane
London
W3 8BZ

Deliveries/access by car from Bollo Lane main entrance.

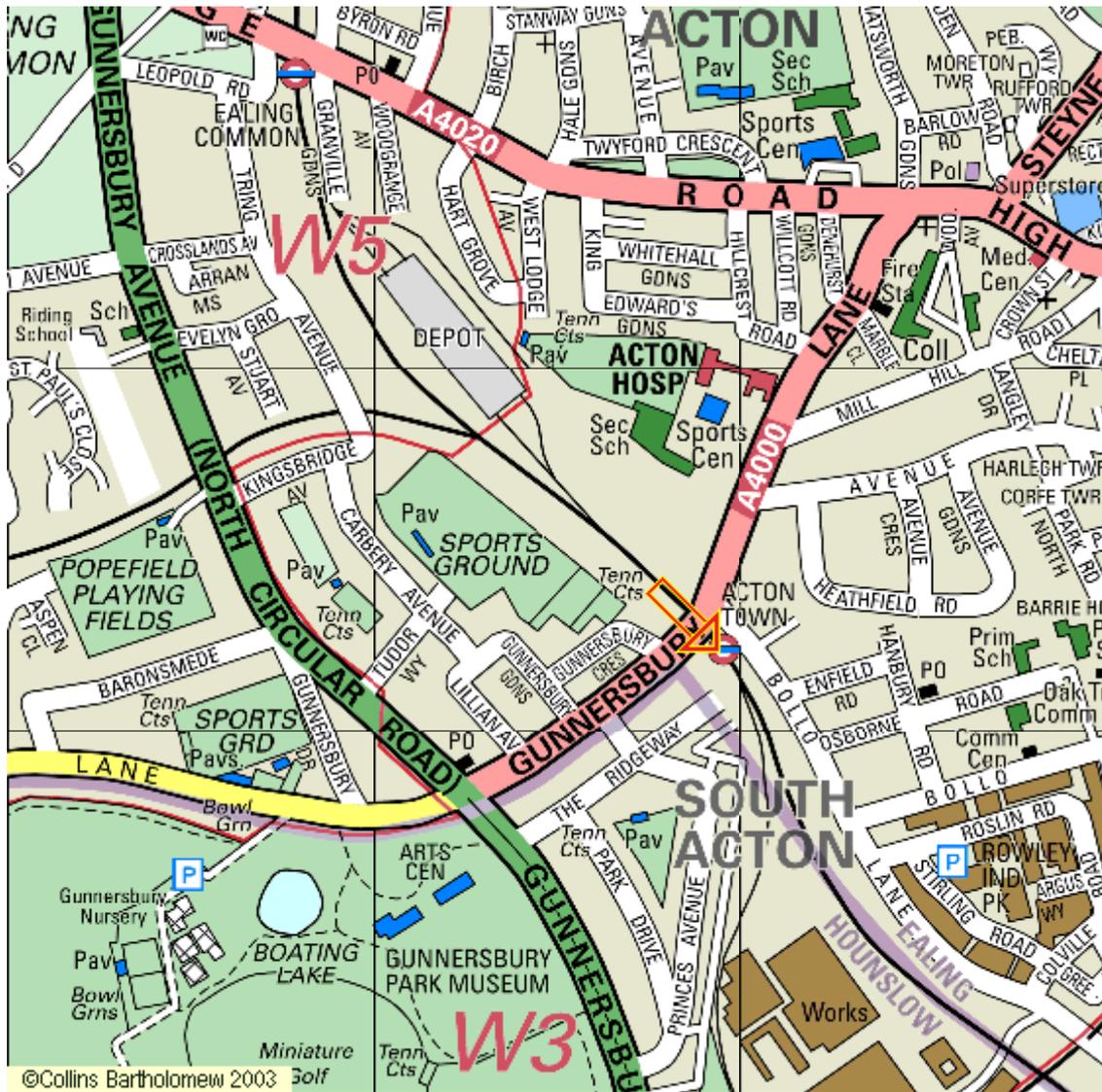
Access by tube from Acton Town: Come out of station, turn left and on the first alley left again. Walk down the road passing the training centre until you meet a set of rail tracks and a security guard box on the left. Show your entry permit card and sign in to obtain a visitor's pass. Return your visitor's pass on your way out.

Contact:

Catering Manager: 020 7918 6545

Facilities: 1st floor kitchen/restaurant

ACTON TOWN



Acton Town

118-120 Gunnersbury Lane
London
W3 9BQ

Deliveries/access by car from Gunnersbury Lane. (Arrange with caterer for parking)

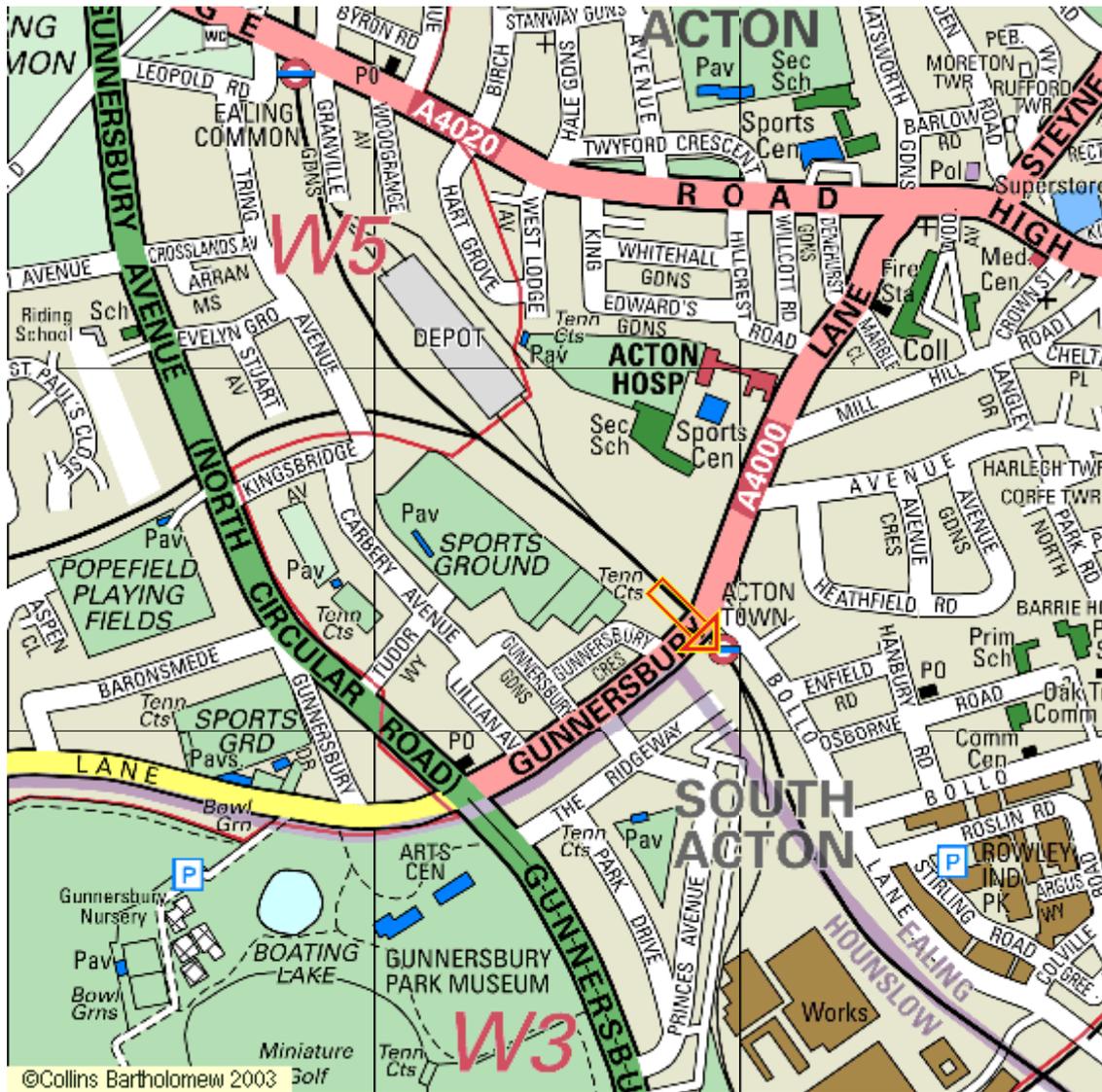
Access by tube from Acton Town: Speak to a member of staff at the station before you go through the ticket machines and out to the ticket hall, to direct you to the canteen. Show your entry permit and state the purpose of your visit as you may not be allowed otherwise to access the premises.

Contact:

Catering Manager: 020 7918 6761

Facilities: ground floor kitchen/restaurant

ACTON APP (TRAINING CENTRE)



Acton Apprentice (Training Centre)

123 Gunnersbury Lane
London
W3 8JR

Deliveries from side entrance/car park via Gunnersbury Lane. (Arrange with caterer for car parking)

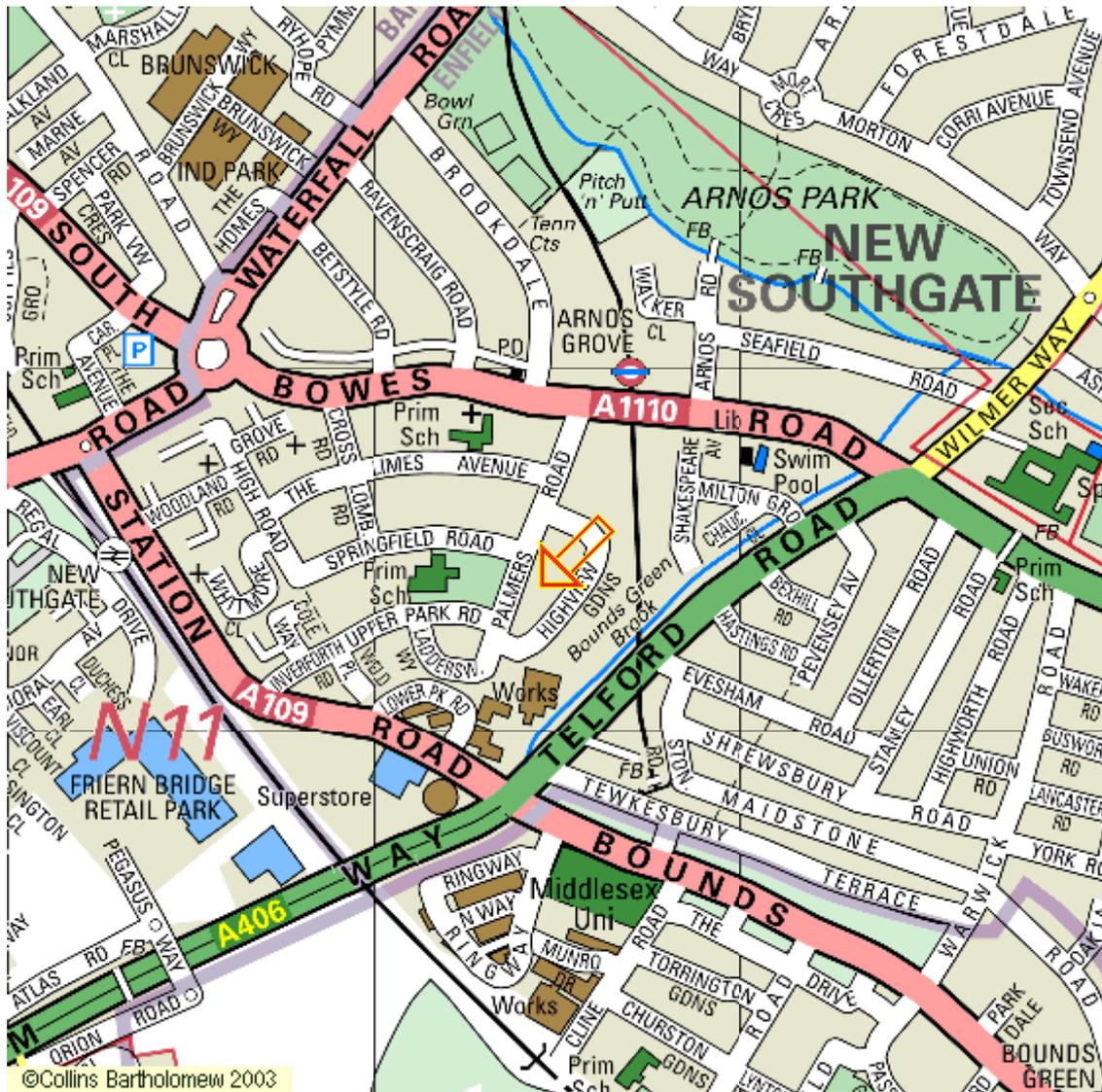
Access by tube from Acton Town: Come out of station, turn left and on the first alley left again. Walk down the road until you see the building of the training centre on your left. Show you entry permit at the reception and sign in for a visitors pass if asked to. Return your visitor's pass on your way out.

Contact:

Catering Manager: 020 8993 0874

Facilities: ground floor kitchen/restaurant

ASH HOUSE (ARNOS GROVE)



Ash House (Arnos Grove)

Arnos Grove Sidings
Palmers Road
London
N11 1SL

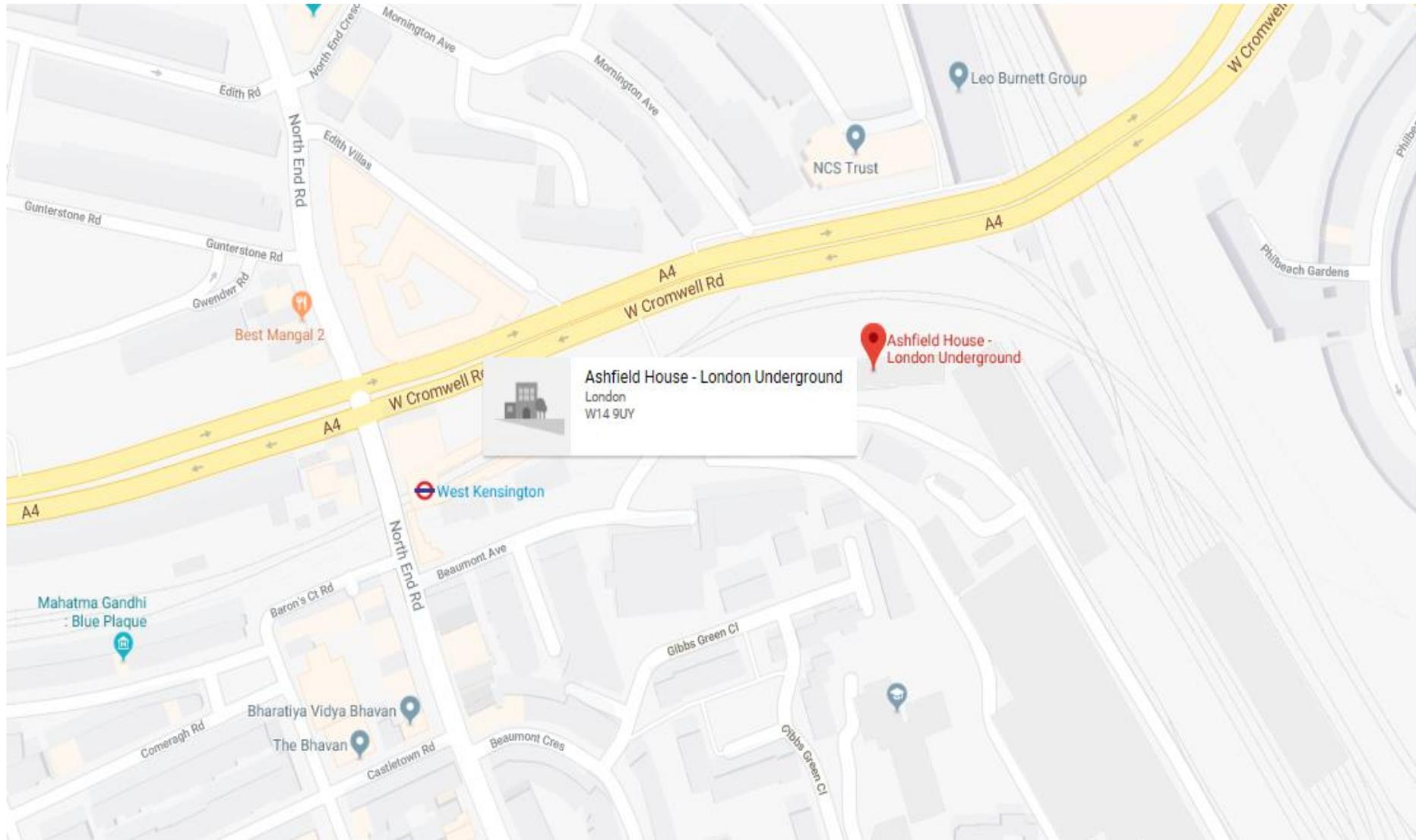
Deliveries/access by car from Palmers Road main entrance.

Access by tube from Arnos Grove: Come out of station, cross the road and start walking to the right until you meet with Palmers Road and turn left. Walk down the road until you find the sign of Arnos Grove / Ash House on your left. Follow the signs for Ash House. When entering the building show your entry permit card and sign in to obtain a visitor's pass if required. Return your visitor's pass on your way out.

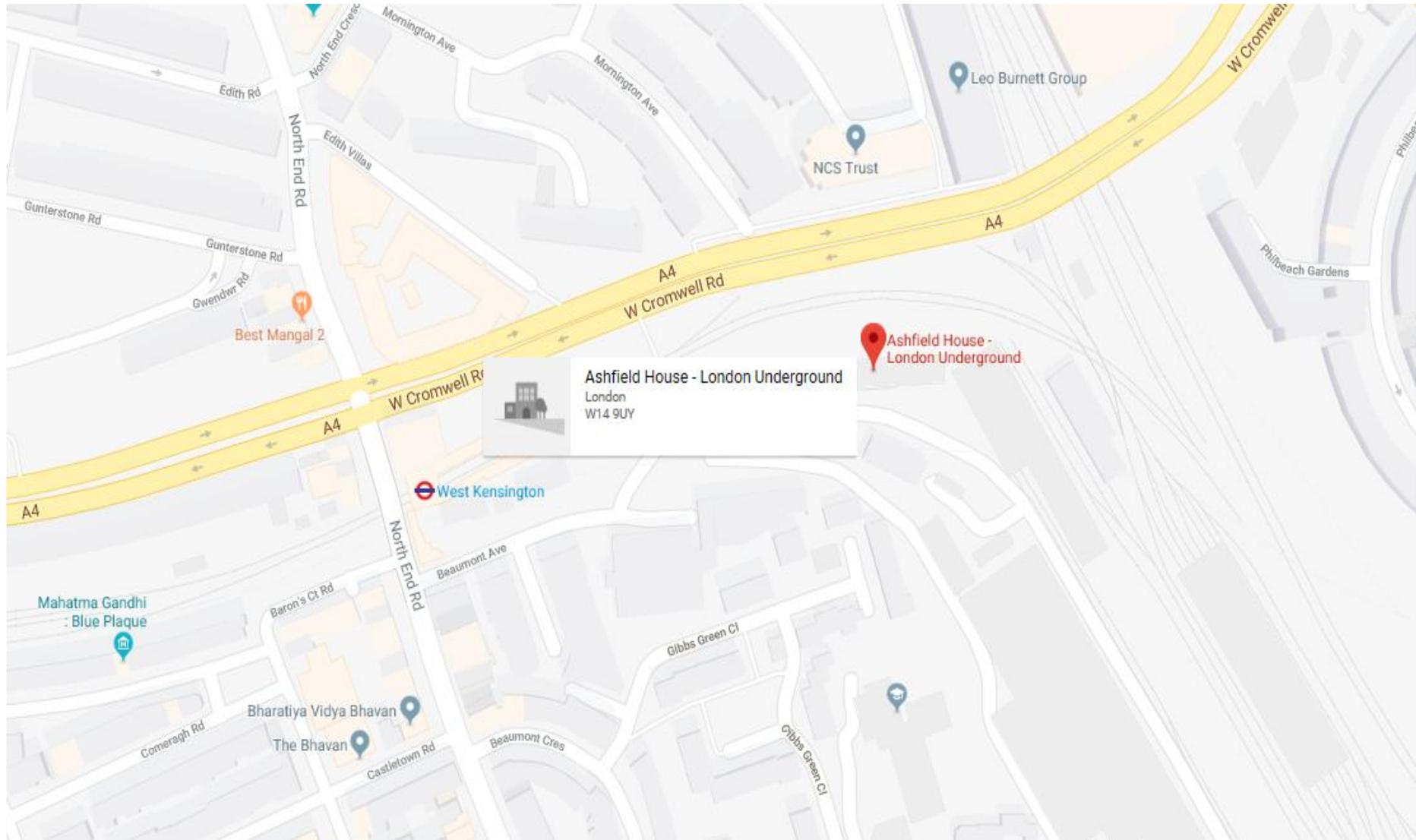
Contact:

Catering Manager: 020 7918 8921

Facilities: ground floor kitchen/restaurant

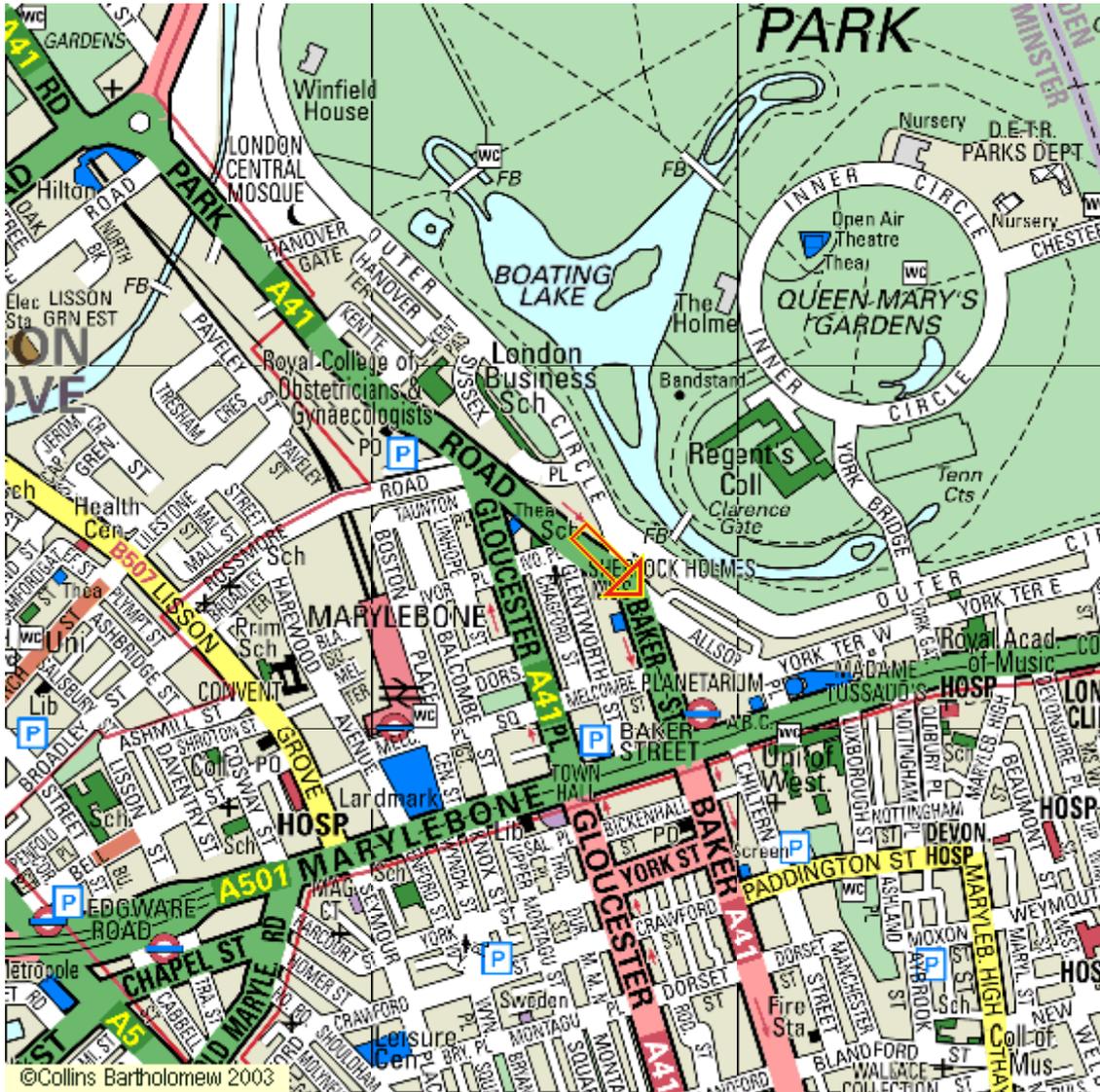


Ashfield House, West Kensington



Ashfield House, West Kensington

BAKER STREET



Baker Street

14-17 Allsop Place
London
NW1 5PL

Deliveries/access by car from Allsop Place kitchen entrance.

Access by tube from Baker Street: Come out of station, turn left and on the first left again. Walk down the road until you see on your left a building with a parking lot at the front. The restaurant is adjacent the parking lot on the right. Please report to the reception/security desk in the main building, and sign in to obtain a visitor's pass. Return your visitor's pass on your way out.

Contact:

Catering Manager: 020 7918 1009

Facilities: ground floor kitchen/restaurant

BARKING



Barking

BR Station Parade
Longbridge Road
Barking
Essex
IG11 8TU

Deliveries/access by car from Station Parade entrance.

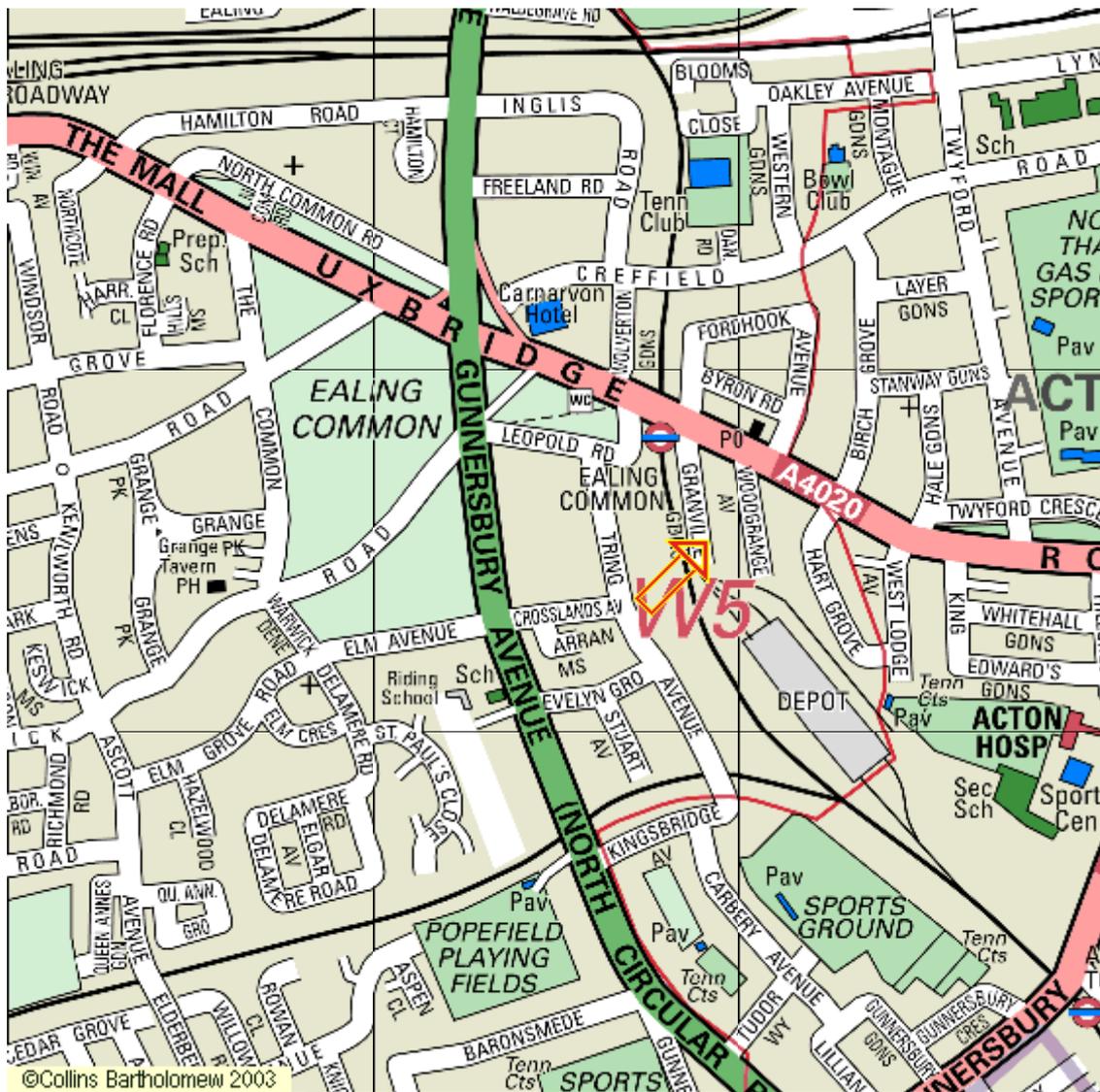
Access by tube from Barking: Walk up stairs from platform, turn right and walk down the corridor. At the end there is a set of double doors with an intercom outside. Press buzzer and announce yourself on reply. Once inside, walk down the stairs. Halfway down you will find on your right a door, go through the door and walk down that corridor to the end, at the duty manager's office, show your entry permit card and sign in to obtain a visitor's pass. Walk back out again to the main staircase and continue going down the stairs to the canteen. Return your visitor's pass on your way out.

Contact:

Catering Manager: 020 8594 2701

Facilities: ground floor kitchen/restaurant

EALING COMMON DEPOT.



Ealing Common Depot.

Booking Office
Granville Garden
London
W5 3PA

Deliveries/access by car from Granville Garden main entrance.

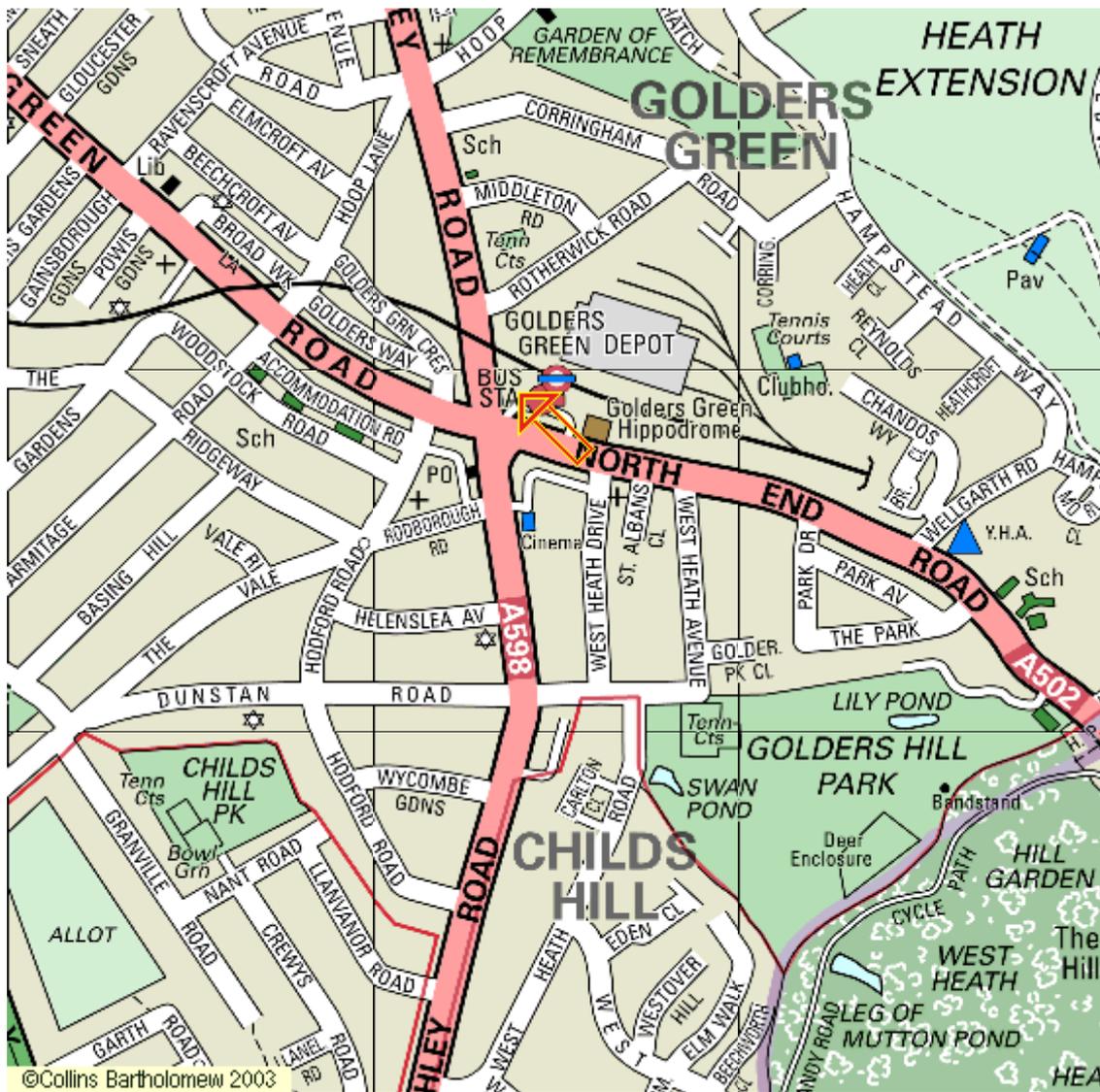
Access by tube from Ealing Common: Come out of station, turn right and right again into Granville Garden. Walk down the road until you reach the main gate/security guard box on the left. Show your entry permit card and sign in to obtain a visitor's pass. Walk down the path until you reach a set of tracks going over the path; pass the track and turn left so you have the tracks on your left and the building on your right. Walk until you find a set of aluminium-glass doors and the 'canteen' sign on the wall. Return your visitor's pass on your way out.

Contact:

Catering Manager: 020 7918 6738

Facilities: 1st floor kitchen/restaurant

GOLDERS GREEN



Golders Green

North End Road
London
NW11 7RN

Deliveries/access by car from station back entrance.

Access by tube from Golders Green: Walk to the ticket barrier. Just before the ticket barrier follow the sign for the southbound trains. Take the first set of stairs* up to your left marked 'staff only' and turn left on the platform towards the end passing the canteen to the supervisors office. Show your entry permit card and sign in to obtain a visitor's pass, return to the platform and walk back to the canteen. Return your visitor's pass on your way out.

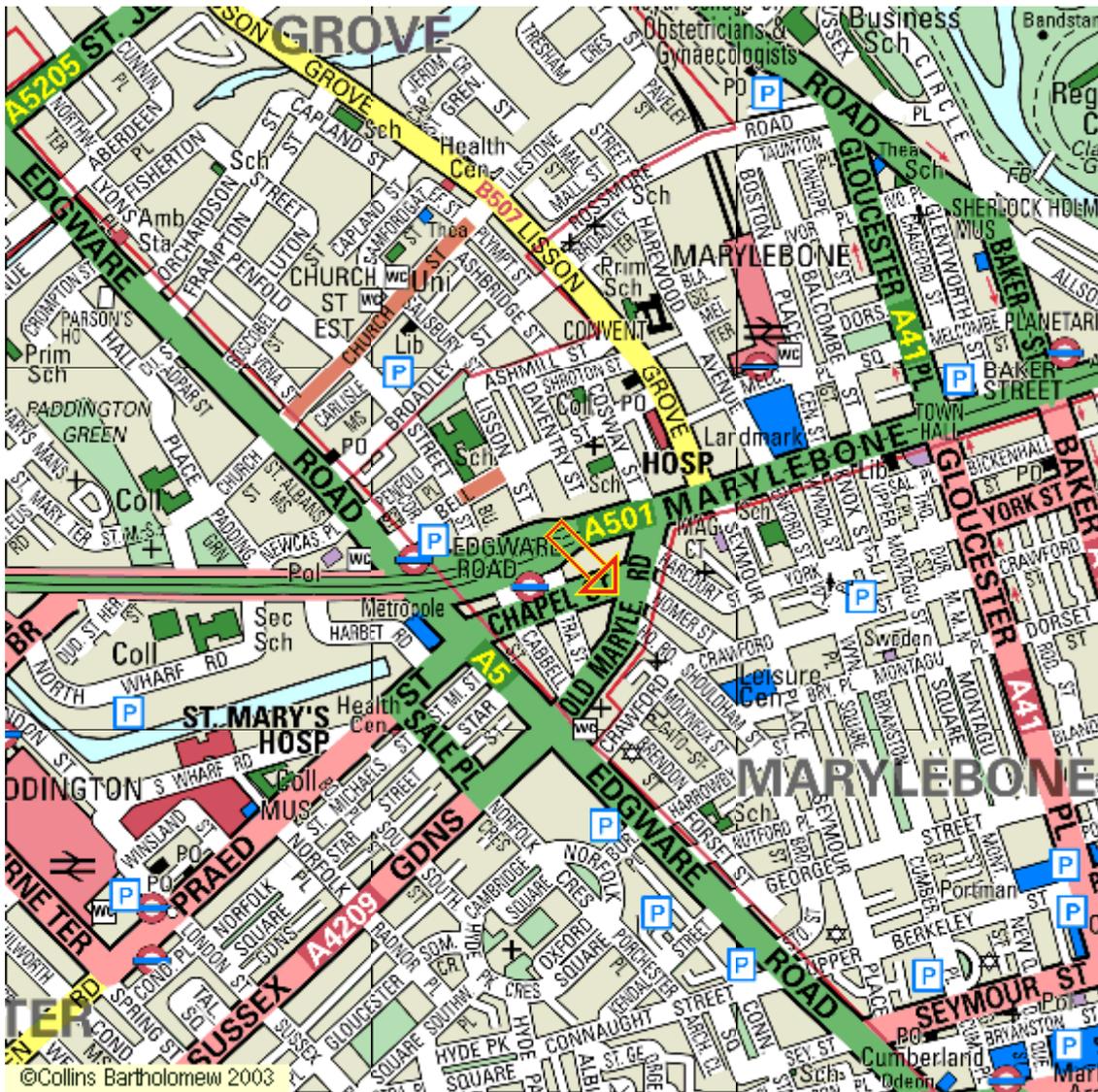
*Note that the stairs of staff entrance is controlled by sliding doors. Ask a member of staff for assistance.

Contact:

Catering Manager: 020 7918 7881

Facilities: platform level kitchen/restaurant

GRIFFITH HOUSE



Griffith House

280 Old Marylebone Road
London
NW1 5RG

Deliveries/access by car from building main entrance.

Access by tube from Edgware Road: Use any of the station's exit on the map more convenient to you (Edgware Road exit from Bakerloo line, Chapel Road exit from District, Hammersmith & City, Circle lines). Sign in to the security desk on arrival to the building, return your visitor's pass on your way out.

Contact:

Catering Manager – 1st Floor: 020 7918 1665
3rd Floor: 020 7918 2137

Facilities: 1st floor kitchen & restaurant
3rd floor kitchen/take away bar

HAINAULT DEPOT.



Hainault Depot.
Thurlow Gardens
Ilford
Essex
IG6 2UU

Deliveries/access by car from Thurlow Gardens main gate.

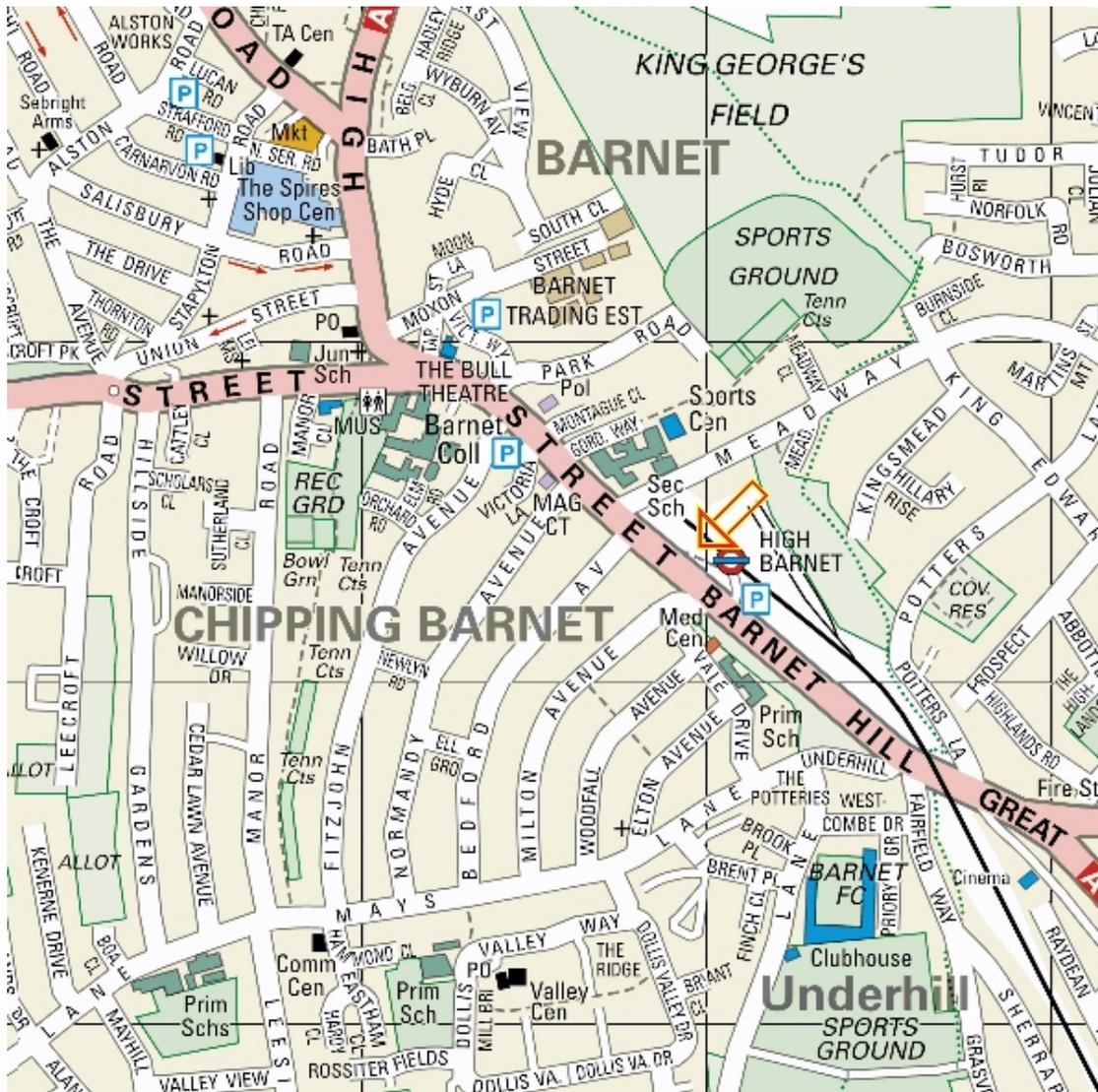
Access by tube from Hainault: Come out of station, cross the road and walk up Thurlow Gardens. Once at the gate show your entry permit and sign in to the security desk to obtain visitor's pass. Return your visitor's pass on your way out.

Contact:

Catering Manager: 020 7918 8040

Facilities: ground floor kitchen / restaurant

HIGH BARNET



Barnet Hill
Abrams House
Enfield
EN5 5RP

Deliveries from Abrams House entrance by the parking lot. Please contact the DMT or DMS at Abrams House if you require parking on the day.

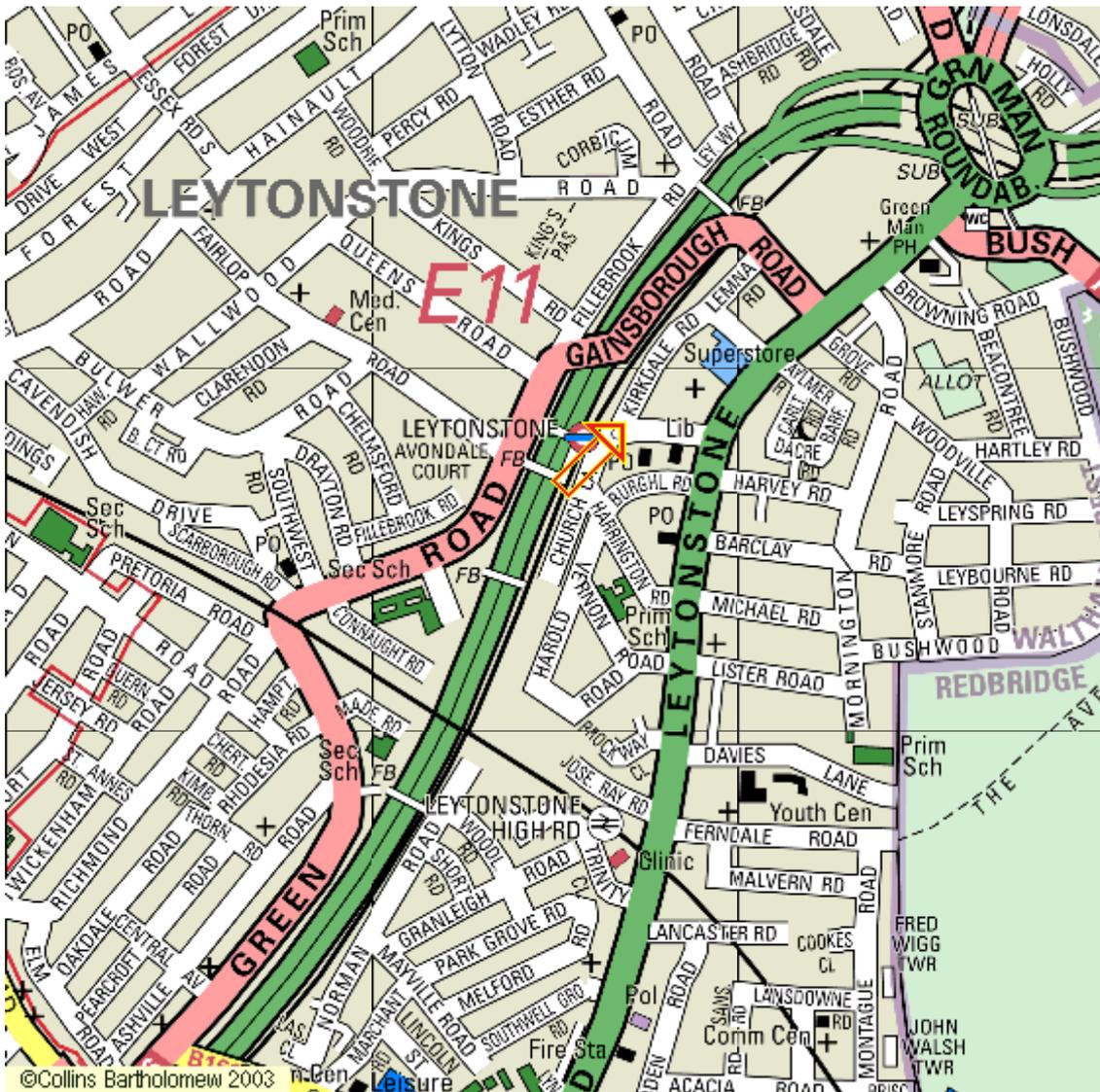
Access by tube from High Barnet: Come out of station and turn left downhill towards the parking lot. Please report to reception on the 1st floor to obtain a visitor's pass. Return your visitor's pass on your way out.

Contact:

Catering Manager: 020 7027 6143

Facilities: 1st floor kitchen/restaurant

LEYTONSTONE



Leytonstone

Church Lane
Leytonstone
London
E11 1HE

Deliveries/access by car from Church Lane

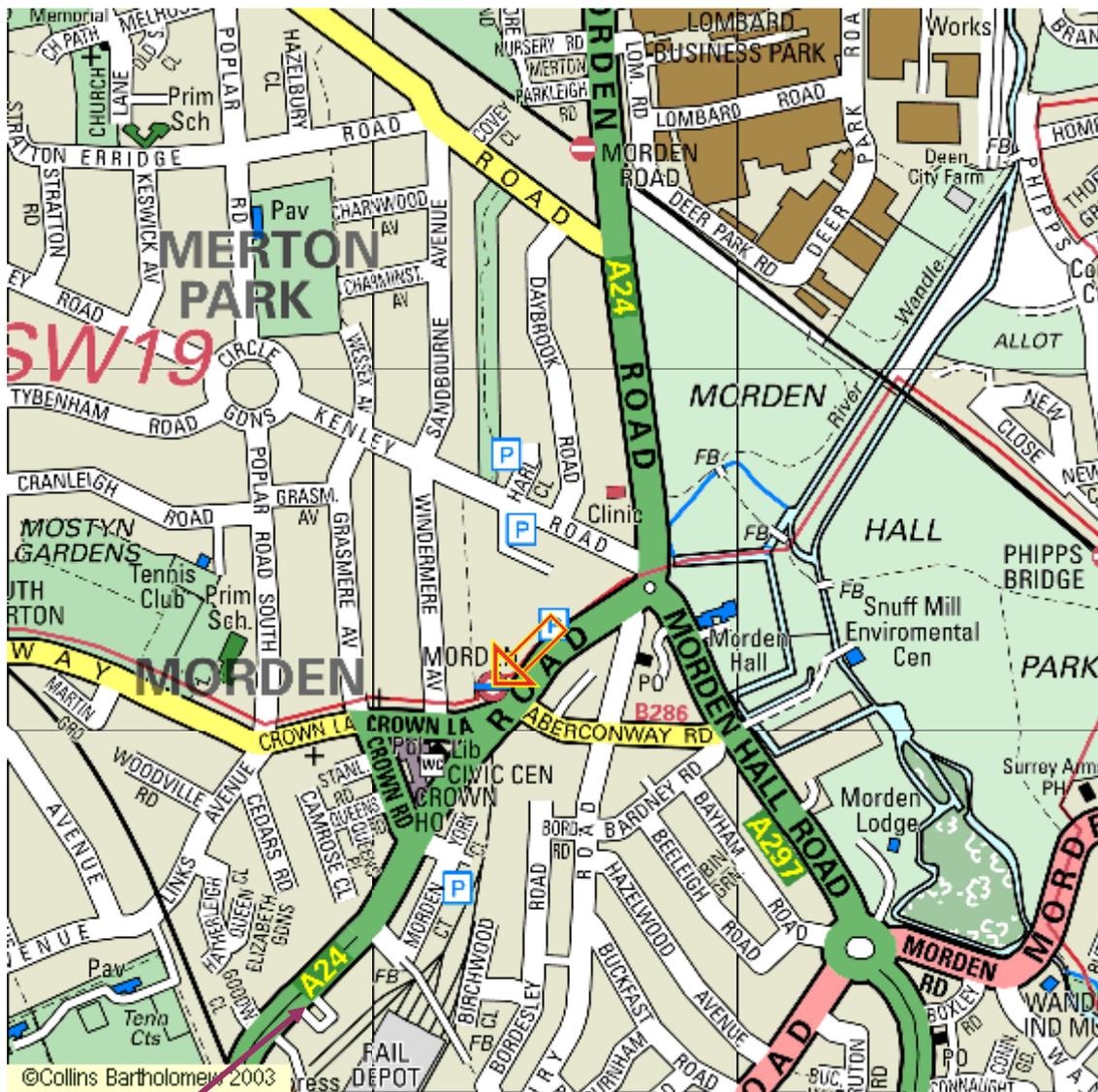
Access by tube from Leytonstone: The canteen is accessible from the eastbound platform via a set of metal steps that connect the platform to the building. A 'J' key is required to access the door from the platform to the building. The building doors have an intercom. Press the buzzer, announce yourself, walk up the stairs to the supervisor's office, show your entry permit card and sign in. Walk back down the stairs to the canteen. Return your visitor's pass on your way out.

Contact:

Catering Manager: 020 7918 8220

Facilities: ground floor kitchen

MORDEN



LONDON ROAD

Morden

London Road

Morden

Surrey

SM4 5AZ

Deliveries/access by car from stations car park.

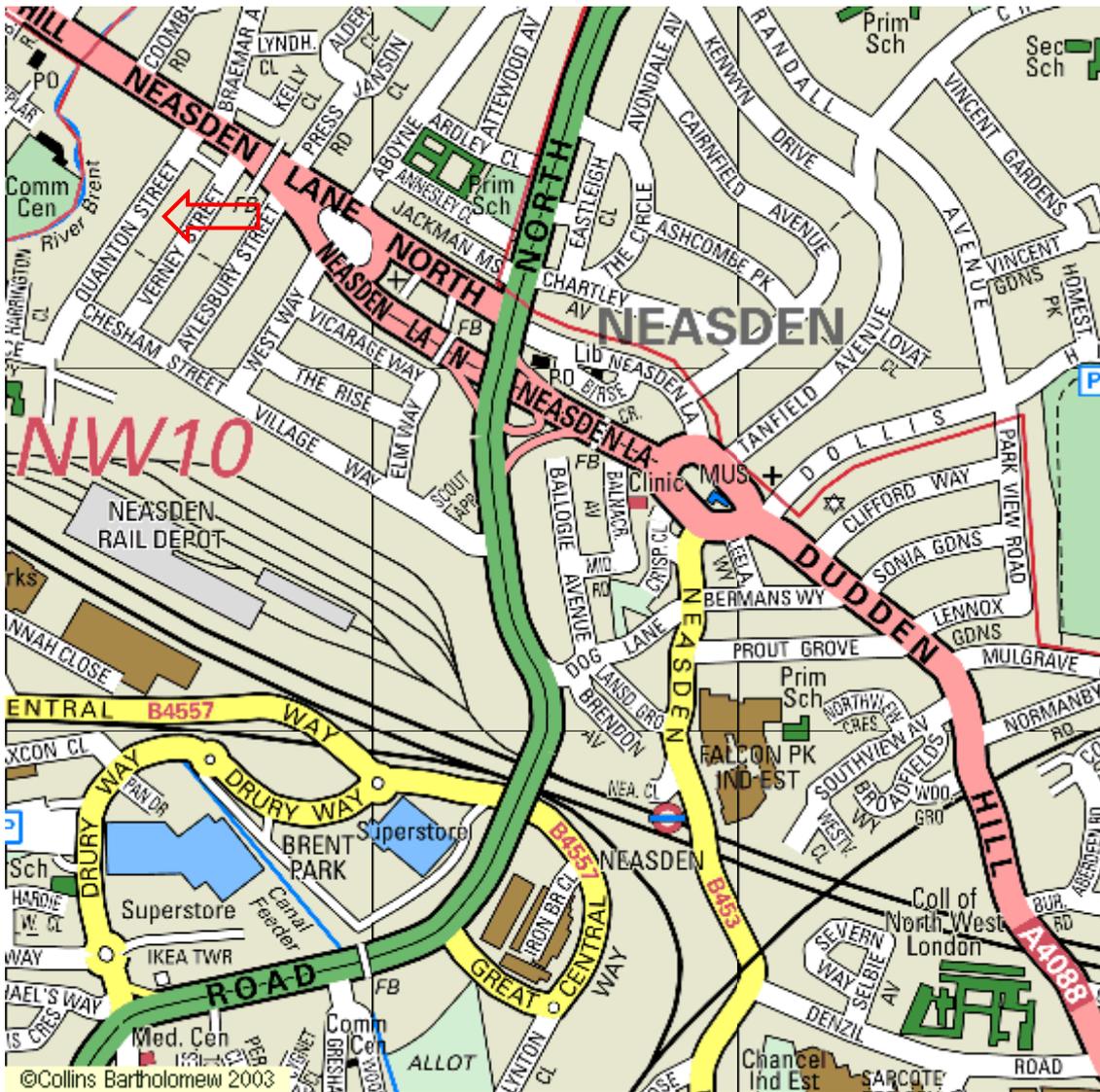
Access by tube from Morden: Whilst on the platform walk to the end where you can see a set of green metal stairs leading to the first floor of the building. These stairs are used by the train drivers to access the canteen and a 'J' key may be required to access the door of the staircase. Once on the first floor, sign in the station supervisor's office which is opposite the canteen entrance. Sign out on your way out.

Contact:

Catering Manager: 020 7918 8679

Facilities: ground level kitchen / restaurant

NEASDEN DEPOT.



Neasden Depot.

Quanton Street - off Neasden Lane
London
NW10 1PH

Deliveries/access by car from Quanton Street main gate.

Access by tube from Neasden: Come out of station, turn left and on the first left again down the ramp into the depot. Proceed to the security desk, show your entry permit card and sign in to obtain a visitor's pass. Follow pathway leading to the depot. Return your visitor's pass on your way out.

Contact:

Manager: 020 7918 9620

Facilities: ground floor kitchen/restaurant.

NORTHUMBERLAND PARK DEPOT



Northumberland Park Depot.

Marsh Lane
Tottenham
London
N17 0XE

Deliveries/access by car from Marsh Lane main gate.

Access by tube from Seven Sisters: Take the Victoria line service to Seven Sisters. Follow the signs to exit for bus services and board no. 476 to Northumberland Park. Get off bus at the end of the route. Northumberland Park depot is on the right hand side of the road accessed from Marsh Road.

On your right by the main gate you will see the security office where you have to sign in producing your entry permit card, get a visitor's pass and go to the building opposite the security's office. In entering the building you will find a staircase. Go to the first floor, turn right and walk down the long corridor until you reach the canteen on your right. Return your visitor's pass on your way out. You can get the train back from the same platform you arrived at the depot. A schedule with train times is posted in the security office.

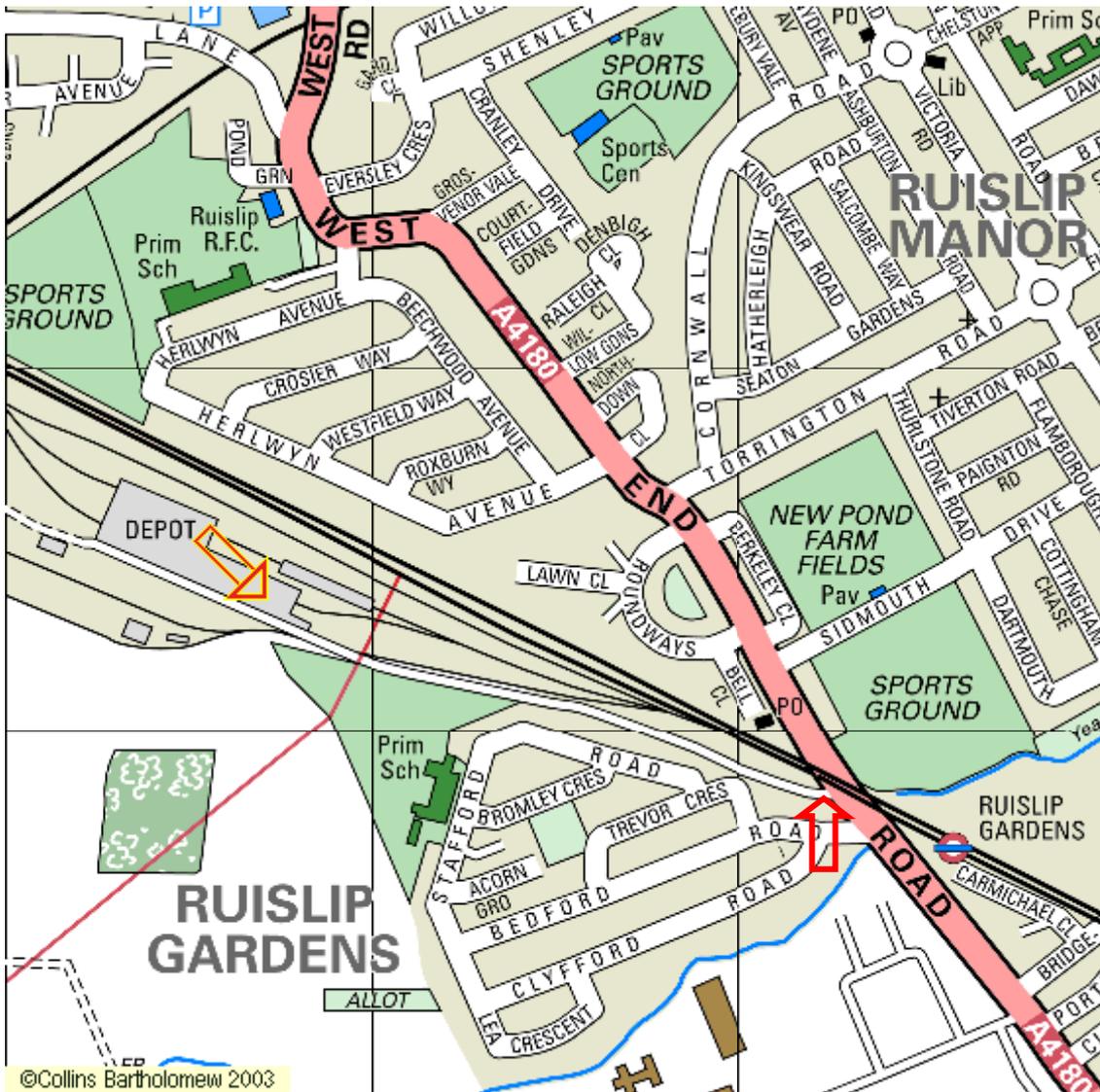
Trains to the depot from Seven Sisters station run approx. every 15 mins.

Contact:

Catering Manager: 020 7918 8964

Facilities: 1st floor kitchen/restaurant

RUISLIP DEOPOT.



Ruislip Gardens.

The Sheds, West End Road
Ruislip
Middlesex
HA4 6NS

Deliveries/access by car from The Sheds, off West End Road.

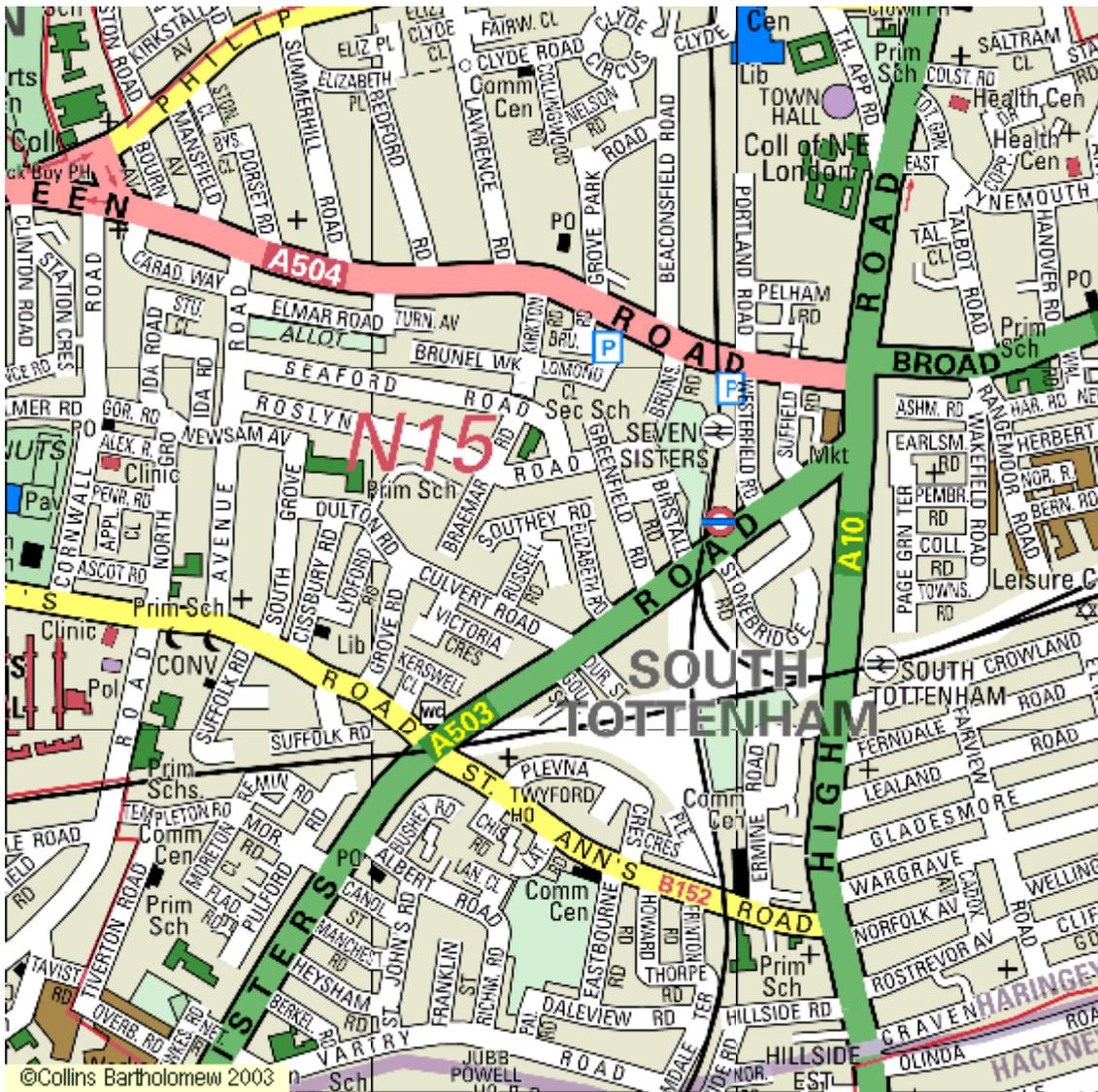
Access by tube from Ruislip Gardens: Come out of station, cross the road and walk up The Sheds. Once at the main gate sign in to the security desk. Return your visitor's pass on your way out.

Contact:

Catering Manager: 01895 678 868

Facilities: ground floor kitchen/restaurant

SEVEN SISTERS



Seven Sisters

Seven Sisters Road, London, N15 5LA

Deliveries/access by car from Westerfield Road, Pleiades House, N15 5LD

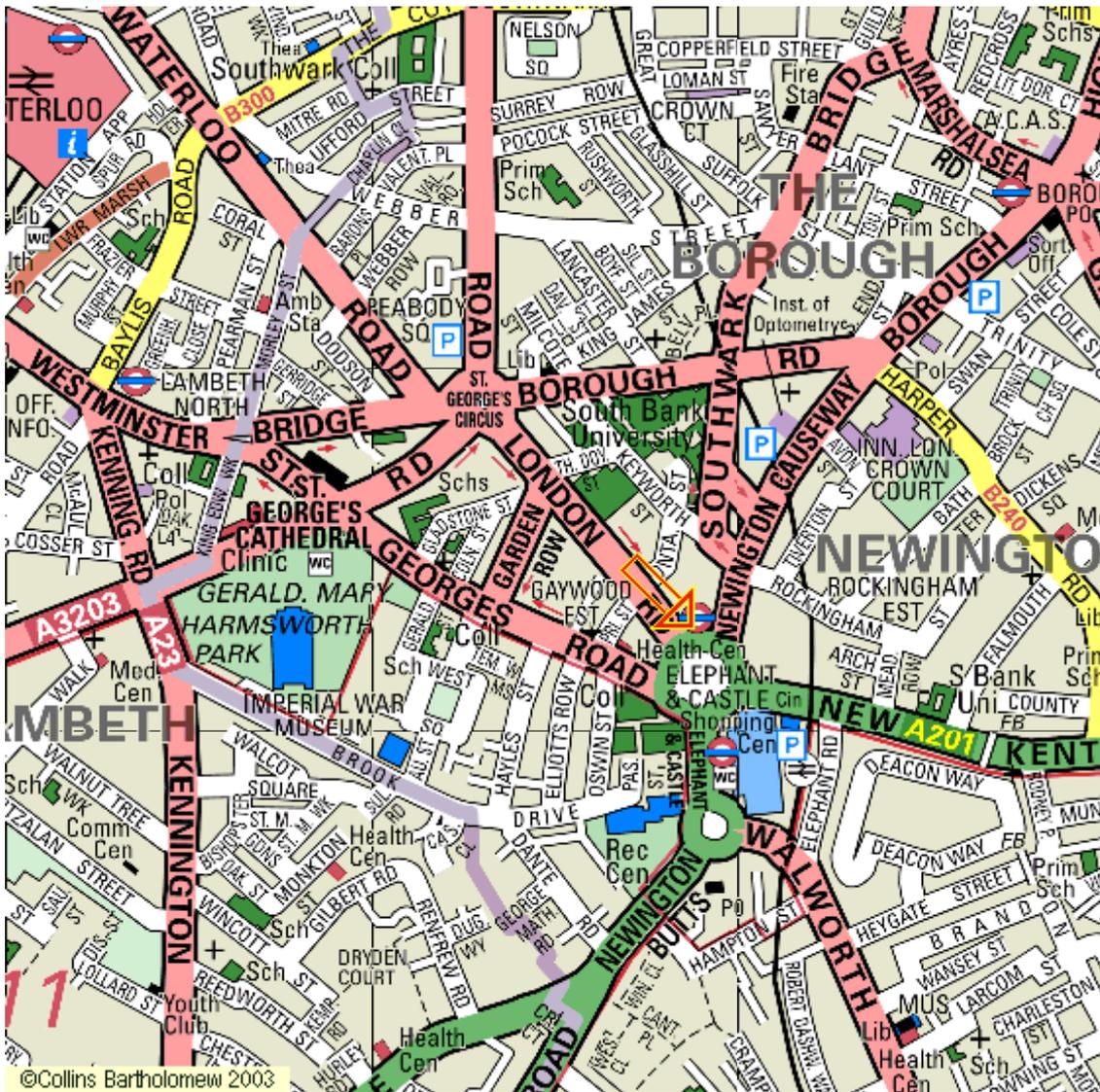
Access by tube from Seven Sisters: Follow exit signs to buses, on top of the escalators on your left there is the glass control room where you need to sign in. Then you have to take the escalators back to the platforms, and follow the exit signs to the opposite direction of the buses exit at the other end of the platform. On top of the escalators before the ticket barriers there is a door on your right that leads to the canteen. To access it, a 'J' key is required. Ask for assistance if you do not have a 'J' key. You will have to return to the other side of the station on your way out to sign out.

Contact:

Catering Manager: 020 8802 2654

Facilities: 1st floor kitchen/restaurant

SOUTH LONDON HOUSE



South London House

70-72 London Road
London
SE1 6LW

Deliveries/access by car from London Road main entrance.

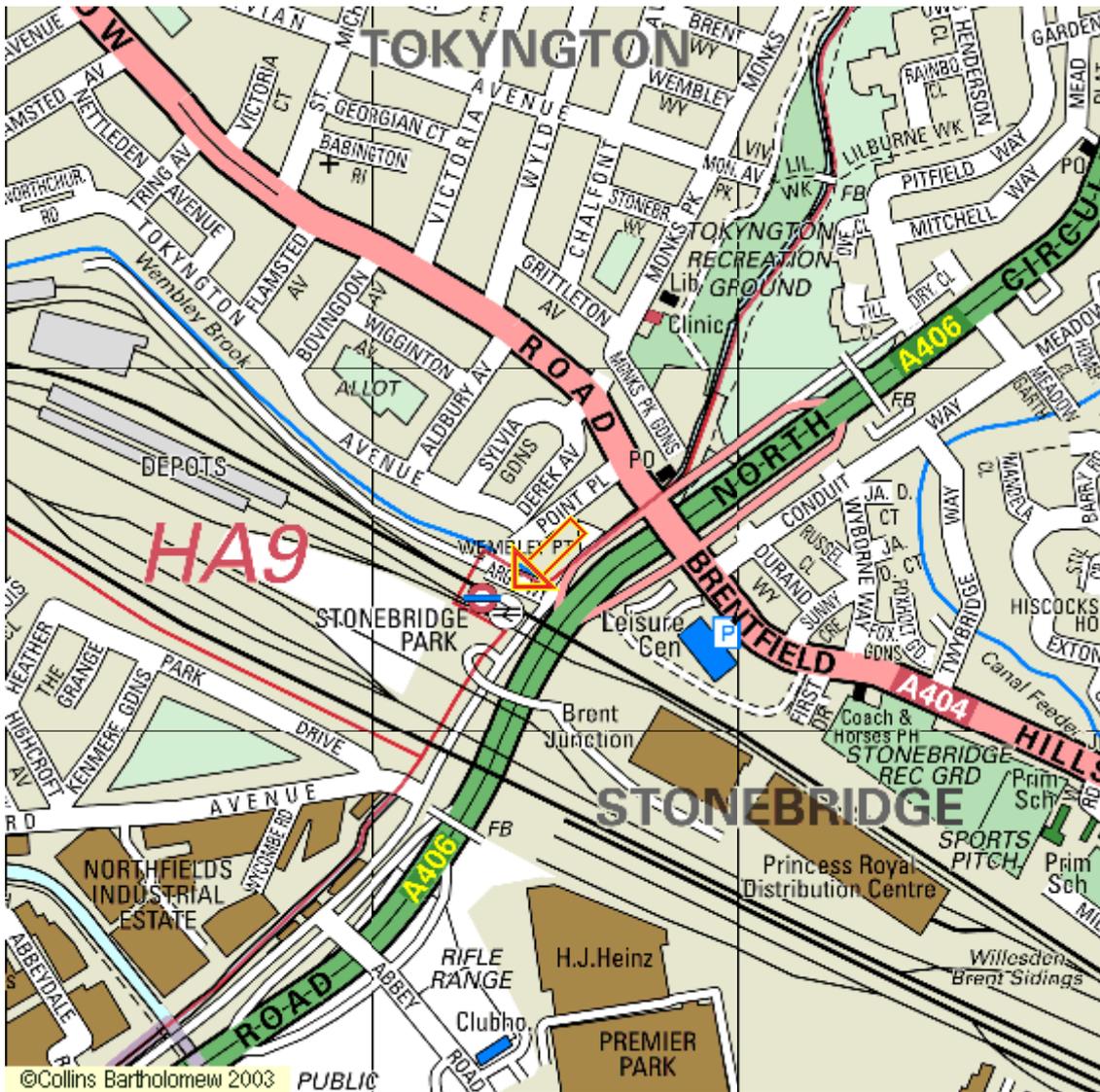
Access by tube from Elephant & Castle: Come out of station following the South Bank University exit sign and turn left. The entrance is on your left. Report to the security desk to sign in; sign out on your way out.

Contact:

Catering Manager: 020 7918 8312

Facilities: 3rd floor kitchen/restaurant

STONEBRIDGE PARK DEPOT.



Stonebridge Park Depot

North Circular Road
London
NW10 0RL

Deliveries/access by car from North Circular

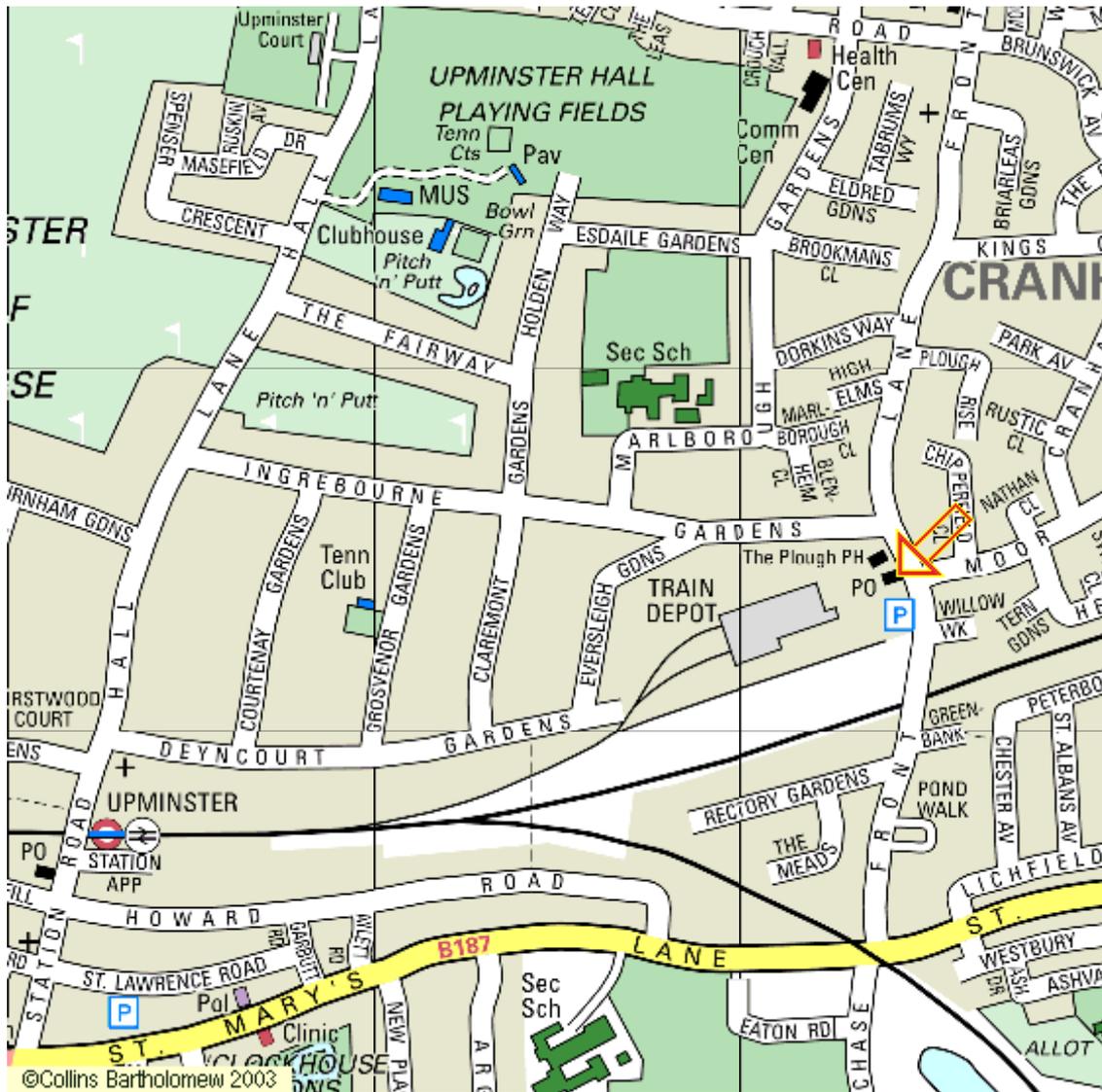
Access by tube from Stonebridge Park Come out of station, turn left and follow signs to depot. Please make sure you follow the Underground depot signs and not the BR depot signs. Once at the gate, sign in at the security desk. Return your visitor's pass on your way out.

Contact:

Catering Manager: 020 8900 1997

Facilities: ground floor kitchen/restaurant

UPMINSTER



Upminster Depot.

Front Lane
Cranham
Essex
RM14 1XL

Deliveries/access by car from Front Lane main gate.

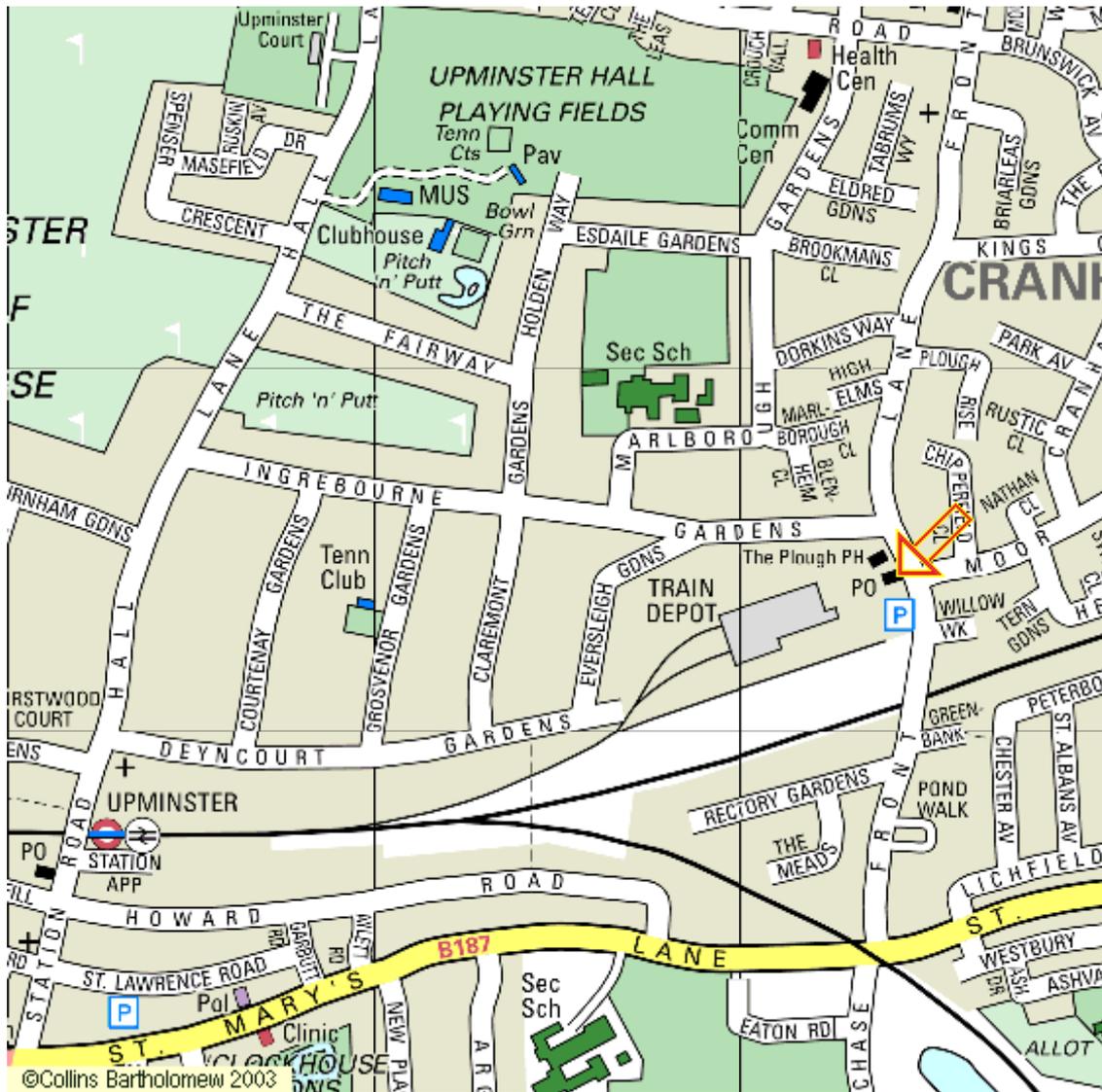
Access by tube from Upminster: Come out of station, and take the bus to Cranham. The bus will enter a vast area of council estates. On exit of the estate please check with driver for bus stop to Upminster depot. Once at the gate sign in to the security desk, return your visitor's pass on your way out.

Contact:

Catering Manager: 01708 222 598

Facilities: ground floor kitchen/take away area

UPMINSTER



Upminster Depot.

Front Lane
Cranham
Essex
RM14 1XL

Deliveries/access by car from Front Lane main gate.

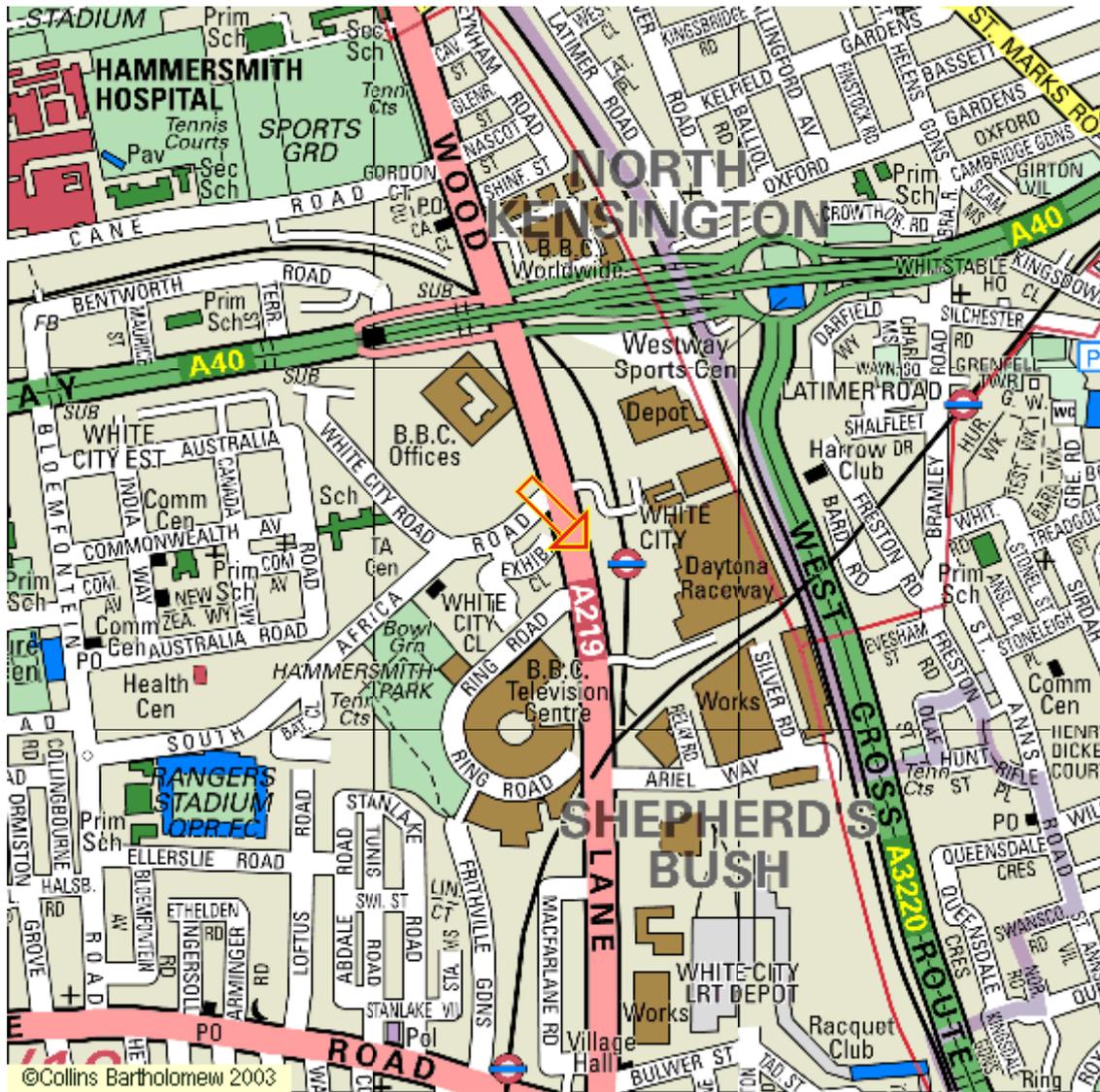
Access by tube from Upminster: Come out of station, and take the bus to Cranham. The bus will enter a vast area of council estates. On exit of the estate please check with driver for bus stop to Upminster depot. Once at the gate sign in to the security desk, return your visitor's pass on your way out.

Contact:

Catering Manager: 01708 222 598

Facilities: ground floor kitchen/take away area

WHITE CITY



White City

Wood Lane
London
W12 7HR

Deliveries/access by car from Wood Lane back entrance.

Access by tube from White City: Sign in at supervisor's office located on the platform producing your entry permit (ask for a member of staff to direct you to the supervisor's office if you can not find it). Take stairs to exit, and before the ticket barriers ask for a member of staff to open the door leading to the canteen for you. Return your visitor's pass on your way out.

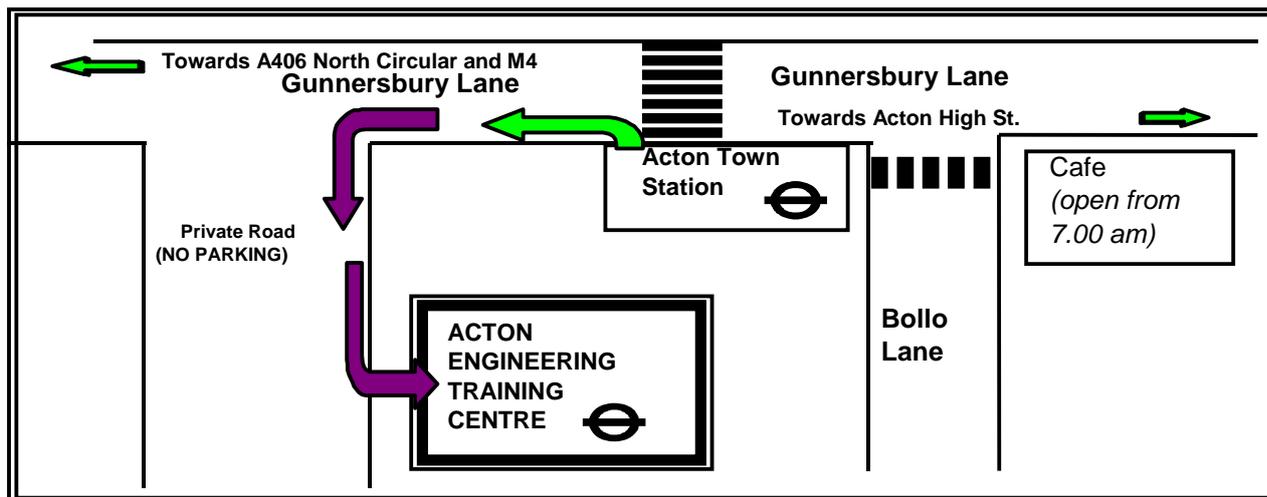
Contact:

Catering Manager: 020 8743 3386

Facilities: ground floor kitchen/restaurant



London Underground
Acton Training Centre
123 Gunnersbury Lane
Acton W3 8JR.



The Training Centre is located on Gunnersbury Lane, which is just off the Gunnersbury Avenue - A406 (North Circular). There is parking outside the building

If you are using public transport, the Centre is adjacent to Acton Town Underground station which is served by the District and Piccadilly Lines.

FOR SAFETY & EVACUATION REASONS - BUILDING IS NOT OPEN UNTIL 8.00 AM

04

Ceiling Finishes

Issue 2 — December 2010



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04 Ceiling Finishes

1 Scope

This Standard sets out requirements for ceiling finishes in non-operational premises intended for use as offices by TfL.

2 References.

This Standard should be read in conjunction with the accompanying Manual to the Standards and TfL Standards RED 03, GRN 01,02,03, BLU 03, 04, 13.

It shall be the responsibility of the designer/installer to reference and comply with all the above and any other TfL Standards where necessary.

Relevant British Standards referred to in the text are listed on the rear cover. Unless otherwise stated, references are to the latest editions and revisions.

3 Definitions / Abbreviations.

For a list of general abbreviations and definitions used within the Standards please see the accompanying Manual to the Standards.

Definitions specific to this standard are:

- Suspended ceiling:
A membrane suspended below a structural floor or roof to provide a finished soffit.
- Acoustic Raft:
Panel of acoustic absorbant material suspended below the structural soffit.

4 General guidance

4.1 Suspended Ceilings

Reference should be made to the definition contained within the Manual to the Standards

for Levels of Refurbishment. Where suspended ceilings are removed, a project shall be deemed as an Intermediate Level refurbishment for which a number of minimum criteria will have to be met unless dispensation is agreed with the Infrastructure Manager.

The finished ceiling must allow access to any services or other equipment requiring inspection or maintenance without damage to the ceiling or any of its components.

In order for services to be integrated effectively with suspended ceilings, a coordinated approach between design consultants, and during construction between services and ceiling contractors, is essential. See Section 7 for specific Design / Contractor submittal procedure requirements.

4.2 Ceiling Finishes

The type of ceiling finish selected for each particular application should be based on the following hierarchy:

- The exploitation of thermal mass and natural ventilation
- The condition of the existing substrate,
- Aesthetic requirements
- Maintenance costs
- Any requirement to conceal building services
- Acoustic considerations

No new ceiling colour or texture shall either necessitate the provision of additional

lighting to achieve the specified lighting levels or reduce existing levels within the space concerned.

The use of ceiling finishes other than those specified in this Standard must be agreed with the Infrastructure Manager.

5 Construction Design Management (CDM)

Reference should be made to the Manual to the Standards for requirements under the CDM regulations.

6 Design Standards

6.1 Painted Ceiling Finish

The finished ceiling shall comply with the spread of flame requirements of The Building Regulations 2000.

All paint finishes must comply with the requirements laid out in TfL standard GRN 01.

6.2 Suspended Ceiling Systems

Prior to the specification of a new / replacement suspended ceiling system options for exploitation of thermal mass (see 6.3) re-use and /or re-orientation must be explored.

The suspended ceiling system shall be of a proprietary design with metal infill panels. Ceiling panels shall have a flush finish and exposed grids shall not be used (See Fig.2).

Systems shall be based on a planning grid of 1500mm and optional setting out of lights.

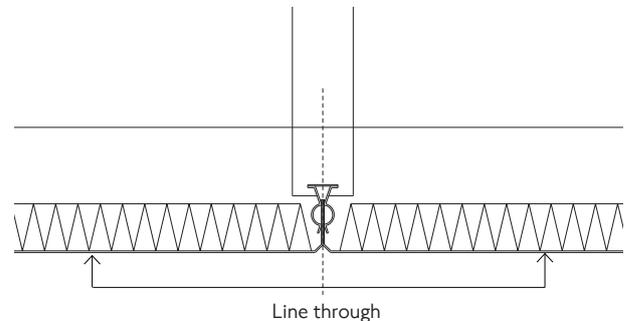


Fig. 1 Typical concealed grid .

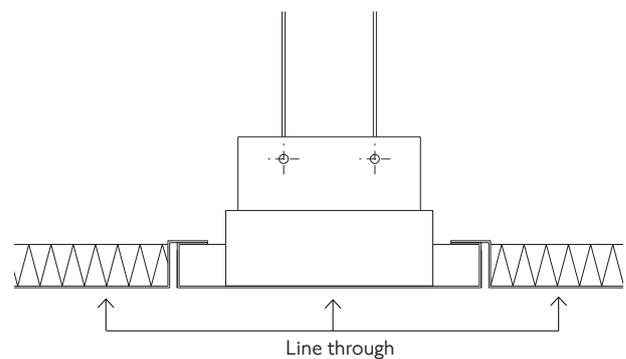


Fig. 2 'Tartan' type grid

All suspended ceiling systems used shall be designed and installed in accordance with BS EN 13964.

Ancillary components (grilles, diffusers, light fittings etc.) whether integrated with, independent of, or supported by the suspended ceiling system; shall be readily removable without affecting or disturbing the remainder of the ceiling system.

Safety cables shall be applied to all large accessible panels to avoid panels swinging down uncontrollably.

Integrated ancillary components must be fully compatible with the proprietary system.

Manufacturer's guidelines must be adhered to at all times to determine the requirement for additional hangers or rigid backing boards to transfer the load. Where rigid backing boards are used these must conform to the material characteristics set out in TfL standard GRN 01.

The ceiling suspension system shall not be used to support equipment and services unless specifically designed to do so.

The fire resistance of the combined ceiling and voids shall comply with the requirements of The Building Regulations 2000 and the Fire Precautions Act 1971. For the requirement of fire detection systems in ceiling voids greater than 800mm see Building Regulations.

6.3 Exposed Soffit.

The principles of exposing the ceiling soffit to utilise the thermal mass of a building in a ventilation / heating and cooling strategy are explained in Fig. 4.

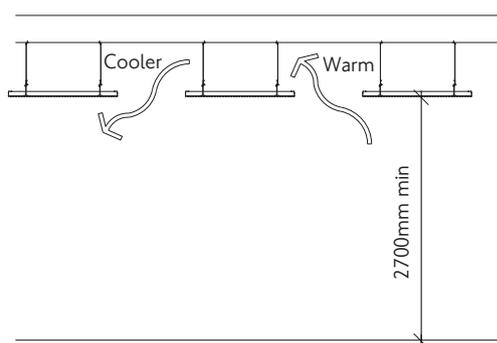


Fig. 3 Acoustic rafts.

Where an exposed soffit is adopted, following consideration of the criteria set out in 4.2 above, the use of acoustic rafts to attenuate sound reverberation and conceal service runs should be used. Each situation is unique - relevant consultants should be used to establish the balance between thermal mass, services distribution, acoustic performance and the visual appearance of the assembled components.

6.4 Acoustic Rafts.

Acoustic rafts shall be 6lb/cuft or 96Kg/m³ density fibre panels with high absorbency in the mid and high frequency.

Rafts shall be mounted at such a distance from the structural ceiling in order to allow passage of air to the soffit and achieve desired acoustic performance. Mounting the rafts away from the ceiling will increase the low-frequency effectiveness of the raft. The fixed height of the panels will maintain a minimum clear floor to ceiling height of 2700mm (See Fig.3).

Rafts shall be 50mm in thickness or to suit acoustic requirements with maximum overall dimensions of 3000x1200x50mm.

Rafts shall be fixed in such a way as to allow access to services located above the rafts when in the fixed position.

7 Design / Contractor Submittal Requirements

Reference should be made to the Manual to the Standards for general requirements for drawing and sample submittals

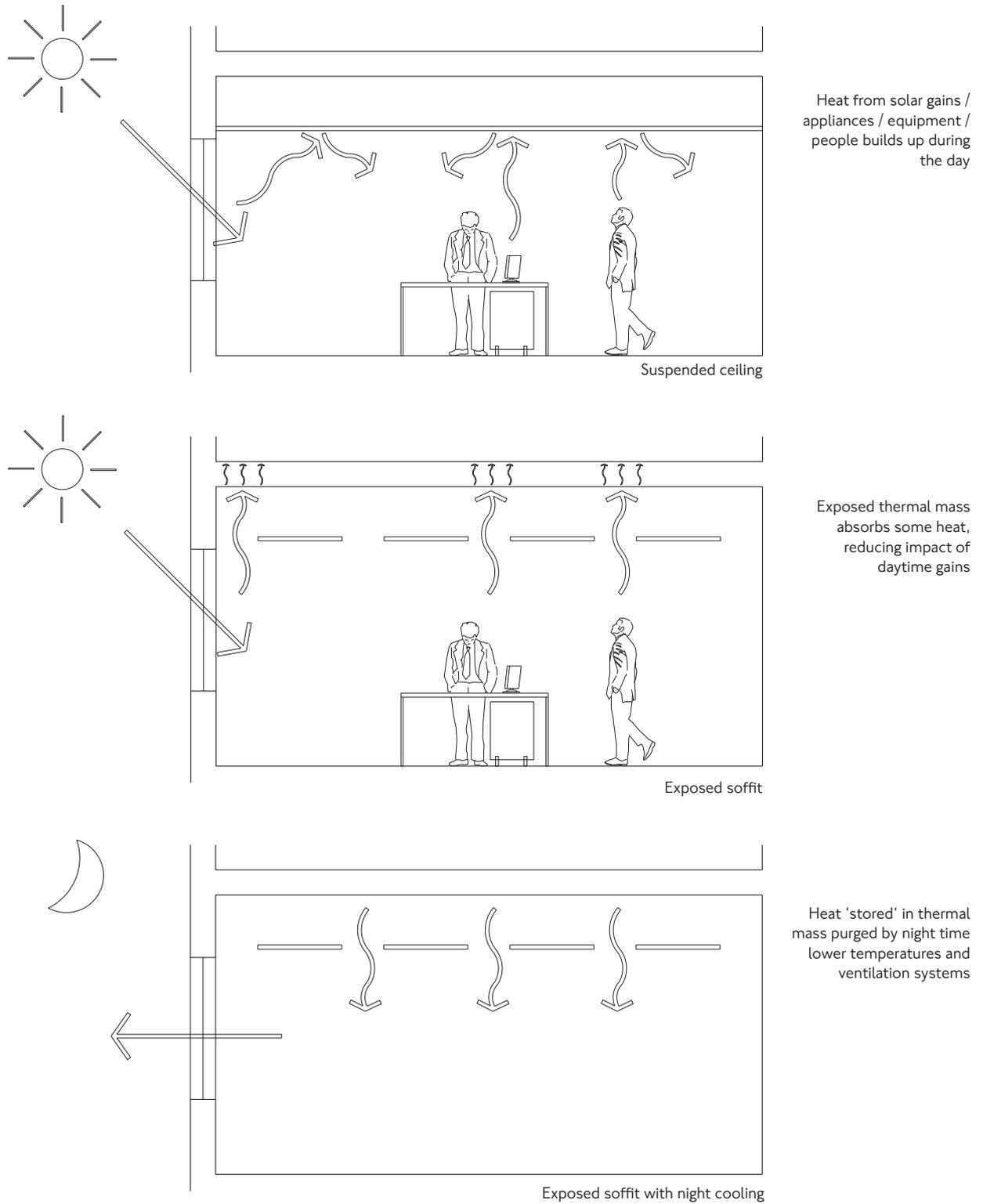


Fig. 4 Principles of exploitation of building thermal mass

Requirements specific to this Standard are:

- Coordinated reflected ceiling plans showing positioning of all lighting and any other ancillary components/ equipment must be included in the design.
- Through the use of cross sections, fabrication drawings should also show what is happening in the ceiling void particularly where services are intense. They should include:
 - Primary grids
 - Void heights
 - Structural soffit members and equipment that has to be bridged
 - Piped and ducted services distribution
 - Air handing units
 - Fire/sound / plenum barriers
 - Partitions taken up to the structural
 - Soffit and movement joints
- A schedule of proposed finishes together with specifications of any proprietary systems must be included in the design.
- Plans showing the proposed locations of any fire barriers must be included in the design. For fire barrier standards see TfL Standard YEL 04.

8 Materials Standards

All materials must be specified / sourced and installed in accordance with the parameters set out in TfL Standard GRN 01, which includes details of requirements for minimum recycled content.

Reference should also be made to TfL 'Black Folder' – Product Selector for examples

of materials and colours of wall finishes acceptable to TfL.

All colours shall be approved by the Infrastructure Manager prior to commencement of works.

Compatibility with existing ceiling finishes must be demonstrated prior to commencement of work taking into account preservatives, stains and varnishes.

Unless stated otherwise within the design brief the normal period between re-decorations shall be assumed to be five years and the design life of all finishes shall be such that replacement will not be required within that period. For materials where replacement is not expected between major refurbishments e.g. acoustic rafts the design life shall not be less than 20 years.

8.1 Paints

Generally paints used as finishes to internal ceiling surfaces shall be water based emulsions conforming to the requirements of BS 7719.

8.2 VOCs

The emissions of VOCs from paints and varnishes are regulated by the directive 2004/42/CE, implemented in the UK by the Volatile Organic Compounds in Paints, Varnishes and Vehicle Refinishing Products Regulation 2005. Products containing high organic solvent content should be avoided (EU VOC Solvent Directive 1999/13/EC).

Reference should be made to GRN 01 for acceptable VOC levels. Where maintenance

/ durability requirements do not allow compliance with this level, dispensation must be sought.

8.3 Suspended Ceilings

Components and fixings shall be of nonferrous materials unless suitably treated to prevent rusting and shall be compatible with any other adjoining materials.

8.4 Acoustic Rafts:

Panels shall be fabricated from Camira Fabric, Cara range, or similar accepted.

9 Installation

Ensure compliance with The Health and Safety at Work Act, The Construction Design and

Management Regulations 2007 and regulations regarding working at height.

Careful consideration of the timing of ceiling installation should be considered to avoid damage to ceiling components by other trades. The existing substrate must be sound, clean, dry and free of any loose material or other visible defects before any new surface finishes are applied.

All finishes must be applied in accordance with the manufacturer's recommendations.

9.1 Painted Ceiling Finishes

Paint systems should be applied with at least one primer coat one undercoat and one finishing coat or in accordance with manufacturer's recommendations.

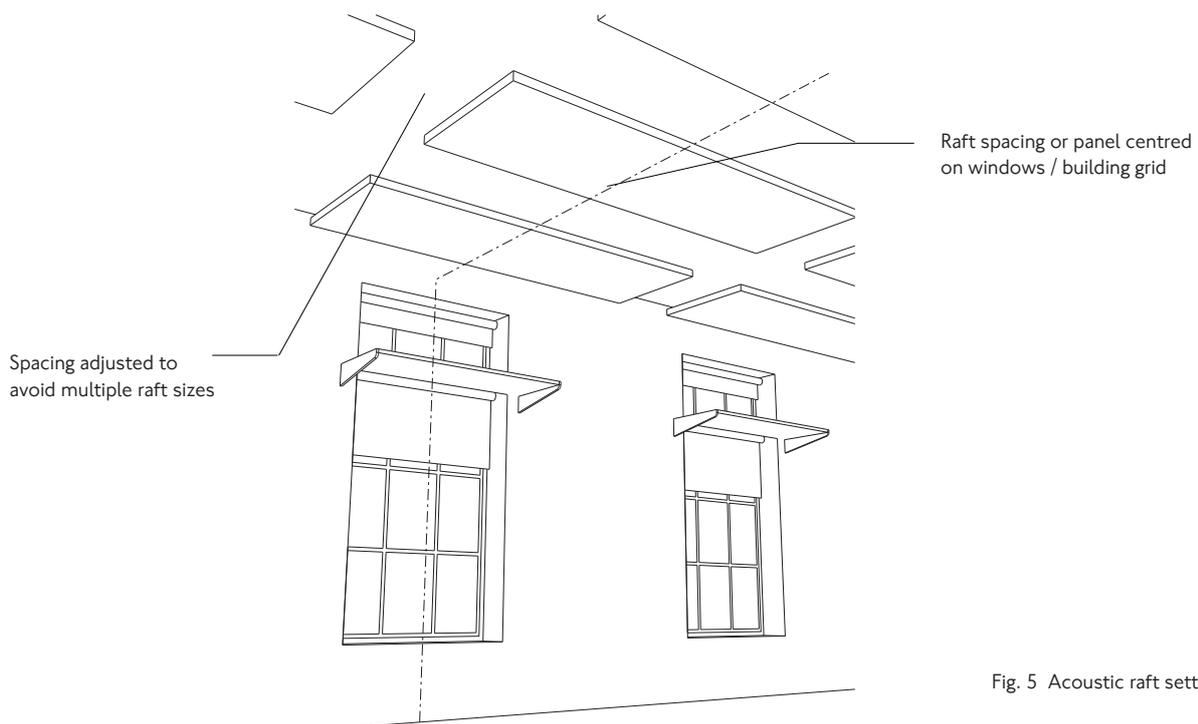


Fig. 5 Acoustic raft setting out.

9.2 Acoustic Rafts

Acoustic rafts shall be mounted in accordance with manufacturer's fixing methods and instructions.

Rafts should be set out to align with windows and structural grid and spaced so that wherever possible: (See Fig. 5)

- Standard sized panels are used
- Rafts along opposite edges are of equal size.

Rafts shall be positioned to allow sufficient passage of air to the exposed soffit for the purposes of exploitation of thermal mass.

10 Handover

The finished ceiling surface shall be smooth, of uniform colour and free of any paint runs or other visible imperfections.

Any fittings (switches, cable runs, light fittings, etc.) shall be free of paint.

All ancillary components will be in good working order with spare fittings passed to the employer for storage.

Reference should be made to the Manual to the Standards for general requirements for handover and submissions required for the Operation and Maintenance Manual. The following information shall be provided specifically for ceiling finishes:

- Complete set of as built drawings to include items set out in section 6
- Completed finishes schedule

10.1 Suspended Ceilings / Acoustic Rafts

Provide 5m² or 2% of ceiling area (whichever is the greater) of spare ceiling tiles.

11 Maintenance

When new equipment is added or alterations are made to existing installations there shall be no detrimental impact on the ease of maintenance of existing facilities unless through dispensation from the Infrastructure Manager.

All maintenance should be carried out strictly in accordance with manufacturer's recommendations as included in the Operation and Maintenance Manual.

12 Further information

12.1 Suspended Ceilings

Further information can be found in the AIS (Association of Interior Specialists) Site Guide for Suspended Ceilings.

Revision History:

Issue	Date	Description
1	18th September 2000	Reformatted - LU Facilities
2	December 2010	Reformatted and revised as TfL Head Office Standards

Relevant British / European Standards

- BS 8290:** Suspended ceilings. Code of practice for design has been superseded by BS EN 13964 but remain current at time of press.
- BS 476:** Fire tests on building materials and structures
- BS 7719:** Water-borne emulsion paints for interior use.
- BS EN 13964:** Requirements and test methods for suspended ceilings

02

Floor Finishes

Issue 4— December 2010



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02 Floor Finishes

1 Scope

This Standard sets out requirements for floor finishes in non-operational premises intended for use as offices by TfL.

2 References

This Standard should be read in conjunction with the accompanying Manual to the Standards and TfL standards GRN 01 and RED 03.

It shall be the responsibility of the designer/installer to reference and comply with all the above and any other TfL Standards where necessary.

Relevant British Standards referred to in the text are listed on the rear cover. Unless otherwise stated, references are to the latest editions and revisions.

3 Definitions / Abbreviations

For a list of general abbreviations and definitions used within the Standards please see the accompanying Manual to the Standards.

Definitions specific to this standard are:

- Sub Floors: the supporting structure to which the floor covering is laid.

Abbreviations specific to this standard are:

- SRV: Slip resistance value
- PTV: Pendulum test value
- RAF: Raised access floors

4 General Guidance

4.1 Raised Access Floors

Reference should be made to the definition contained within the Manual to the Standards for Levels of Refurbishment. Where raised access floors are installed a project shall be deemed as an Intermediate Level refurbishment for which a number of minimum criteria will have to be met unless dispensation is agreed with the Infrastructure Manager.

4.2 Floor Finishes

Before the specification and installation of new floor coverings all options for re-use / reorientation must be explored.

Where possible, carpet manufacturers who offer a take back scheme to reuse / recycle carpet shall be used.

Redundant carpets must be sent to an appropriate recycling centre.

All floor finishes shall comply with the requirements of The Workplace (Health and Safety and Welfare) Regulations 1992.

Floor finishes shall comply with BS 8300 and recommendations within RIBA Enterprises: Designing for Accessibility.

The Specifier's Handbook for Inclusive Design – internal floor finishes, which provides guidance on the inclusive design of internal floor finishes in line with BS 8300 and the requirements of the Disability Discrimination Act (DDA). These recommendations should be followed at all times including but not restricted to:

- Very shiny surfaces shall be avoided due to glare and being perceived as slippery.
- Large repeating patterns should be avoided.
- Floor surfaces should offer a level of slip resistance that provides firm foothold and wheel grip.
- Adjacent floor surfaces should have similar levels of grip.
- Appropriate entrance flooring systems should be used to minimise the ingress of soil and moisture to the building. (If practicable a mat well with recessed system with replaceable inserts should be used).
- Deep pile carpets and coir matting should not be used on the surface of a floor or within matt wells.

Poor selection of floor finishes, incorrect cleaning regimes and negligent maintenance can result in the creation of slip and trip hazards. Design considerations must take into account, and balance, slip resistance and ease of cleaning.

No floor finish shall impair the free movement of any door. Where necessary, existing doors shall be adjusted to suit the new finish.

Note:

Insulating barriers may be required below the raised access floor to prevent flanking transmission of sound. The option of taking partitions down to the sub floor should be avoided where possible to facilitate future flexibility and avoid cut floor tiles.

In addition to those required at fire resisting partitions and for acoustic requirements, cavity fire barriers shall be provided at a maximum of 8m centres across the entire width and length of the floor.

All materials used in the installation of any floor finish or raised flooring system must have been tested and approved for fire resistance and surface spread of flame in accordance with BS EN ISO 9239.

In general where new carpet is to be laid carpet tiles shall be used. However, due to the range of property in the TfL portfolio and the potential need to replace incumbent sheet or roll carpet (in historical buildings or areas such as traditional staircases), on a like for like basis, these carpet types are also included in the Standard.

5 Construction Design and Management Regulations (CDM)

Reference should be made to the Manual to the Standards for requirements under the CDM regulations.

6 Design Standards

Setting out requirements must be considered at the design stage. For setting out guidelines see Section: 9 Installation.

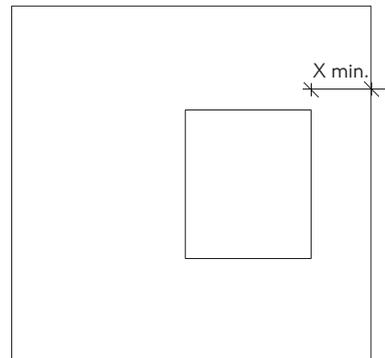
6.1 Sub-floors

The sub-floor shall comply with the tolerances allowed for 'In situ-floorings' in BS 5606 unless agreed otherwise by the Infrastructure Manager. Where an existing floor does not fall within the required tolerances the method of levelling shall be agreed with the Infrastructure Manager before work commences and comply with the recommendations in BS 8203 and BS 5325.

6.2 Raised Access Floors (RAF)

All RAF should comply with the Property Services Agency (PSA) Method of building performance specification 'Platform Floors (Raised Access Floors)', MOB PF2 PS/SPU and be designed to BS EN 12825.

RAF should be of rigid construction, fully accessible wherever possible and of a minimum medium structural grade, whilst capable of supporting the specified design load with minimum deflection. Where the void beneath the RAF is to be used as a plenum for the distribution of air, specialist design advice should be sought.



Note: X= Manufacturer's recommendation.
Fig. 1 RAF tile cut out.

Raised floors shall be sealed against the ingress of dust.

Pedestals shall be fixed to the sub-floor using mechanical fixings in addition to adhesives, unless the installer can prove by a site test that adhesive fixing only is sufficient.

The support system must provide sufficient adjustment to ensure a flat and level surface can be obtained across the entire floor and allow for further adjustment throughout the life of the floor.

All substantial metal parts of the floor are to be electrically continuous and fully earth bonded in accordance with BS 7671 (IEE Wiring Regulations.)

RAF shall be designed with a minimum zone of 150mm unless otherwise agreed with the Infrastructure Manager.

Where not installed as part of the base build RAF shall be set out to account for the structural grid.

Table 1. Performance Requirement for Class HC/U underlays (when tested in accordance with BS 5808)

Property	Performance requirement	
Breaking Strength	40 N min/	
Elongation	10% max extension for applied force of 40N	
Loss in thickness		
a) Static loading: recovery period 24hr	Fibrous underlay	40% max
	Non-fibrous underlay	15% max
	Combined underlay	40% max
b) Dynamic loading: after 1000 cycles	Fibrous underlay	40% max
	Non-fibrous underlay	15% max
	Combined underlay	20% max
Thickness deviation		
a) Mean original thickness from nominal thickness	Fibrous and combined underlay	15% max
	Non-fibrous underlay	12% max
b) Difference between maximum and minimum original thickness	Fibrous and combined underlay	4mm max
	Non fibrous underlay	3mm max
Compression after dynamic loading	2mm min, 4mm max.	
Work compression after dynamic loading	75 J/m ² . min, 200J/m ² . max.	
Retention of original work of compression	40% min.	
Resistance to breaking and cracking	No cracks longer than 50mm.	

Table 2. Use Classification of Typical Resilient Floor Coverings

Area of Use	BS EN 685 classification	DIN 51130	Suggested floor covering
Kitchenette areas, lifts	Public and commercial Class 33	R 9/10	Rubber
Anti static electronic storage facilities	Light Industrial Class 41		Rubber
Back of house areas e.g. refuse stores / wash down areas	Light Industrial Class 43	R12	Plastic

Where electrical outlet boxes are required, they should be fixed into pre-cut holes within the floor panels in accordance with manufacturer’s recommendations and shall be flush with the finished floor surface.

Unless otherwise concealed, for example within a partition, wiring and cables required to pass through the floor must do so through purpose made floor boxes or grommets which shall incorporate a bezel / trim to conceal the cut edge of the floor finish.

Cut outs shall be positioned a minimum distance from the edge of the tile in accordance with manufacturer’s recommendations. (See Fig 1) and be large enough to retrieve a nomad box without lifting tiles.

6.3 Carpet Underlays

Underlays must be flame retardant and certified as being of Class HC/U, suitable for heavy contract use, as defined in BS 5808.

Underlays must comply with the performance requirements of BS 5808 and BS EN14499.

Minimum performance requirements for underlays to meet Class HC/U are summarised in Table 1.

On stairs felt underlay should be used to prevent degradation on the exposed front edge.

Felt or fibrous underlay should be used with carpets that have seams on the backing.

6.4 Carpets

All carpets must conform to the requirements of BS EN 1307.

Category: Type 1
 Level of use class: Heavy Contract 33
 Luxury rating class: LC1

Carpets must comply with the castor chair test requirements of BS EN 985 and carry a 10 year anti-fade, anti-stain and anti-static guarantee.

Carpet tiles should be non-directional to minimise waste.

6.5 Entrance Matting

Entrance matting must comply with BS 7953.

Table 3. Performance Criteria for Stone / Composite Floor Coverings

Property	Relevant standard	Performance	
Slip Resistance Value (SRV) / Pendulum test Value (PTV)	BS 7932	Sandblasted Finish	= or >65
		Honed Finish	35-65
Surface Roughness Value	BS 1134		20+
Coefficient of Friction ¹	BS 8204:Part 3,4,5 and BS7044: Part 2, Section 2.2	Sandblasted Finish	>75
		Honed Finish	35-45

Note:

Coefficient of friction to be measured between tile and smooth rubber sole in accordance with TRRL pendulum test.

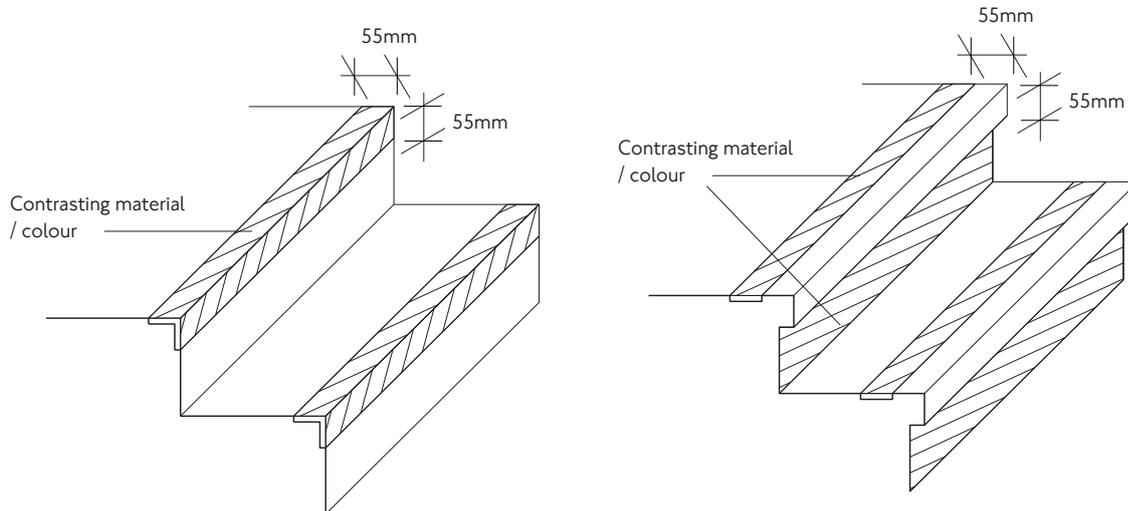


Fig. 2 Stair nosing - alternative options.

A minimum of 3 to 5 metres of barrier matting should be placed at the point of entry to the building unless agreed otherwise with the Infrastructure Manager.

Matting should be suitable to withstand heavy traffic and provide no discernible change in level at the entrance.

Joints in matting should not coincide with the main pedestrian flow / route.

6.6 Resilient Floor Coverings

The specific use and detailed specification of resilient floor finishes should be agreed with the Infrastructure Manager and where appropriate ICT team, but generally follow classifications to BS EN 685 as described in Table 2.

Floor composition is to be 'non-delaminating' and must not delaminate through use – i.e. the repeated movement of rolling loads (within the structural limits of the floor) throughout its life (15 year life expectancy).

Where anti-static properties are required, for example in ICT rooms, resilient floor coverings shall be in accordance with BS EN 1081 and factory bonded to raised access floors.

In all other areas a fabricated underlay of min 6mm marine plywood shall be used.

Access to the floor void must also be considered.

6.7 Stone / Composite Floor Tiles

Where applied to raised access floors stone / composite floor tiles shall be factory bonded in accordance with manufacturer's recommendations.

Design performance shall be in accordance with Table 3.

6.8 Alternative Floor Finishes

The use of floor finishes other than those specified in this standard must be agreed with the Infrastructure Manager.

6.9 Stairs and Ramps

New ramps and stairs shall comply with the requirements of The Building Regulations 2000 and recommendations within Designing for Accessibility.

Stair nosings shall be of a continuous, anti-slip material the full width of the tread applied integral to both the tread and riser. The nosing should be 55mm wide on the tread and riser and provide visual contrast between the remainder of the tread / riser.

7 Design / Contractor Submittal Requirements

Reference should be made to the Manual to the Standards for general requirements for

drawing and sample submittal requirements. Requirements specific to this standard are:

- A finishes schedule and corresponding drawings must be completed and approved by the Infrastructure Manager as part of the design process.
- Plans showing the proposed positions of fire barriers must be included in the design.
- Plans showing the location of any floor grommet or boxes and any other services penetrations must be included at the design stage.
- Samples of each type of floor finish in accordance with the Manual to the Standards must be approved prior to installation.

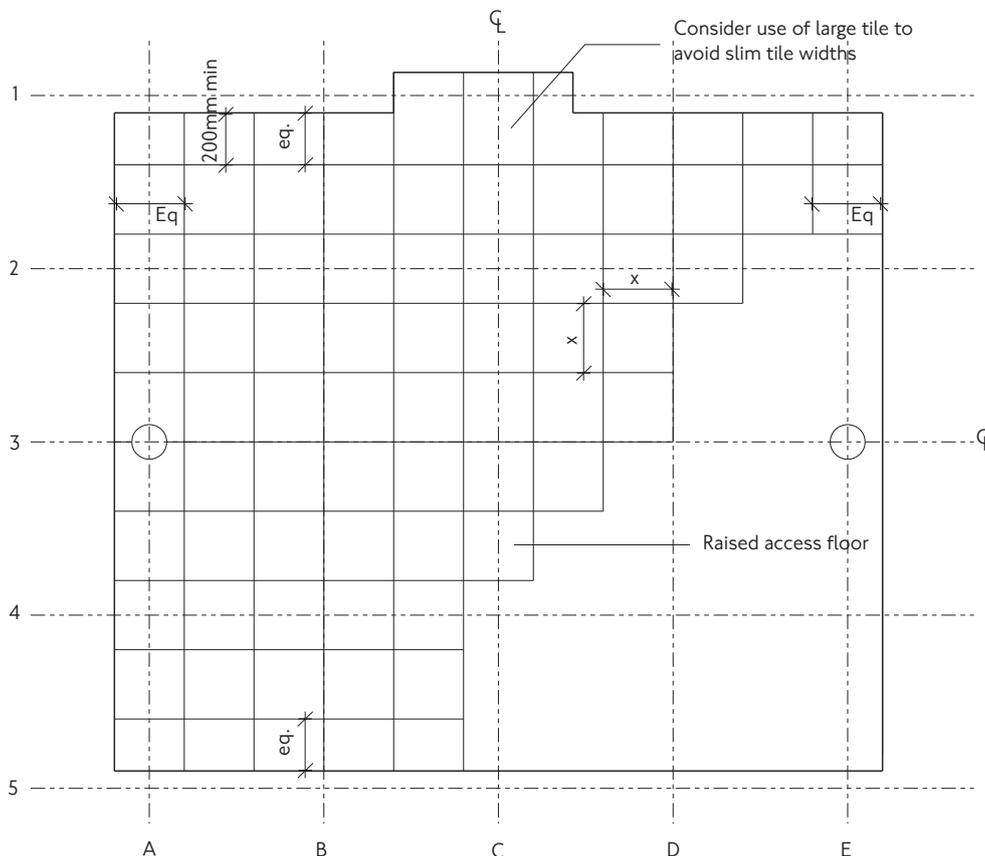


Fig. 3 Raised access floor setting out diagram

- Control samples: An area of the works shall be completed and approval gained for the appearance before proceeding with the remainder of the work.

8 Materials standards

All materials must be specified / sourced and installed in accordance with the parameters set out in TfL Standard GRN 01, which includes details of requirements for minimum recycled content.

Reference should also be made to TfL 'Black Folder' – Product Selector for examples of materials and colours of wall finishes acceptable to TfL.

All colours shall be approved by the Infrastructure Manager prior to commencement of works.

8.1 Raised Access Floors

Panels shall be protected from corrosion by the manufacturer's standard factory applied finishes. Edges of cut panels should be protected through the application of aluminium foil adhesive tape with a Class O spread of flame rating.

Floor panels shall have a cement based core to provide thermal mass, encapsulated in galvanized steel sheet.

8.2 Underlays

Where possible underlays made from recycled natural materials shall be used.

8.3 Carpets

Foam backed sheet carpets shall not be used. Polyvinyl chloride (PVC) backed carpet tiles shall not be used.

Unless agreed otherwise with the Infrastructure Manager pile fibres for carpet installations shall be of recycled solution dyed nylon.

9 Installation

9.1 Sub-Floors

The existing sub-floor must be sound, clean, dry and free of any loose material before any new surface finishes are applied or laid.

Coverings should not be laid on bases with a relative humidity above 75%.

9.2 Raised Access Floor

Raised flooring systems must be installed in accordance with the manufacturer's recommendations paying particular attention to expansion gaps where applicable.

Before commencing work ensure that fixtures around which panels are to be cut or over which supports are to bridge, are completed.

Where not installed as part of a base build the RAF should be set out to take account of structural grids and to minimise the requirement for cut tiles. Manufacturer's guidelines must be followed for minimum tile sizes and the requirement for additional pedestals (See Fig. 3).

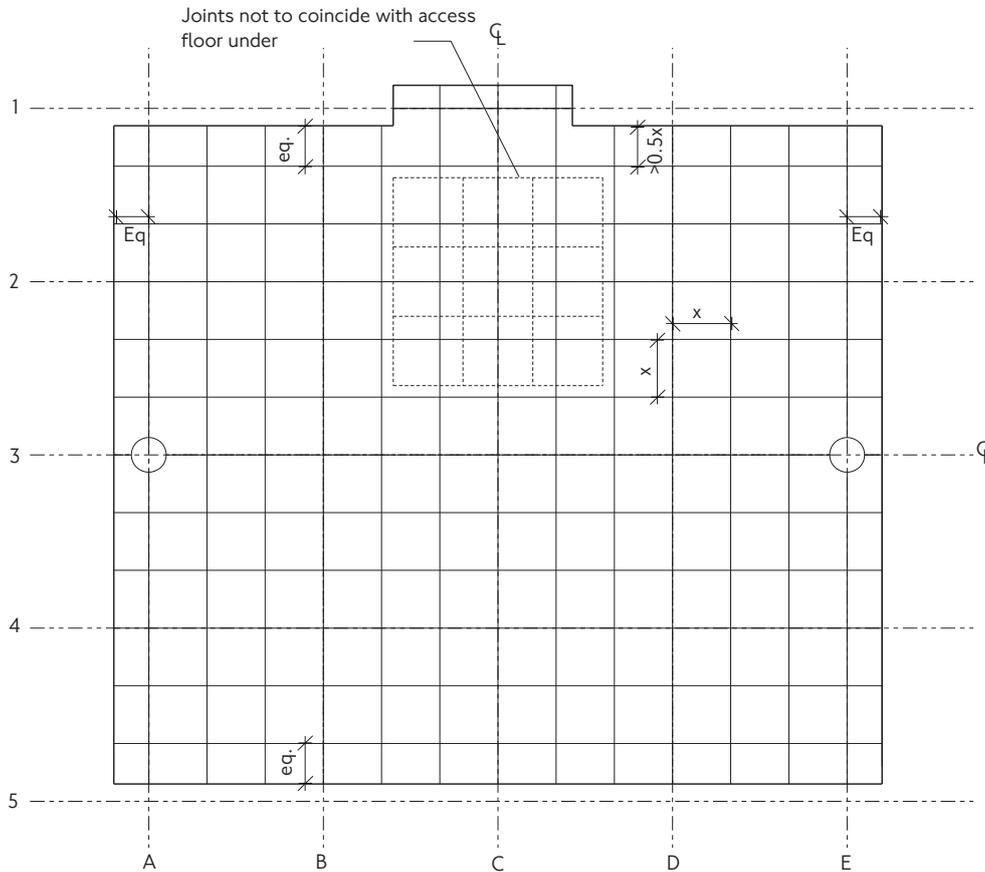


Fig. 4 Carpet Tile setting out diagram.

9.3 Floor Finishes - General

All floor finishes shall be laid in accordance with manufacturer’s recommendations using the same batch numbers.

Unless specifically recommended by the manufacturer, all floor finishes shall be laid using methods which allow removal without undue damage to either the finish or the sub-floor.

The adhesive type (and primer if recommended by manufacturer) should be as specified by the covering / underlay, manufacturer in compliance with TfL Standard GRN 01.

Exposed edges shall be securely fixed and protected with a continuous metal edge trim of a type approved by the Infrastructure Manager to provide a safe and hard wearing junction with the adjoining floor.

Where floor finishes abut skirtings, architrave or other vertical surfaces, edges shall be closely fitted without visible gaps.

No new carpet floor finish shall be laid over an existing carpet.

9.4 Carpet Underlays

Carpet underlays shall generally be laid with seams at 90° to those of the carpet finish.

Carpet underlays shall not be used in conjunction with carpet tiles unless specifically recommended by the carpet tile manufacturer.

9.5 Sheet / Roll Carpet

Sheet / Roll carpet floor finishes shall be installed such that:

- Seams and joints should be unobtrusive and kept to a minimum
- Seams shall be positioned so that where possible:
 - They run the length of an area.
 - Traffic runs in the direction of the seam rather than across them.
 - Incident light does not strike across them.
- Seams are positioned away from areas subjected to heavy wear, e.g. doorways, lift entrances, etc.
- Joints at doorways shall be made within the thickness of the door. Patterns across seams shall be accurately matched.
- Changes of direction of pile shall be mitred where the pattern allows.

Note:

When factory cutting composite tiles, ensure that factory ambient temperature is at a suitable level to minimise thermal expansion of tiles when installed in building to prevent 'locking' of tiles once building is in operation.

- The pile of adjoining lengths of carpet shall run in the same direction, unless recommended otherwise by the carpet manufacturer or the shape of the area to be carpeted renders it undesirable.

Sheet carpets shall not be installed over raised floors.

9.6 Carpet Tiling

Tiles should be set out from the centre of the room so that wherever possible:

- Tiles along opposite edges are of equal size.
- Edge tiles are more than 50% of full tile width.
- Joints between carpet tiles shall be positioned so as not to coincide with the joints in any raised flooring system.

Where floor boxes or grommets or any other services penetration exist floor tiles shall be neatly cut around the opening.

9.7 Resilient Floor Coverings

Floor to be laid flush with adjacent floor finishes – adjust levels of base and sub base to suit.

Seam welding shall be strictly in accordance with manufacturer's recommendations.

For anti-static floor coverings agree location for and fix brass plate, size 50 x 75 mm, engraved with the following details:

- The words 'Anti-static Floor'
- Manufacturer and reference of flooring

- Name of flooring contractor
- Date when laid

9.8 Stone / Composite Floor Tiles

Ensure no lipping between adjacent tiles on differing backgrounds. Also ensure that joints between tiles on adjacent backgrounds are the same width and sealed with a removable clear silicone sealant.

Apply impregnator to tiles in three applications after tiles have been bonded to raised access floor tiles and before floor is re-laid.

Ensure that the specification of impregnator and method of application strictly in accordance with manufacturer's recommendations.

10 Handover

The finished floor surface shall be free of lumps, ripples, gaps or other noticeable variations in pattern or colour.

Following completion, provide spare tiles in protective packaging for client spares – spares to be from same batch to ensure colour match. 5m² or 2% of floor area shall be provided as spares (whichever is greater).

Reference should be made to the Manual to the Standards for general requirements for handover and submissions for the Operation and Maintenance Manual.

The following information shall be provided specifically for floor finishes in good time for inclusion in the building's Operation and Maintenance records:

- Complete set of as built drawings to include items set out in Section 7
- Completed finishes schedule

Raised access floor:

- After completion of the floor and associated services, arrange for tests to demonstrate that the floor is electrically continuous and fully earth bonded. Points chosen for testing to include randomly selected pedestals, stringers, tops and bottom of panels, etc.
- The raised access floor shall be 'de rocked' prior to handover.

Rubber flooring:

- Rubber flooring shall be washed and re-sealed (if required) in accordance with manufacturer's recommendations. Anti-static flooring shall be tested with results recorded and submitted for inclusion in Operation and Maintenance manuals.

11 Maintenance

When new equipment is added, or alterations are made to existing installations, there shall be no detrimental impact on the ease of maintenance of existing facilities unless through dispensation from the Infrastructure Manager.

Regular maintenance is essential to ensure continued performance of floor finishes and maximise product life span.

Maintenance should be carried out strictly in accordance with manufacturer's instructions

and details included in the Operation and Maintenance manuals.

12 Further information

- RIBA Enterprises: Designing for Accessibility.
The Specifier's Handbook for Inclusive Design – internal floor finishes.
- CIRIA publication, 'Safer surfaces to walk on - reducing the risk of slipping'.

Revision History:

Issue	Date	Description
1		Preliminary Issue
2	20th November 1999	Minor Revisions
3	18th September 2000	Reformatted - LU Facilities
4	December 2010	Reformatted and revised as TfL Head Office Standards

Relevant British / European Standards

BS 8300:	Design of buildings and their approaches to meet the needs of disabled people – Code of practice
BS 5606:	Guide to accuracy in building
BS 8203:	Code of practice for installation of sheet and tile flooring
Bs 5325:	Installation of textile floor coverings. Code of practice
BS 5808:	Specification for underlays for textile floor coverings
BS 7953:	Entrance flooring systems, selection installation and maintenance.
BS 7671:	Requirements for electrical installations
BS EN ISO 9239:	Reaction to fire tests. Horizontal surface spread of flame on floor-covering systems. Determination of the burning behaviour using a radiant heat source
BS EN 12825	Raised Access Floors
BS EN14499:	Textile floor coverings. Minimum requirements for carpet underlays
BS EN 1307:	Textile floor coverings. Classification of pile carpets
BS EN 985:	Textile floor coverings. Castor chair test
BS EN 685:	Resilient and laminate floor coverings. Classification
BS EN 1081	Resilient floor coverings. Determination of the electrical resistance
DIN 51130:	Testing of floor coverings; determination of the antislip properties; workrooms and fields of activities with slip danger; walking method; ramp test German National Standard 2004

05

Internal Solar Shading Devices

Issue 1 — December 2010



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05 Internal Solar Shading Devices

1 Scope

This Standard covers the requirements for internal solar shading devices in non-operational premises intended for use as offices by TfL. This Standard does not include solar films – refer to RED 07: Window Films.

This Standard supersedes LUF-A006-ST Window blinds.

2 References

This document should be read in conjunction with TfL Standards RED 03, 08, 09, YEL 01 GRN 01,02, BLU 01, 03, 04, 13, 17.

It shall be the responsibility of the designer/installer to reference and comply with all the above and any other TfL Standards where necessary.

Relevant British Standards referred to in the text are listed on the rear cover. Unless otherwise stated, references are to the latest editions and revisions.

3 Definitions / Abbreviations

For a list of general abbreviations and definitions used within the Standards please see the accompanying Manual to the Standards.

Definitions specific to this standard are:

- Sunlight glare – glare attributed to direct sunlight.
- Sky glare – Glare from windows arising from excessive contrast between the luminance of the visible sky and the internal surfaces.

- Relevant area - an area within the office which contains workstations / benches/ desks/ close work / where visual aids are used.

4 General Guidance

In line with the requirements to gain a Health and Well Being credit toward BREEAM excellent, occupants must be provided with user controlled blinds to prevent glare and resulting eye strain in ‘relevant areas’ of the internal environment.

The Health and Safety (Display Screen Equipment) Regulations 1992 require that ‘windows shall be fitted with a suitable system of adjustable covering to attenuate the daylight that falls on the workstation’.

‘Good daylight design has also been linked to a 15% reduction in absenteeism in office environments and improvements in student attendance at school’ – British Council for Offices Guide 2005.

If no solar shading device currently exists, an appropriate internal system shall be used as these are generally cheaper, give greater user control and are easily retro-fitted to existing buildings.

Where internal solar shading is installed, consideration shall be given to the installation of light shelves which can improve illuminance by redirecting sunlight deeper into the building plan. Light shelves can also be used to reduce glare (See Fig. 1-2).

Reference should be made to the definition contained within the Manual to the Standards for Levels of Refurbishment. Where internal solar shading devices are installed a project shall be deemed a Minor Level refurbishment for which a number of minimum criteria will have to be met, unless dispensation is agreed with the Infrastructure Manager.

5 Construction Design and Management Regulations (CDM)

Reference should be made to the Manual to the Standards for requirements under the CDM regulations.

6 Design Standards

The use of internal shading devices should where possible maintain optimum day

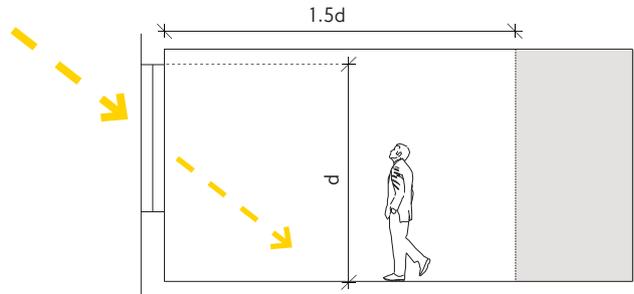


Fig. 1 Rule of thumb for daylight penetration.

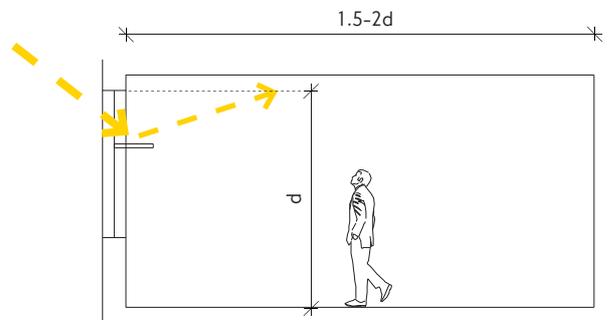


Fig. 2 Rule of thumb for daylight penetration - with light shelf.

lighting standards for the office workplace as described in TfL Standard GRN 02.

Reference shall be made to TfL Standard GRN 02 for required daylight factors and methods of calculation.

Table 1. Internal shading device characteristics		
Device	Advantages	Disadvantages
Roller blinds	Technically reliable, cost effective Advanced materials available for tailored control	Can restrict ventilation – if perimeter / natural May cause difficulty with inward opening lights
Light shelves	Can be used to redirect sunlight deeper into plan Maintains views out	Cost / maintenance – dirt trap
Venetian	Flexible shade control Does not interfere with natural ventilation Can be perforated to allow additional daylight through	Slightly more complex than roller May cause difficulty with inward opening lights Susceptible to misuse / malfunction Allows ventilation but can cause noise interference

The design of any internal shading system must be approved by the Infrastructure Manager, having considered orientation, window opening, daylight factor, fixing method and integration with building services and management systems.

Reference should be made to relevant BRE and CIBSE guidance for the calculation of solar control calculations e.g. CIBSE publication TM37:2006 and CIBSE publication. 'Design for Improved Solar Shading Control'.

6.1 Blinds

All blinds must be coordinated with window design and not interfere with window opening.

All internal blinds shall be roller type unless utilised as part of a sealed cladding / partitioning system, in which case venetian blinds will be acceptable.

Blinds shall be user operable. Where budgetary restrictions allow, blinds to external facades shall also be fitted with an automatic reset i.e. raising of blinds at midnight every day.

Blinds to high level clearstory glazing shall be linked to lighting control system to maximise/optimize internal daylight levels.

Roller blinds shall be controlled by a friction system that can be raised and lowered to any position by a smooth action continuous bead chain mechanism.

6.2 Light Shelves

Light shelves shall not be installed below 2100mm. Internal light shelves shall be used on facades receiving direct sunlight.

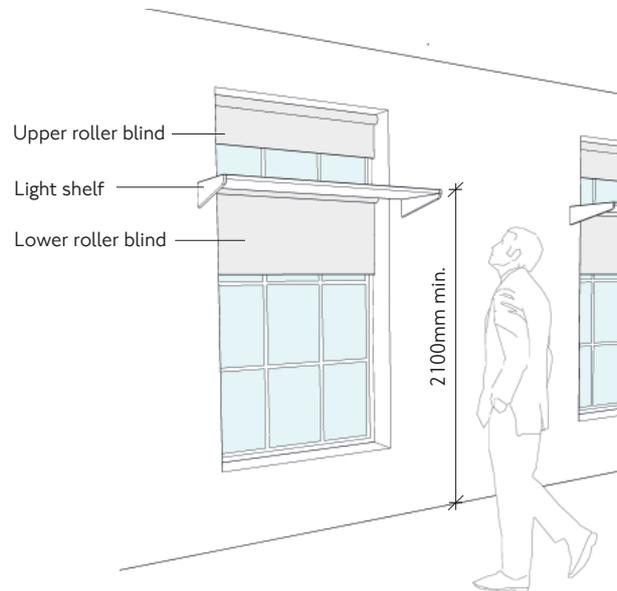


Fig. 3 Light Shelf.

Where light shelves are not considered suitable, justification for their admission shall accompany an application for dispensation.

The upper surface of the light shelf shall not be visible from any point in the room. Consideration shall be given to the shape and angle of the shelf to maximise potential benefits.

Light shelves shall be designed for ease of maintenance / cleaning, i.e. the use of hinged access to aid cleaning of the light shelf and glazing shall be provided.

The area of window above light shelves shall have automated blinds linked to the building lighting control system where applicable to maximise/optimize internal daylight levels. Blinds below light shelves shall be designed as Section 6.1 above.

7 Design / Contractor Submittal Requirements

Reference should be made to the Manual to the Standards for general requirements for drawing and sample submittal requirements.

8 Materials Standards

All materials must be specified / sourced and installed in accordance with the parameters set out in TfL Standard GRN 01, which includes details of requirements for minimum recycled content.

Reference should also be made to TfL Product Selector for examples of materials and colours of window blinds acceptable to TfL.

All colours shall be approved by the Infrastructure Manager prior to commencement of works.

All internal shading devices are to have PVC and halogen free construction.

8.1 Blinds

Materials for fabric roller blinds installed to external facades shall be PVC free – Hexcel Screen Nature Opaque 1260 fabric or similar and selected in accordance with Table 2.

Table 2. Internal Roller Blinds to External Facades

Property	
Material reflectance	>0.5
Transmittance	<0.1
Openess factor	
North facade	5%
West, South East facade	3%

9 Installation

Blinds and light shelves shall be installed in accordance with manufacturer's recommendations.

Fixing procedures shall take into account, and must not detrimentally affect, curtain walling or partitioning warranties.

Blind mounted head rails shall be straight, within maximum tolerance of +/- 3mm / m. and shall not display any signs of sagging or twisting . Ends shall be capped.

On inclined facades a tension or weight system shall be used to prevent blinds from sagging.

10 Handover

Ensure installation procedures followed. Ensure device is fully operational and that device does not interfere with opening window. Ensure shading device is clean and free from debris / dust.

Reference should be made to the Manual to the Standards for general requirements for handover and submissions required for the Operation and Maintenance Manual.

11 Maintenance

When new equipment is added or alterations are made to existing installations, there shall be no detrimental impact on the ease of maintenance of existing facilities unless through dispensation from the Infrastructure Manager.

Regular cleaning procedures will be required to ensure the effectiveness of internal solar shading devices and to prolong the life of the fittings.

Security / cleaners shall be instructed to raise / pull back blinds at the end of each working day to reduce over use and restriction of natural day lighting, where automated systems are not used.

12 Further information

- CIBSE: 'Day lighting and window design. Lighting Guide' LG:10: 1999
- CIBSE: 'Design for Improved Solar Shading Control'.TM37:2006
- Estimating daylight in buildings Parts 1 and 2 BRE Digests 309 and 310, London: Construction Research Communications, 1986.

Revision History:		
Issue	Date	Description
1	December 2010	Supersedes LUF-A006-ST Window blinds

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Relevant British / European Standards

- BS EN 12464-1** Light and lighting. Lighting of work places. Indoor work places.
- BS EN 12665** Light and lighting. Basic terms and criteria for specifying lighting requirements.
- BS EN 13220** Internal blinds. Performance requirements including safety.

01

Signage

Issue 1 — December 2010



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01 Signage

1 Scope

This Standard sets out the requirement for all safety and non-statutory signage to all premises intended for use as offices by TfL. It is intended that the document will support the navigation of both staff and visitors.

This document part supersedes LUF-A001-ST Interior decoration - general principles

2 References

This Standard should be read in conjunction with the Manual to the Standards and TfL standard Red 03.

It shall be the responsibility of the designer/installer to reference and comply with all the above and any other TfL Standards where necessary.

Relevant British Standards referred to in the text are listed on the rear cover. Unless otherwise stated, references are to the latest editions and revisions.

3 Definitions / Abbreviations

For a list of general abbreviations and definitions used within the standards please see the accompanying Manual to the Standards.

4 General Guidance

General guidance found in BS 8300 for 'surfaces and communication aids' should be followed at all times.

Signage must form part of an integrated communication system that gives clear directions, information and instructions for the use of the building.

The colour, design and typeface of signs should be consistent throughout the building.

The signage strategy should accommodate all users whether familiar with the building or not.

The overarching objective of the signage strategy should be one of clarity through simplicity and the avoidance of over population of directions.

The main contractor shall be responsible for all statutory signage which must be fully coordinated with any other directional signage and the overall signage strategy.

5 Construction Design and Management Regulations (CDM)

Reference should be made to the Manual to the Standards for requirements under the CDM regulations.

6 Design Standards

6.1 General

The design and placement of safety signs must comply with the requirements of The Health and Safety (Safety Signs and Signals) Regulations 1996, statutory requirements and European safety signs directive (92/58/EEC).

As part of the requirements of Disability Discrimination Act (DDA) 1995 inclusive signage may be required: legible to people with visual impairment; to form part of the way finding strategy of the building. The Joint Mobility Unit (JMU) together with Sign Design Society produced 'Sign Design Guide – a guide to inclusive signage'.

Key Points:

- The sign board should be colour and tone contrasted with the background. (A difference in LRV of 70 points between the letters symbols or pictograms and the signboard and the signboard and the wall ensures good visual contrast- BS 8300).

- Signs should be fixed 1.4-1.7m above floor level with easy access for close viewing or touching.
- The sign background and characters should have a non reflective finish or gloss factor of less than 15%.
- Character size (min):
Long distance – 150mm
Medium range – 50-100mm
Close up reading – 15-25mm.

The typeface of TfL is New Johnston, which should be set in mixed upper and lower case. New Johnston Medium shall be used for all text in relation to signage.

Where visually impaired users of the building cannot be served solely by visual signs, tactile signs will be incorporated. Braille should be English Standard Braille with Grade I type used for single words and short descriptions and Braille Grade II for longer descriptions and sentences.

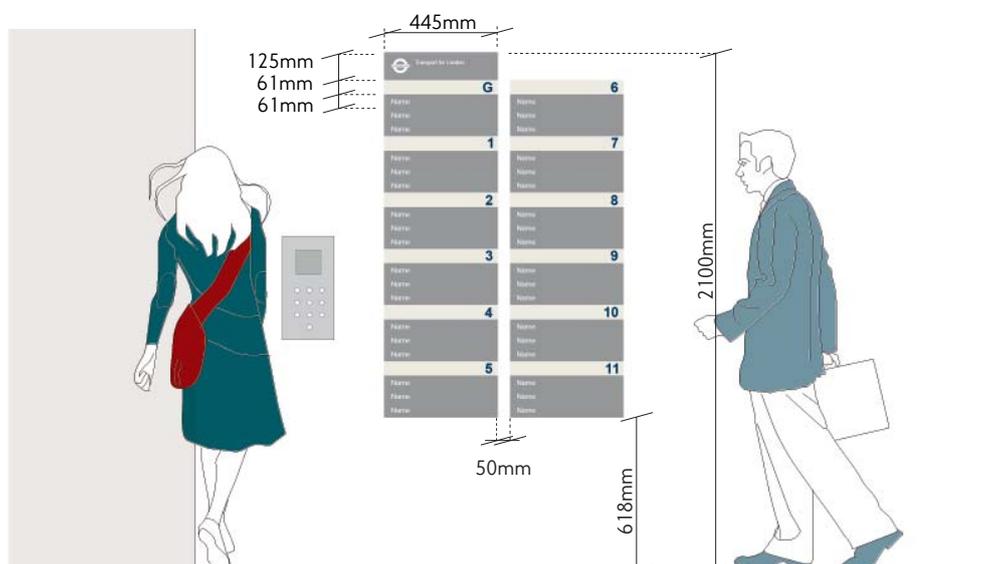


Fig. 1 Front of House Directory.

Signs to facilities for disabled people, such as accessible entrances and accessible toilets, should incorporate the International Symbol for Access.

Universally accepted colour coding should be used for the background and text of warning signs as appropriate. Safety signs including fire safety and fire escape signs should conform to BS 5499-4 and BS 5499-5.

6.2 Directional Signage

The directional signage within refurbished and new offices should follow the following principles.

6.2.1 Front of House

A ‘front of house’ directory listing all floors and the principle departments and organisations should be clearly visible at the building reception level before entering the means of vertical circulation.

‘Slats’, upon which each department or directorate is printed, shall be interchangeable to allow movement between floors.

6.2.2 Arrival on Floor

Each floor shall have a floor directory. This will use the same format as the building directory on the ground / principal floor but will incorporate a floor pictogram - orientated to reflect the orientation of the building - illustrating the colour coded sections of the floor, location of the viewer, principle accommodations such as social and orientation space adjacent to the lift lobby, meeting rooms, W.C.s etc.

Below this pictogram at a height suitable for both wheelchair and non-wheelchair users,



Fig. 2 - Floor Directory.



Fig. 3 Staircase Directory.

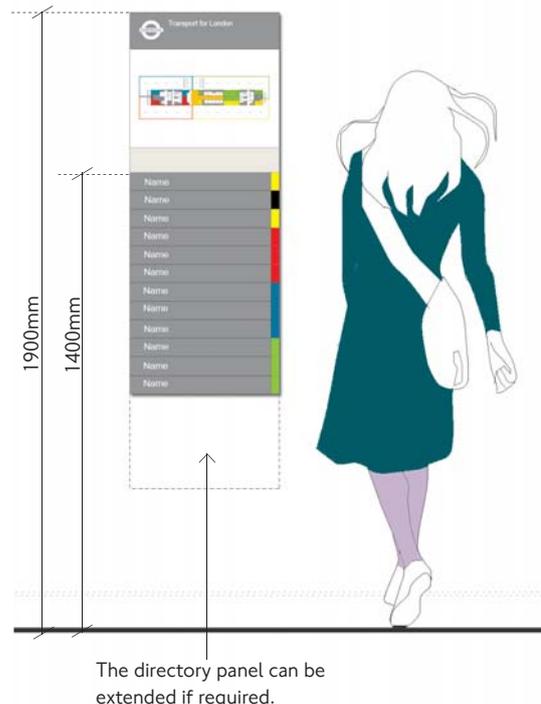


Fig. 4 Floor Directory setting out.

an embossed floor number shall be provided for disabled users who are not able to make use of the voice indicators in the lifts or the illuminated floor indicator.

The lower portion of the sign shall contain the directory listing the departments and directorates on the relevant floor – the colour of the section in which the department or directorate sits shall be indicated.

To ensure simplicity, the sub division of directorates or departments shall be limited to that which will fit on a single directory board. If further sub division is required it is proposed that this is achieved on the floor plate through branding identification which will be of more relevance once a visitor has navigated their way to the correct portion of the floor.

In addition, where a separate stair lobby is provided, each stair landing will be provided with a floor directory. Where this stair opens onto the main lobby a simplified directory shall be provided containing all the information provided in the main lobby but without the pictogram.

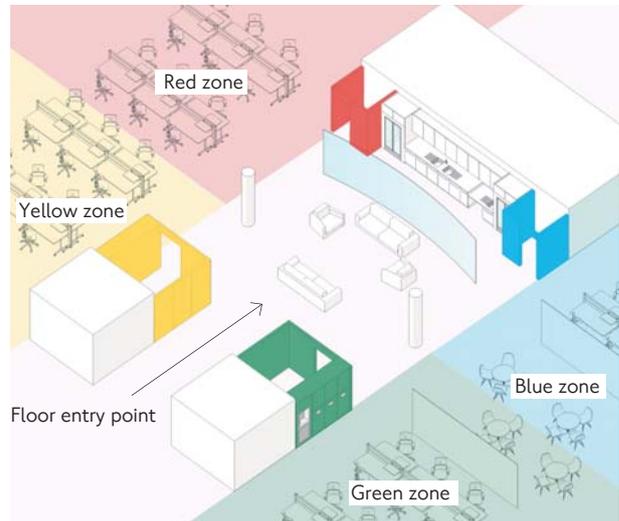


Fig. 5 TfL Palestra. Coloured joinery used to orientate user to floor colour zones.

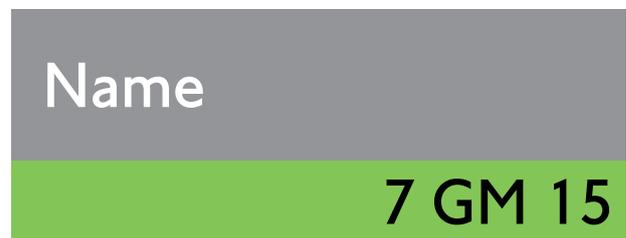


Fig. 6 Facility signage. This sign reads 7 (for seventh floor), G (for green zone), M (for meeting room) and 15 (for room no. 15).

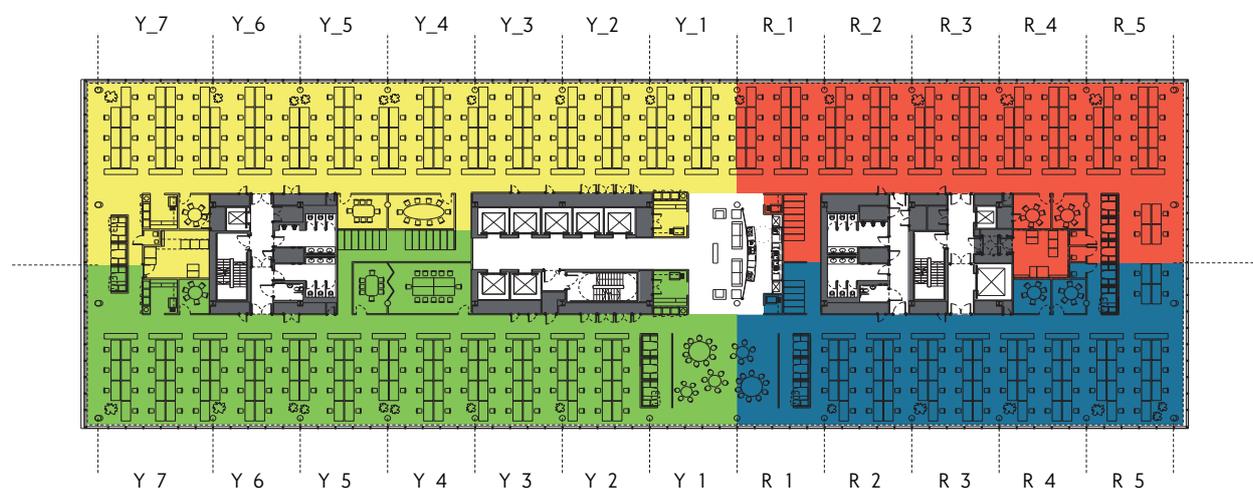


Fig. 7 TfL Palestra, Floor plan divided into colour coded quarters.

6.2.3 On Floor Navigation

In order to aid the management of TfL head offices a unique reference shall be given to each facility on each floor. This will allow any member of staff to report an issue with sufficient accuracy for it to be resolved without delay due to ambiguity of location.

To achieve this larger floorplates shall be divided into sections and colour coded. The colour coded sections of the floor plate should be indicated through the use of a flash of corresponding colour, e.g. coloured joinery items, providing a visual key in the next step of the journey. This flash of colour should be visible when entering the floor from the orientation space / lobby.

6.2.4 On Floor Signage

The on floor colour coding shall extend through to the signage of meeting rooms, seating booths, zones of desks and other support accommodation, including storage areas. Each facility shall be given a unique reference code containing the floor number, the on floor colour section it can be found in, its use (meeting room, booth etc.) and its unique number.

Providing directional signage for open plan desk layouts can be complex as flexibility must be incorporated as the layouts of the desks and where individuals sit within groups of desks often change.

Open plan office areas within each colour section shall be divided into groups using buildings lines, columns etc. as the boundaries between each group. The reference for each group of desks shall follow the same rules established for areas such as the meeting

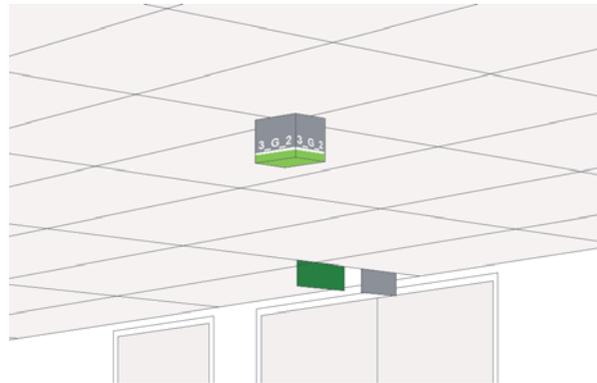
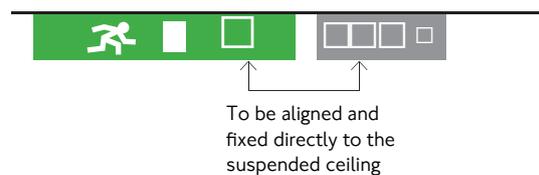
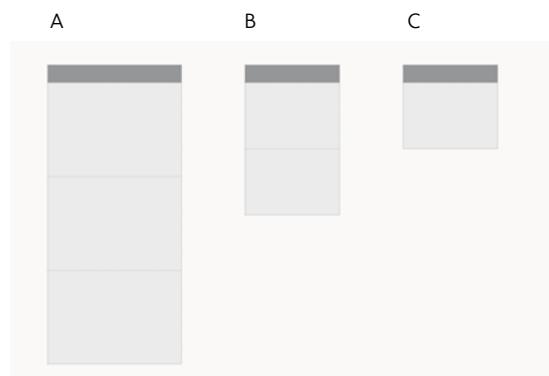


Fig. 8 - Magnetic cubes fixed to suspended ceiling.



Signs suspended from the ceiling. Emergency exit and toilet signs will be located outside the entrances to the cores. The latter will be aligned to match the former's size and position.

Fig.9 Suspended ceiling signs.



- A. 3 x A3 replaceable display of information with header panel
- top of panel at +1700mm above floor level
- B. 2 x A4 display with header panel
- top of panel at +1700mm above floor level
- C. 1 x A4 display with header panel
- top of panel at +1100mm above floor level

Fig. 10 Additional signage

rooms and shall be displayed on magnetic cubes placed on the ceiling where possible. Where this is not possible e.g. where an exposed soffit / acoustic panels are utilized, alternative ceiling signage must be agreed with the Infrastructure Manager.

Desk group references shall then also be used as part of the postal addressing for the building with each group having one 'post box' at the end of one of the banks of desks. Support facilities such meeting rooms, computer equipment rooms etc. shall also use the colour coding to assist in identifying their location. The following prefixes should be used:

M	= Meeting room
T	= Training room
C	= Conference room
MH	= Mini Hub
PB	= Phone Booth
TER	= Technical equipment room
FM	= Facilities Management room
P	= Plant room

Where more than one of each room exists in a colour zone then a numerical suffix should be used to identify it.

6.2.5 Emergency Signage

The emergency escape signage shall be in accordance with statutory requirements. Signs indicating the location of the building's WCs both male & female and disabled shall be located adjacent to these emergency escape signs.

6.3 Call points

Depending on the building evacuation strategy 'call points' may be required. These

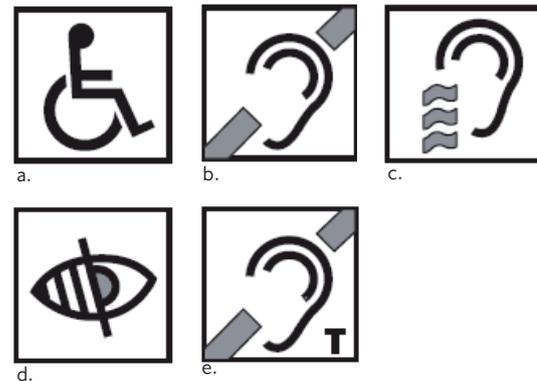


Fig. 11 Statutory signage, extract from BS 8300.

- a) International symbol for access
- b) World federation of the Deaf sign to indicate facilities for deaf people.
- c) Equipment to enhance microphone sound through an infrared receiver.
- d) Facilities for blind and partially sighted people.
- e) Equipment to enhance microphone sound for people whose hearing aid is fitted with a 'T' switch.

should provide further signage to display the evacuation strategy and any requirements specific to TfL. This signage shall take the form of a fixed header (identifying the subject) sitting above 3x A3 landscape format display panels where the relevant notices and building pictogram can be placed and easily updated.

At each call point the provision should be made to supply and fit 2x A4 landscape format signs to display the relevant advice regarding the use of any fire extinguishers provided.

6.4 Disabled refuge

A disabled refuge shall, where possible and in line with the building evacuation strategy, be provided within each of the stairs. At each refuge location signage in the form of 1x A4 landscape format display panel with a fixed header above shall be accommodated. As with the call point signage it is proposed that the information required is printed onto an appropriate sized piece of paper and inserted

into the display system to ensure it can be updated easily (See Option C Fig. 9)

6.5 Induction loops

Induction loops should conform to BS 7594 and BS EN60118-4.

As a minimum induction loops should be provided to reception areas, conference rooms and at least one small and one large meeting room per floor.

Induction loops must be designed to ensure that any spill over from one loop does not affect another loop or compromise confidentiality. The presence of an induction loop system should be clearly indicated for each looped area with the appropriate symbol as shown in Fig. 11, both at the approach to and inside the room or space in which the system is fitted.

7 Design / Contractor Submittal Requirements

Reference should be made to the Manual to the Standards for general requirements for drawing and sample submittal requirements.

A signage strategy document to include plans and a corresponding schedule showing the proposed locations, positioning / setting out, layout and content of all signs shall be included in the design.

8 Materials standards

All materials must be specified / sourced and installed in accordance with the parameters set out in TfL standards GRE 01 – Environmental Guidelines.

All material finishes / colours must be chosen in accordance with the TfL Product Selector and agreed with the Infrastructure Manager.

9 Installation Standards

The main contractor shall be responsible for all statutory signage which must be fully coordinated with any other directional signage and the overall signage strategy.

All other signage installation shall be carried out by the preferred signage supplier.

Fixings shall allow for the removal of signage without damage to the surface substrate.

Signage shall be installed after completion of decorations.

10 Handover

Signs shall be fixed straight, securely and shall be free of any paint.

In addition, reference should be made to the Manual to the Standards for general requirements for handover and submissions required for the Operation and Maintenance Manual.

11 Maintenance

When new equipment is added, or alterations are made to existing installations, there shall be no detrimental impact on the ease of

maintenance of existing facilities unless through dispensation from the Infrastructure Manager.

A periodic review of signage strategy and compliance thereof shall be agreed with the Infrastructure Manager and included in the signage strategy document to form part of the Operations and Maintenance Manual.

12 Further information

The JMU together with Sign Design Society produced 'Sign Design Guide – a guide to inclusive signage'.

Revision History:

Issue	Date	Description
1	December 2010	New standard part supersedes LUF-A001-ST Interior decoration - general principles

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Relevant British / European Standards

- BS 5499:** Graphical symbols and signs. Safety signs, including fire safety signs
- BS 8501:** Graphical symbols and signs – public information symbols.
- BS 7594:** Code of practice for audio-frequency induction-loop systems
- BS 8300 :** Design of buildings and their approaches to meet the needs of disabled people
Code of practice.
- BS ISO 16069:** Graphical symbols. Safety signs. Safety way guidance systems (SWGS)
- BS EN 60118-4:** Hearing aids. Magnetic field strength in audio-frequency induction loops for hearing aid purposes

03

Wall Finishes and Internal Partitions

Issue 4 — December 2010



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03 Wall Finishes and Internal Partitions

1 Scope.

This Standard sets out requirements for wall finishes in non-operational premises intended for use as offices by TfL.

2 References

This Standard should be read in conjunction with the accompanying Manual to the Standards and TfL Standards RED 08, GRN 01, 02, 03, YEL 01,02.

It shall be the responsibility of the designer/installer to reference and comply with all the above and any other TfL Standards where necessary.

Relevant British Standards referred to in the text are listed on the rear cover. Unless otherwise stated, references are to the latest editions and revisions.

3 Definitions / Abbreviations

For a list of general abbreviations and definitions used within the Standards please see the accompanying Manual to the Standards.

Definitions specific to this standard are:

- Partition: an internal, non-loadbearing dividing wall.

Abbreviations specific to this standard are:

- LRV: Light Reflectance Value is the total quantity of visible light reflected by a surface at all wavelengths and directions when illuminated by a light source.

4 General Guidance

4.1 Finishes

The Infrastructure Manager must be consulted where any proposal to re-decorate includes changes to existing finishes where:

- The life of the existing finish is likely to exceed the normal period between redecorations; or
- The existing finish forms an integral part of the design philosophy of the whole building.

Any such proposal must be supported by a cost / benefit analysis report justifying the requirement for re-decoration.

Where necessary, a careful study shall be made of any existing finishes to determine their condition and compatibility with a new material.

The LRV of a wall should be 30 points different from that of the ceiling and the floor. Skirtings should have the same LRV as the wall.

No new wall colour or texture shall either necessitate the provision of additional lighting to achieve the specified lighting levels or reduce existing levels within the space concerned.

The type of wall finish selected for a particular application is dependent on several factors, the most significant of which are:

- The condition of the existing substrate,
- Aesthetic requirements
- Building use and level of occupancy
- Cost (both initial and projected maintenance)

Service outlets, light switches, and other functional elements on the surface of walls should be distinguishable from the wall, using visual and textural contrast.

The location and detailing of switches and controls should take into account ease of operation, height, distance from corners, visibility and unobstructed access.

Switches should be located in accordance with the Approved Document Part M and where possible be located on a datum of 1000mm above floor level (See Fig1).

4.2 Internal Partitions

Reference should be made to the definition contained within the Manual to the Standards for Levels of Refurbishment. Where partitions are erected a project shall be deemed as an Intermediate Level refurbishment for which a number of minimum criteria will have to be met unless dispensation is agreed with the Infrastructure Manager.

5 Construction Design and Management Regulations (CDM)

Reference should be made to the Manual to the Standards for requirements under the CDM regulations.

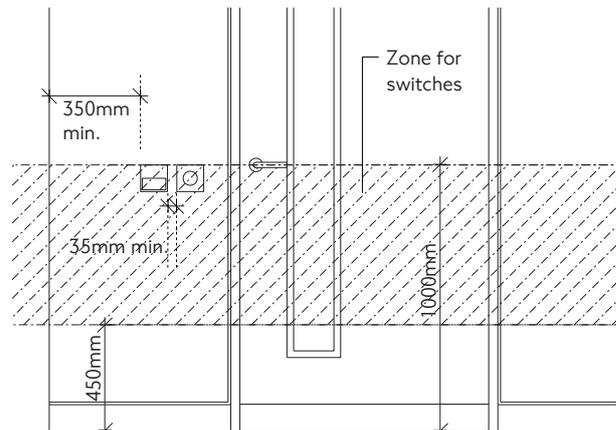


Fig. 1 Socket setting out

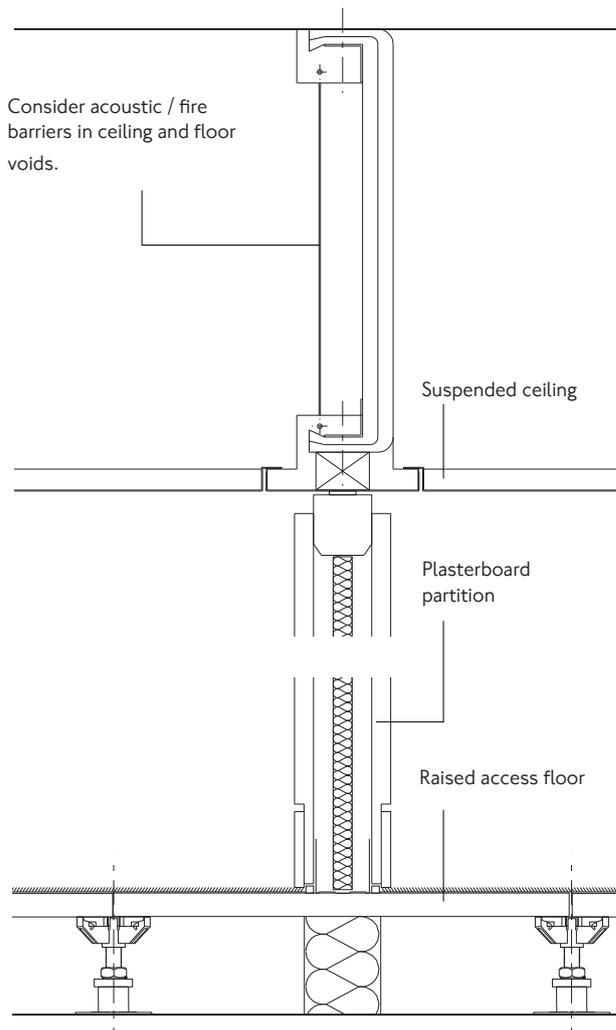


Fig. 2 Typical plasterboard partition

Note:

Movement or erection of any partition shall result in the work being given Intermediate Refurbishment Level status. (See Manual to the Standards for details)

Prior to the movement or erection of any partitions reference must be made to fire compartment drawings, Approved Document Part B Volume 2, section B1; Means of warning and escape and TfL Standard RED 08

6 Design Standards

6.1 General

All new partitions must make allowance for soffit / floor movement.

Internal partitions shall be designed and constructed in accordance with BS 5234 and shall be of Grade HD (Heavy duty) as defined in that standard.

Partitions that pass through raised access floors / suspended ceilings to the structural slab should be avoided where possible to facilitate future flexibility and avoid the need for cut tiles.

All partitions shall be provided with a continuous skirting the top of which shall be not less than 75 mm above finished floor level or where applicable match that of adjoining existing walls (See Fig. 2).

6.2 Proprietary Partitioning Systems

Where proprietary partitioning systems are incumbent within a building for refurbishment these may be reused.

6.3 Plasterboard Partitions

Where non-proprietary partitioning is used, all new partitions shall be constructed from metal or timber stud and plasterboard with taped and filled joints.

The use of materials involving wet trades, e.g. plaster, brick, block, etc. should be avoided.

Plasterboard manufacturers must demonstrate good environmental management, e.g. implementation of BS EN ISO 14001 or the EC's Eco-management and Audit System (EMAS).

The form of construction and partition build up selected for each particular application should be based on the following criteria:

- The requirements for fire protection
- Future demountability and relocation
- Aesthetic requirements
- Cost
- Incorporation of any building services

The resulting proposed form of construction of each partition shall be specified in the design and must be agreed with the Infrastructure Manager.

6.4 Internal Glazed Partitions

Glazed walls should conform to glazing standard BS 6262, requirements of The Building Regulations 2000 - Approved Document N and Regulation 14 of The

Workplace (Health Safety and Welfare) Regulations 1992.

Glass should conform to BS 952.

For all full and door height glazed panels the form of manifestation (to cover at least the extent defined in The Building Regulations) must be approved by the Infrastructure Manager.

Glazing systems without mullions should be used.

Any free standing edges of glazed screen should have a strip contrasting visually with the surroundings against which they are seen.

6.5 Sliding Folding Partitions

Sliding folding partitions may be used to divide large meeting rooms into multiple smaller rooms in line with TfL's policy of providing flexible space.

Partitions shall be manually operated with individual sandwich panels hung from two points from an aluminium ceiling track. Tracks shall be fixed via adjustable steel suspension units to the load bearing structural component.

Panels shall be connected with male and female interlocking aluminium profiles.

Systems shall be fully adjustable to accommodate floor and ceiling unevenness and incorporate an end closure element of overlapping, compensating design of the same material as the partition panels.

Non-adjustable systems shall not be used.

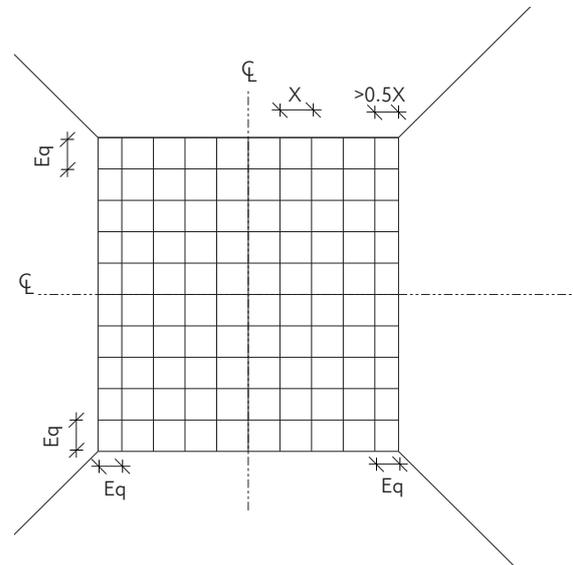


Fig. 3 Tile setting out - complete wall

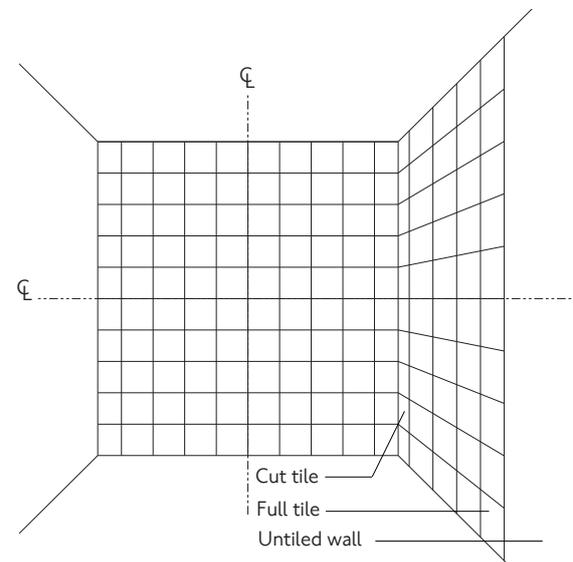


Fig. 4 Tile setting out - partial wall return

A mechanical emergency unlocking device shall be provided for all elements.

Systems shall have an in use acoustic performance of 55dB R_w with panel weights no greater than 40 kg/m².

6.6 Access Panels

Where access to voids is required, removable panels shall be provided and where possible should match the adjacent wall. Access panels shall be lockable and easily removable without causing damage to the panel or the adjacent surfaces.

Access panels smaller than 600mm wide x 2100mm wide shall consist of a proprietary system. Panels of 600x2100mm or larger shall be formed with a door in accordance with TfL Standard YEL 02.

6.7 Ceramic Tiling

Tiles should be set out from the centre of the wall so that wherever possible:

- Tiles along opposite edges are of equal size
- Edge tiles are more than 50% of full tile width
- No cut or unfinished tiles shall be exposed at edges or corners

Properly designed movement joints should be:

- Built into tiling at centres not exceeding 4.5m both vertically and horizontally
- Located at all vertical corners in large tiled areas
- Located at junctions with other surfaces or backgrounds (See Figs 3,4)

6.8 Rigid Sheet Hygienic Wall Linings

Rigid sheet hygienic wall linings shall be provided to all back of house wet areas such as changing rooms. Supporting partitions shall have one layer of plywood for application of fixings / shelving etc.

The jointing method shall allow for incorporation of an upturned floor finish at the perimeter.

6.9 Acoustics

Recommendations for acoustic design given in TfL Standard GRN 03 should be followed in order to choose an appropriate acoustic absorbency for each surface / partition and appropriate noise reduction between adjoining rooms / uses.

Particular care should be taken to ensure the acoustic integrity and sound attenuation of partitions is maintained:

- Where the partition extends only to the underside of a suspended ceiling or the finished surface of a raised floor or abut window mullions
- Where building services pass through the partition,
- Above ceiling void and under raised access floor.

Doors and frames should be selected and detailed to provide, as nearly as is practicable, the sound attenuation of the partition.

6.10 Fire

The fire characteristics of all finishes should be stated in the design in terms of fire resistance, spread of flame, combustibility and toxic fume emission. The designer must determine and state in the design the relevant standards and the appropriate form of testing for each finish specified.

Reference should be made to approved Document Part B Fire Safety, Volume 2

Buildings other than Dwelling Houses and BS 9999; Code of Practice for Fire Safety in The Design, Management and Use of Buildings.

Where appropriate, materials must have been tested and approved for fire resistance and surface spread of flame in accordance with the Approved Document B and the Fire Precautions Act 1971 and appropriate parts of BS 476.

Particular care should be taken to ensure the integrity of any fire barriers is maintained:

- Where the partition extends only to the underside of a suspended ceiling or the finished surface of a raised floor
- Where building services pass through a partition, (See YEL 03: Fire Stopping to Walls)

Protection of structural steel should be in accordance with BS EN ISO 12944.

In no circumstances should fire equipment be painted.

The movement of partitions should not resulting areas not being provided with detection heads where there was detection before.

It is generally acceptable to provide inner rooms (where persons have to escape via an access room) providing:

- The inner rooms should not be provided for more than 60 persons and
- The partitions are no higher than 500mm below the ceiling or;

- A suitable sited vision panel is provided which is not less than 0.1m² in area on the wall or door or;
- The access room should be provided with a detector head

Where single directional travel in a corridor is produced due to a change in layout, then the corridor should be provided with fire protection.

Sprinkler positions may require alteration and should be considered at the earliest stage.

7 Design / Contractor Submittal Requirements

Reference should be made to the Manual to the Standards for general requirements for drawing and sample submittals. Requirements specific to this standard are:

- A finishes schedule and corresponding drawings must be completed and approved by the Infrastructure Manager as part of the design process.
- Plans showing the proposed positions of fire barriers must be included in the design.
- Plans identifying the type and location of the different partitions installed must be included in the design.
- Plans showing the proposed fire resistance of all new partitions and fire compartments must be included in the design.
- Samples of each type of wall finish in accordance with the Manual to the Standard must be approved prior to installation.

- Control samples: An area of the works shall be completed and approval gained for the appearance before proceeding with the remainder of the work.

8 Materials Standards

All materials must be specified / sourced and installed in accordance with the parameters set out in TfL Standard GRN 01, which includes details of requirements for minimum recycled content.

Reference should also be made to TfL Product Selector for examples of materials and colours of wall finishes acceptable to TfL.

All colours shall be approved by the Infrastructure Manager prior to commencement of works.

Compatibility with existing wall finishes must be demonstrated prior to commencement of work taking into account preservatives, stains and varnishes and glazing compounds.

Surfaces must be capable of withstanding normal office cleaning processes.

Unless stated otherwise within the design brief, the normal period between re-decorations shall be assumed to be five years and the design life of all finishes shall be such that replacement will not be required within that period. For materials where replacement is not expected between major refurbishments (wood panelling, ceramic tiles, etc.) the design life shall not be less than 20 years.

8.1 VOCs

The emissions of VOCs from paints and varnishes are regulated by the directive 2004/42/CE, implemented in the UK by the Volatile Organic Compounds in Paints, Varnishes and Vehicle Refinishing Products Regulation 2005. Products containing high organic solvent content should be avoided (EU VOC Solvent Directive 1999/13/EC).

Reference should be made to GRN 01 for acceptable VOC levels. Where maintenance / durability requirements do not allow compliance with this level, dispensation must be sought.

8.2 Sliding Folding Partitions.

Materials used must be non-corroding or corrosion protected.

Sealing strips shall be high strength aluminium capable of meeting the highest requirements in terms of sound attenuation and stability.

9 Installation

All finishes must be applied in accordance with the manufacturer's recommendations. The existing substrate must be sound, clean, dry and free of any loose material or other visible defects before any new surface finishes are applied.

9.1 Paint

Paint systems should be applied with at least one primer coat, one undercoat and one finishing coat or in accordance with manufacturer's recommendations.

9.2 Rigid Sheet Hygienic Wall Linings

When dry, apply antistatic solution to all surfaces.

Treatment to service penetrations – all holes to be cut to allow 3-4 mm silicone seal around all penetrations.

Clean with cleaner / thinner and seal in accordance to manufacturer's recommendation.

10 Handover

The finished wall surface shall be smooth, of uniform colour and free of any paint runs or other visible imperfections.

Any fittings (switches, cable runs, light fittings, etc.) shall be free of paint.

Wall tiling shall have consistent aligned joints.

Reference should be made to the Manual to the Standards for general requirements for handover and submissions required for the Operation and Maintenance Manual. The following information shall be provided specifically for wall finishes and partitions in good time for inclusion in the buildings Operation and Maintenance records:

- Complete set of as built drawings to include items set out in Section 6.
- Completed finishes schedule.

11 Maintenance

When new equipment is added or alterations are made to existing installations, there shall be no detrimental impact on the ease of maintenance of existing facilities unless through dispensation from the Infrastructure Manager.

All maintenance should be carried out strictly in accordance with manufacturer's recommendations which should be included in the Operation and Maintenance Manual.

12 Further information

For further information on plasterboard partitions see

- British Gypsum – 'White Book'
- Partitions: Health Technical Memorandum HTM 56
- BRE Publication : Good Building Guide, Plasterboard : Types and their applications.

Revision History:

Issue	Date	Description
1		Preliminary Issue
2	20th November 1999	Minor Revisions
3	18th September 2000	Reformatted - LU Facilities
4	December 2010	Reformatted and revised as TfL Head Office Standards

Relevant British / European Standards

- BS 476:** Fire tests on building materials and structures
Part 6 - Method of test for fire propagation for products
Part 7 - Method of test to determine the classification of the surface spread of flame of products
Part 20:1987 Method for determination of the fire resistance of elements of construction (general principles)
Part 22: 1987 Methods for determination of the fire resistance of non loadbearing elements of construction.
- BS 5234:** Partitions (including matching linings)
- BS 6150:** Code of practice for painting in buildings.
- BS 8212:** Code of practice for dry lining and partitioning using gypsum plasterboard.
- BS 9999:** Code of practice for fire safety in the design , management and use of buildings.
- BS EN 520** Gypsum plasterboard. Definitions, requirements and test methods.
- BS EN 1364** Fire resistance tests for non-load bearing elements.
- BS EN 14246** Gypsum elements for suspended ceilings. Definitions, requirements and test methods.

07

Window Films and Draught Proofing

Issue 1 — December 2010



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07 Window Films and Draught Proofing

1 Scope

This Standard sets out requirements for security and solar films and draught proofing to be applied to existing windows in TfL non-operational office premises.

Window construction, being fundamental to the fabric of the building is beyond the scope of this standard. Where the provision of new or replacement windows is envisaged as part of a project the design must be agreed with the Infrastructure Manager and comply with TfL Standard YEL 01.

Requirements for manifestations to internal glazed panels are described in TfL Standard RED 03.

This standard supersedes LUF-A008-ST Solar films.

2 References

This Standard should be read in conjunction with the accompanying Manual to the standards and TfL standards RED 05, YEL 01, GRN 01,02.

It shall be the responsibility of the designer/installer to reference and comply with all the above and any other TfL Standards where necessary.

Relevant British Standards referred to in the text are listed in Appendix 1. Unless otherwise stated, references are to the latest editions and revisions.

3 Definitions / Abbreviations

For a list of general abbreviations and definitions used within the Standards

please see the accompanying Manual to the Standards. Definitions specific to this standard are;

- Safety glass
Glass that either does not break or breaks safely in accordance with the criteria and test requirements specified in BS EN 12600
- Security film
A plastics film which, in combination with the glass to which it is bonded, meets the requirements for safety glass as defined in BS EN 12600.
- Solar film
A plastics film which, when bonded to a window, reduces heat transmission and glare.

4 General Guidance

4.1 Window Films

Solar film assists in reducing heat intake and glare through windows exposed to direct and reflected sunlight. It can also reduce heat loss during winter months.

Security film significantly reduces the risk of injury from splinters and fragments of broken glass thrown into or out of a building as a result of an explosion or heavy impact.

The use of security film would normally be considered where the installation of safety glass of an equivalent standard is either impractical or uneconomical, or where retrofitted to existing glazing.

Where low levels of security are required, consideration should be given to the use of combined solar and safety film.

4.2 Draught Proofing

Where window films are applied consideration must be given to the application of draught proofing / stripping in accordance with the minimum criteria set out in the Manual to the Standards for a Minor Refurbishment.

Note:

Because of the diverse nature of TfL's buildings this standard contains general requirements which may not be universally applicable. The designer should in each case discuss and agree the exact level of window films or draught proofing required with the Infrastructure Manager. It may be necessary to commission independent studies or assessments to establish an appropriate scope.

5 Construction Design and Management Regulations (CDM)

Reference should be made to the Manual to the Standards for requirements under the CDM regulations.

6 Design Standards

6.1 Films

The designer is responsible for establishing the need for both security and solar films.

Table 1. Adhesive peel strength tests

Class	Property	Requirement
1	Force to initiate peeling	Not less than 800 gms
		Not more than 4000 gms
2	Mean force required to peel at a constant rate of 300mm / minute, or	Not less than 1500 gms
	Time to peel 300mm at a constant force of 1500gms	Not less than 1 minute

The type of solar / security film to be used will be dependant on the specific requirements, for example orientation of glazing or compatibility with glazing types or existing films. Therefore in all instances manufacturer's advice shall be sought to determine the most appropriate film for the project.

Where solar control is the objective a ratio of Shading Coefficient: Light Transmission of 1.5-2.0: 1 shall be achieved.

In all calculations reference should be made to TfL Standard GRN 02 for design criteria for daylighting and CIBSE publication, Design for Improved Solar Shading Control for the calculation of solar control calculations.

A written statement outlining the findings of this research must be submitted as part of the design.

Windows with existing film shall be peel tested in accordance with Table 1. (Unless documentation of install date, film type etc. are available) Window film that fails the peel test shall be replaced by removing existing film and replacing with new, to specification determined by energy / security assessment as above.

Where existing security film exists and a solar control is deemed necessary, consideration shall be given to the addition of solar control applied on top of the original film.

Ultraviolet light transmission through the film / adhesive combination shall not be more than 2%.

Any scratch resistant coatings or treatment shall resist damage when subjected to a standard wire wool test and shall not impair any other properties of the film.

The installed film/adhesive combination shall have a design life of not less than ten years with deterioration in the properties specified in this Standard of not more than 10%.

6.2 Adhesives

The adhesive shall be optically clear, pressure sensitive, acrylic adhesive containing ultraviolet inhibitors sufficient to protect it for its required life or other adhesive having equivalent or better optical, strength and life properties.

Any adhesive must be compatible with the proposed film. Where the specification of a proprietary adhesive is preferred, the manufacturer should be consulted about its properties and suitability.

6.3 Security films

Security films shall comply with the behaviour requirements for Class 1B1 and Class 2B2 safety glass and plastics defined in BS EN 12600 and summarised in Table 2.

The class of security film to be used for particular applications shall be as summarised as per the guidance provided in Table 3.

Existing glass type should be checked before the final specification. Edge retention should be considered in high risk or vulnerable areas.

Table 2. Classes of safety glass

Class	Behaviour on impact	
	Drop height 457mm	Drop height 1219mm
1B1 ¹	No breakage, or breaks safely	No breakage, breaks safely
2B2 ²	No breakage, or breaks safely	No requirement

Notes

- 1 The base film shall have an average thickness of not less than 175 microns and a minimum thickness of not less than 170 microns (excluding any adhesive release liner or de-tackifying coat).
- 2 The base film shall have an average thickness of not less than 100 microns and a minimum thickness of not less than 95 microns (excluding any adhesive release liner or de-tackifying coat).

Extract from BS EN 12600. Included for guidance only.

Table 3. Security film types for various applications

Application	Class
Single glazed windows on floors up to and including 10th floor	1
Single glazed windows on floors above 10th floor	2
Secondary glazed windows - all floors	2
Sealed units (low risk areas) - all floors	2
Internal glazed partitions	2
Large shop front / reception glazing over 3 m ²	1 ¹
Patterned glass	2 ²

Notes

- 1 Should be made safe with a film of >250 microns.
- 2 Glass to which film cannot be adequately bonded shall be treated with Decothane to Class B strength. Decothane shall not be applied to clear glass.

A security consultant must be employed to verify the requirement for security films, this table is for guidance only.

Table 4. Fire resistance

Property	Requirement	Standard
Ignitability	Not easily ignitable	BS 476 : Part 12
Fire propagation	Zero performance index	BS 476 : Part 6
Surface spread of flame	Class 1	BS 476 : Part 7
Toxicity	No toxic or other harmful fumes to be given off	

6.4 Draught Proofing

Draught proofing shall be proprietary self adhesive compressive strips.

No draught proofing shall affect the weather tightness of windows.

Draught proofing shall be concealed from view when the window is open.

- Physical properties and independent testing agency reports showing compliance with specified tests.
- Preparation instructions and recommendations.
- Storage and handling requirements and recommendations.
- Installation methods.

7 Design / Contractor Submittal Requirements

Reference should be made to the Manual to the Standards for general requirements for drawing and sample submittals.

Requirements specific to this Standard are listed below.

7.1 Design stage

Any proposal to install window film must be accompanied by a written statement containing manufacturer's advice to determine the most appropriate film for the project. An energy / security assessment shall also be included which shall consider:

- The levels of direct and indirect sunlight to which the window is normally exposed.
- The level of risk from terrorist activities in and around the location of the building.
- The benefits to be gained by using a combined solar and security film.
- The levels of security and solar protection currently afforded to the building occupants.
- A cost/benefit analysis justifying its use.

7.2 Installation

Prior to installation the contractor shall provide manufacturer's data sheets on each product to be used, including:

8 Materials Standards

All materials must be specified / sourced and installed in accordance with the parameters set out in TfL standard GRN 01, which includes details of requirements for minimum recycled content.

Films shall be of polyethylene terephthalate (polyester) based, optically clear, biaxially orientated, polyester, or other having proven equivalent or better durability, strength and optical properties.

The finished film shall be self-adhesive and include a coating to reduce the effects of scratching and abrasions that occur in normal daily activity and also include absorbers and inhibitors for the purpose of reducing ultra violet rays.

A warranty of not less than 10 years shall be provided against installation and materials by the chosen operative / manufacturer against failure of film, including peeling, change in colour, bubbling, rippling, cracking, delamination and demetalization.

All film shall at least comply with the fire resistance criteria listed in Table 4.

Note: All toughened glass shall be heat soak tested in accordance with DIN 18516.

9 Installation

Film must be applied to one complete window, which may form part of the completed works, for approval prior to proceeding with the remainder of the works. Installation shall not be carried out prior to substrates having been properly prepared in accordance with the manufacturer's recommendations.

Installation shall be carried out in accordance with the manufacturer's recommendations by a trained and experienced operative approved by the film manufacturer and with documented experience in the application of self-adhesive window films with at least 10 applications of similar size and complexity,

Once installed further contact with the applied film should be avoided until the adhesive has cured. Where installed film could be damaged by subsequent construction, measures shall be provided to prevent contact.

Application must be carried out under environmental conditions (temperature, humidity, and ventilation) within limits recommended by the manufacturer for optimum results. Films must not be installed under environmental conditions outside manufacturer's absolute limits.

Installation shall be in accordance with the Glass and Glazing Federation Installation Quality Standard for applying Window Film to Glass

The peel strength of the adhesive measured 30 days after installation on a 25 mm wide strip of film fixed to glass and with a pull angle of 180° shall meet the criteria set out in Table 1.

10 Handover

Completed work must be fully adhered to the glass with no peeling, and be free from bubbles, wrinkles, cracks, dirt, cuts, tears or gaps between film and frame.

Reference should be made to the Manual to the Standards for general requirements for handover and submissions required for the Operation and Maintenance Manual.

The following information shall be provided specifically for window films in good time for inclusion in the buildings Operation and Maintenance records;

- Complete and verified set of 'As Built' drawings of the works indicating the location and type of window film installed.
- All information as set out in Section 7 above.

11 Maintenance

When new equipment is added or alterations are made to existing installations there shall be no detrimental impact on the ease of maintenance of existing facilities, unless through dispensation from the Infrastructure Manager.

All window film shall undergo a visible inspection after five years of installation.

Window film shall undergo a peel test after an additional five years prior to termination of the film warranty.

A regular maintenance procedure will extend the life of the window film and shall be strictly in accordance with manufacturer's recommendations.

The use of dry clothes products containing ammonia for cleaning should be avoided.

12 Further information

- BRE: Solar shading of buildings.
- CIBSE: Design for Improved Solar Shading Control. TM37: 2006.

Revision History:

Issue	Date	Description
1	December 2010	New TfL Head Office Standards supersedes LUF-A008-ST Solar films

Relevant British / European Standards

- BS 476** Fire tests on building materials and structures
Part 6 - Method of test for fire propagation for products
Part 7 - Method for classification of the surface spread of flame of products
Part 12 - Method of test for ignitability of products by direct flame
impingement
- BS EN12600** Glass in building. Pendulum test. Impact test method and classification for flat
glass.

04

Air Conditioning

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04 Air Conditioning

1 Scope

This Standard sets out requirements for air conditioning in non-operational premises intended for use as offices by Transport for London (TfL).

This Standard part supersedes standard LUF-M003-ST Ventilation and Air Conditioning.

- Requirements for central heating plant and distribution are set out in BLU 01 Central Heating Plant.
- Requirements for ventilation are set out in BLU 03 Mechanical Ventilation.
- Requirements for refrigeration and air cooling are set out in BLU 05 Refrigeration and Cooling.
- Requirements for control and monitoring are set out in BLU 17 Building Management Systems.
- Requirements for metering are set out in BLU 18 Metering.

All works shall comply with the requirements of non domestic heating, cooling and ventilation compliance guide.

2 References

This Standard should be read in conjunction with the accompanying Manual to the Standards and TfL standards GRN 01, 02, 03 BLU 01,03,04,05,08.

It shall be the responsibility of the designer/installer to reference and comply with all the above and any other Standards where necessary.

Relevant British Standards referred to in the text are listed on the rear cover. Unless

otherwise stated, references are to the latest editions and revisions.

3 Definitions / Abbreviations

For a list of general abbreviations and definitions used within the Standards please see the accompanying Manual to the Standards.

4 Construction Design and Management Regulations (CDM)

Reference should be made to the Manual to the Standards for requirements under the CDM regulations.

5 Performance Standards

5.1 General Standards

Any system designed to deliver heating, comfort cooling or humidity control to occupied spaces by forced circulation of air shall comply with this standard. Systems shall also comply with Standard BLU 03 Mechanical Ventilation.

Before considering air conditioning the designer shall first consider alternative forms of heating or cooling. In order of preference systems for comfort cooling shall be:

- Natural Ventilation.
- Natural ventilation and radiative cooling
- Natural or mechanical ventilation with local cooling units
- Central air conditioning

Systems shall be configured for peak - lopping rather than absolute temperature control wherever operating conditions permit.

Local air conditioning units shall not be installed without first establishing that sufficient fresh air supply exists either through natural or mechanical ventilation. If there is insufficient fresh air to maintain indoor air quality then a central air system shall be installed complying also with the requirements of standard BLU 03 Mechanical Ventilation.

The designer shall make due allowance for the space heating contribution from environmental and casual heat gains. The occupancy heat gains shall be derived from GRN 02 Design Criteria.

The designer shall make due allowance for the affects of solar radiation, radiant asymmetry and cold down draughts from windows and large areas of glazing.

The designer must assess and make provisions to ameliorate any adverse effects on the building fabric, e.g. condensation at cold spots.

Air conditioning systems shall incorporate appropriate mechanisms to enable localised control to be exercised within all parts of the building.

The designer must assess any existing system within the building when calculating the proposed heating and cooling loads. Any imbalance in the capacities of the central plant and distribution systems shall be determined and corrected so as to meet the requirements efficiently and economically.

5.2 Temperature Requirements

Air conditioning systems shall be designed to maintain internal temperatures with outside air temperatures and insulation values for building fabric as set out in GRN 02 Design Criteria.

Room temperatures shall be maintained as specified in GRN 02 Design Criteria, throughout normal working hours with variations generally not exceeding +/-1.5°C.

The temperature variation between floor level and a plane 1.8m above floor level shall not exceed 2°C.

Air cooling by refrigeration may only be considered once the opportunity for free cooling by fresh air has been exhausted.

5.3 Zone Control

All air conditioning systems shall be provided with zone control to suit the building layout, occupancy patterns and solar exposure.

Central all-air conditioning systems shall not be installed without zone control using VAV or similar.

Local cooling within occupied spaces shall be provided in order of preference by:

- Chilled beams or ceilings.
- VRF fan coil units with heat pump / heat recovery operation.
- Versatemp type fan coil units with central heat recovery
- 4 pipe heating / cooling fan coil units
- Split system D.X. fan coil units.

6 Equipment Standards

6.1 General Requirements

Where a product or component required for the works appears in any category on the Energy Technology Criteria List then the product or component selected for the installation shall comply fully with the relevant criteria.

With the exception of items designed to be disposable, the design life of the materials and equipment used shall be not less than five

years. For materials and equipment whose replacement is not expected between major refurbishments, the design life shall be a minimum of 15 years.

Unusual, non-standard and non-proprietary components, substances and materials shall not be used.

6.2 Sensors & Thermostats

Where it is desirable to provide user control of air conditioning in a zone and a BMS system is installed use temperature sensors / adjusters that allow the set point to be reset each night rather than devices where the adjustment is hardwired within the sensor.

6.3 Flow Control

All new air conditioning systems shall be designed for variable airflow using inverter driven speed controlled fans to limit the volume of air circulated to only that needed for the heating or cooling loads or to maintain minimum fresh air supply when the thermal demands are satisfied.

6.4 Heat Recovery

All air conditioning systems shall be provided with heat recovery.

Central air supply systems shall incorporate air to air heat recovery using recirculation, thermal wheels or plate heat exchangers in the air handling units.

Recirculation shall be controlled on enthalpy to select the most advantageous source. Re-circulating systems shall also be controlled by CO₂ sensors to maintain sufficient fresh air at all times (refer to BLU 03 Mechanical Ventilation).

VRV systems shall be configured as heat pump systems with point to point heat recovery within the system.

7 Design / Contractor Submittal Requirements.

Reference should be made to the Manual to the Standards for general requirements for drawing and sample submittal requirements.

All redundant services are to be stripped out during the works. A schedule of redundant services is to be issued to the Infrastructure Manager prior to commencing work.

8 Materials Standards

The ductwork system shall be designed in accordance with BLU 03 Mechanical Ventilation.

Where supply terminal units, fan coils etc. serve more than one partitioned space provide cross talk attenuators.

All ductwork conveying air at temperatures other than the internal ambient temperature shall be insulated in accordance with the requirements of the building regulations Part L.

9 Workmanship Standards

All companies who propose to install, maintain or service refrigeration, air conditioning and/or heat pump equipment shall be registered with REFCOM.

All ductwork shall be fabricated and installed to DW144.

All systems shall be identified in accordance with BS 1710.

All ductwork and equipment supports shall utilise unistrut, steel angle and threaded rods or similar arrangements. Straps and cable suspensions are not permitted.

10 Testing & Commissioning

Carry out commissioning of installation with the procedures, checks and tolerances given in the BSRIA Application Guide for air systems to achieve the standards set in the CIBSE Commissioning Codes.

Any ductwork covered up without a pressure test witnessed by the Infrastructure Manager will be entirely at the contractor's risk. Advise the Infrastructure Manager at least five days in advance of the time that pressure tests may be witnessed.

All control components shall be set up and commissioned in accordance with the manufacturer's recommendations.

All traverse holes shall be plugged upon completion of commissioning.

Keep a systematic record of all tests and commissioning procedures. Provide copies to the TfL Infrastructure Manager on request.

11 Handover

Reference should be made to the Manual to the Standards for general requirements for handover and submissions required for the Operation and Maintenance Manual.

Axonometric or full 3D drawings shall be provided for all plant rooms clearly identifying the equipment and interconnecting services.

12 Maintenance

The contractor shall provide full maintenance during the defects liability period in accordance with the TfL maintenance model. Any departure from this requirement will require the grant of dispensation from the Infrastructure Manager.

When new equipment is added or alterations are made to existing installations there shall be no detrimental impact on the ease of maintenance of existing facilities unless through dispensation from the Infrastructure Manager.

The contractor shall create and maintain a maintenance log recording all reported defects, problems and maintenance issues and their resolution. Upon completion of the rectification of defects the log shall be issued to the Infrastructure Manager prior to the release of any retention monies.

13 Further Information

13.1 Legislation:

- Energy Technology Criteria List - www.eca.gov.uk.
- Non-Domestic Heating, Cooling and Ventilation Compliance Guide - Dept. for Communities and Local Government. (Tier 2 document to Part L2,)

13.2 Design Guidance

CIBSE Guide B2 Ventilation & Air Conditioning
CIBSE Guide F Energy Efficiency in Buildings

Revision History:		
Issue	Date	Description
1	December 2010	This standards part supersedes standard LUF-M003-ST Ventilation and Air Conditioning.

Every effort has been made to ensure the accuracy of the information contained in this document however, Pringle Richards Sharratt Ltd. accepts no responsibility or liability for any damages or costs of any type arising out of or in any way connected with your use of this standard. Data and information is provided for information purposes only. Pringle Richards Sharratt Ltd. shall not be liable for any errors in the content, or for any actions taken in reliance thereon.

Relevant British / European Standards

- BS 1710** Specification for identification of pipelines and services.
- BS 8207** Code of practice for energy efficiency in buildings

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Building Management System

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17 Building Management Systems

1 Scope

This standard sets out requirements for building management systems in non-operational premises intended for use as offices by Transport for London (TfL).

This standard supersedes standard M009 Building Management Systems.

- Requirements for metering are set out in BLU 18 Metering.

All works shall comply with the requirements of non-domestic heating, cooling and ventilation compliance guide.

2 References

This Standard should be read in conjunction with the accompanying Manual to the Standards and TfL Standards GRN 01, 02, 03, BLU 01, 03, 04, 05, 08, 11, 18.

It shall be the responsibility of the designer/installer to reference and comply with all the above and any other Standards where necessary.

The requirements for BMS operator graphics are set out in the supplementary document BMS Graphics Standards.

BMS & Controls installations shall comply with the following requirements and Standards:

- CIBSE guide H and commissioning code C;
- BS 7671 & HD 384 – Electrical Installations in Buildings;
- prEN 13646:1999 – Building control systems – equipment characteristics;

- prEN 16484-2: Building control systems part 2 – HVAC control system functionality;

Relevant British Standards referred to in the text are listed on the rear cover. Unless otherwise stated, references are to the latest editions and revisions.

3 Definitions / Abbreviations

For a list of general abbreviations and definitions used within the standards please see the accompanying Manual to the Standards.

4 Construction Design and Management Regulations (CDM)

Reference should be made to the Manual to the Standards for requirements under the CDM regulations.

5 Performance Standards

5.1 General Standards

New BMS systems shall be designed to BS EN 15232 Class A.

User controls and interfaces shall be designed in accordance with the BCIA Guide, 'Controls for End Users.'

BMS shall provide the following facilities:

- Automatic control of plant and equipment
- Automatic control of terminal devices and ancillary equipment
- Monitoring of the plant and systems
- Alarm messages and remote signalling
- Reports of maintenance items requiring attention
- Remote monitoring and supervision
- Remote revision of setpoints
- Adjustment of system operational hours

The BMS designer shall ensure that the specification includes :

- Individual enabling, control and sequencing of N+1 plant e.g. boilers, chillers, pumps and fans etc. where applicable.
- Individual monitoring of plant operational status. Provide as a minimum run and common fault status for each item of plant.
- Monitoring of fan's operation by differential pressure switch or current relay on low duty fans.
- Monitoring and control of auto changeover of fans on duty failure by a common differential pressure switch across the fan set.

- Monitoring of pump operation by differential pressure switch or current relay on low duty pumps.
- Monitoring and control of auto changeover of pumps on duty failure by a common differential pressure switch across the pump set.
- Monitoring of filter status by differential pressure switch (set in accordance with the filter manufacturer's recommendations) across the separate filters.
- Monitoring of MCC control switches for drive 'Out of Auto' positions and alarming at the BMS.
- Provision of Frequency Inverters on variable speed drives. Provide BMS enable, status, speed control output, feedback and fault.
- Provision of Frequency Inverters on fixed speed drives where appropriate. Provide BMS enable, status and fault.
- Monitoring of packaged plant items e.g. pressurisation units, booster sets etc. Provide as a minimum plant operational (e.g. Run) status and common fault status.
- Monitoring of all safety shut-down circuits/devices e.g. gas safety, fire alarm, ductwork fire dampers, frost etc.

All plant having duty and standby arrangement shall include for a duty rotation/sharing changeover programme.

All analogue outputs shall have the facility to be manually overridden from the BMS supervisor for maintenance, commissioning and demonstration purposes. This shall not circumvent any safety overrides or control features e.g. Frost Protection.

All plant enable signals shall have the facility to be manually overridden OFF & ON from the BMS supervisor for maintenance, commissioning and demonstration purposes. This shall not circumvent any safety overrides or control features e.g. Fire Shutdown.

The BMS shall provide interfaces with the internal controls of packaged plant items and shall provide sequence control of boilers, chillers etc.

All new designs should incorporate open architecture programming and network capabilities.

All control systems shall be capable of being linked to an integrated computerised Building Management System, both on site and remotely via a suitable datalink.

The system designer shall submit a point schedule for approval by the Infrastructure Manager prior to commencing detail design installation or programming of the system.

All temperature control systems are to have as a minimum 7 day programmers with multiple time zones. Building management systems are to include full multi-zone time scheduling.

Notwithstanding the requirements of this Standard, all products, materials and workmanship shall comply with any relevant British Standards and Codes of Practice, legislation and statutory regulations as a minimum. Any deviation from the requirements of this Standard must be approved by the Infrastructure Manager.

The proposed design, together with supporting calculations and details of components and equipment, must be submitted to the Infrastructure Manager for approval before any installation is commenced.

All life safety and equipment interlocks, where possible damage to plant may occur, shall be hardwired and not be reliant on BMS software to perform the function. The interlock shall be so configured that regardless of whether the plant is in the "Auto" or "Hand" position the plant will be overridden accordingly.

5.2 Temperature Control

Heating systems shall be designed to maintain internal temperatures with outside air temperatures and insulation values for building fabric as set out in GRN 02 Design Criteria.

Room temperatures shall be maintained as specified in GRN 02 Design Criteria, throughout normal working hours with variations generally not exceeding +/-1.5°C.

The temperature variation between floor level and a plane 1.8m above floor level shall not exceed 2°C.

All heating systems shall provide building protection temperature control.

Configure the thermal conditioning control system to allow for a temperature dead band of at least 2°C in order to eliminate the risk of heating and cooling simultaneously and to reduce energy consumption.

Air cooling by refrigeration may only be considered once the opportunity for free cooling by fresh air has been exhausted.

5.3 Control & Monitoring

The BMS system shall be configured to communicate with an off-site server which includes the capability for logging and storing data from any control point on the system. The server will then deliver operational information over the internet in a graphical form and receive operational adjustments for transmission back to the BMS.

The outstations and controllers shall be capable of intelligent independent function in the event of failure of the communications network. Each unit shall have its own internal, battery-backed RAM operating all local control functions. Plant Controllers shall be capable of sharing information with the entire network for full global control. Any controller programme shall be capable of accessing any point regardless of its actual location within the system.

Each control centre is to be provided with a front panel mounted, menu driven display interface unit to allow adjustment of set points and examination of operational parameters without having to return to the operator's PC. Nevertheless it is not required to install more than one interface unit in a single plant room.

The BMS shall initially be configured with logging of all control points at a maximum of 30 minute intervals with the data stored on the outstation. Logged data shall be automatically uploaded to the server computer at appropriate intervals to ensure no loss of data. Data logging and storage shall be configured in accordance with TfL data logging technical note.

The following points shall be logged as a minimum:

- All sensors e.g. temperature, humidity, pressure, volume, level etc.
- All calculated set points
- All main heating and cooling plant enable signals (i.e. boilers, chillers etc.)
- Plant run hours and status.
- Other points as required by the specific project.

Where dispensation has been obtained under BLU 18 Metering to gather meter data via the BMS, the server shall be configured to permanently record half hourly data as well as providing this automatically to TfL's M&T software.

5.4 System Alarms

The alarm routing software shall be engineered to include multiple alarm priorities and destinations. This shall enable any single alarm generated within the system to be sent to different locations depending on priority. These shall include as a minimum:

- Alarm priorities
- General maintenance alarms – e.g. Filter dirty, duty plant fault/failure etc.
- Critical alarms – Total plant failure, Temperature out of limits alarms, Life safety systems operating etc.
- Alarm Routing
- The server for central monitoring and recording of alarm data.
- The GP & F helpdesk, either by e-mail or via Mobile Phone / pager system.
- Other destinations as determined by the specific project requirements.

5.5 Energy Efficiency

Energy efficient plant start/stop and control strategies shall be adopted. Specific strategies shall be developed for the particular building in consultation with the TfL Infrastructure Manager and the Sustainable Buildings Team. Typical examples include:

- Optimum start and stop.
- Weather compensation.
- Avoid simultaneous heating and cooling. Utilise dead-bands of at least 2°C.
- Provide demand based operation of main heating & cooling plant.
- Provide demand based speed control of fans where possible e.g. Variable volume, space CO₂ control.
- Provide demand based speed control of pumps where possible e.g. Variable volume on system differential pressure in conjunction with 2-port control valves etc.
- Limit optimum start of plant to a maximum of 3 hours before required occupancy.
- Summer/Winter shift operation based on outside air temperature.
- Utilise free heating & cooling where possible e.g. heat recovery and night purge etc.
- Scheduling of supply air or space temperature control against outside air temperature.
- Night set-back on 24hr plant operation.

6 Equipment Standards

6.1 General Standards

Where a product or component required for the works appears in any category on the Energy Technology Criteria List then the product or component selected for the

installation shall comply fully with the relevant criteria.

Where a System is already in place, any new controls shall, where possible, be identical to those already installed. Where this is not possible, the Infrastructure Manager must be notified prior to the commencement of the works.

Calibration of field devices must be easily achievable through the provision of a suitable means of checking close to the Detector, e.g. binder points in pipework or ductwork access points.

At least 25% spare capacity shall be provided within any new installation or control panel for future additions. Suitable rail, terminals and trunking shall be provided where necessary.

In refurbishment scenarios, designer/contractor shall be required to inform TfL if the proposed solution will lead to less than 5% spare capacity being left, along with proposed costs to reinstate the 25% spare capacity so that TfL can make an informed decision on how to progress.

No door mounted instrument or control shall be fitted more than 1800mm above floor level.

6.2 Sensors & Detectors

The BMS shall include all sensors and field wiring necessary to provide the required control functions.

Sensors for duct and pipe systems shall be inserted into the flow or medium as

immersion or pocketed sensors. Strap on external sensors are not permitted.

Where it is desirable to provide user control of heating in a zone and a BMS system is installed use temperature sensors / adjusters that allow the set point to be reset each night rather than devices where the adjustment is hardwired within the sensor.

In respect of space sensors or any item “on view”, samples of the proposed equipment shall be submitted to the Infrastructure Manager for approval.

6.3 Actuators

The BMS shall include all control valves (complete with fittings) and actuators connected with field wiring to the control systems. Control components shall be selected with reference to the final mechanical system designs taking into account the following:

- Full details of the selected control valve manufacturers range of control valves.
- Full details of pressure loss, flow rates, line and connection sizes.
- Valve application i.e. variable volume, 2 port control etc plus associated CV values.

The BMS shall include all actuators to control dampers to provide correct torque requirement based on the damper/duct sizes indicated on the mechanical ventilation system drawings.

Provide positive feedback sensors and devices to confirm the correct operation of plant items, equipment and the actual position of modulating actuators etc. Do not rely on the

driver signals from the BMS to indicate the function of a device.

6.4 Motor Control Panels

Control panels shall be type tested assemblies to BS EN 60439-1 with minimum internal subdivision to Form 2 Type 2 standard.

The control panel shall include the following construction requirements as a minimum:

- The control panels shall generally be of two sections, with a “Control Section” and a “Power Section”.
- Fascia mounted Hand/Off/Auto facility for all drives controlled from the MCC along with dedicated “Run & Trip” or “Run & Fault” indication as applicable.
- Fascia mounted Off/Auto facility for all packaged plant controlled from the MCC along with dedicated ‘Enabled & Common Fault’ indication.
- Duty/Standby plant selection shall be provided when in hand.
- Cluster LED type indication lamps with lamp test facility.
- 100mm plinth to be included for floor standing MCCs.
- Internal anti-condensation heater and ventilation fans with control stat as necessary.
- Internal luminaire controlled from door micro-switch for sections in excess of 1000mm.
- Control section drop down lap-top shelf and 13A socket outlet.
- Fascia mounted Touch Screen interface (Per MCC or plant room). Mounting height of displays to be 1500mm above FFL.
- The control section shall not have any voltage greater than 50v unless it is

segregated from the rest of the control circuitry (by double insulated cable as a minimum), and marked with the appropriate warning labels. This section shall house the controller plus all necessary control interfaces.

- The power section shall house all the starter equipment associated with the control panel, and shall incorporate a door-interlocked isolator i.e. the power section panel door cannot be opened unless the door isolator is in the “OFF” position, thus isolating all hazardous voltages within the section.

6.5 System Supervisor Graphics

The graphics shall be based on the system schematics and layout drawings for the project. All graphics shall accord with the standards set out in the supplementary document BMS Graphics Standards.

Graphics to be configured in line with established site operator privileges as follows:

- Level 1 - View only
- Level 2 - Reset / acknowledge alarms and operate plant
- Level 3 - Time schedules, set point changes, run time schedules
- Level 4 - Override plant controls
- Level 5 - Full engineering access

The dynamic graphics shall display regularly updated dynamic values required (as a minimum).

The graphics shall utilise all BMS input and output points, along with any software “knobs” and “switches”, to give a full and

concise overview of plant monitoring and performance.

Where applicable, the graphics shall identify all enable signals clearly adjacent to each item of plant.

7 Design / Contractor Submittal Requirements

Reference should be made to the Manual to the Standards for general requirements for drawing and sample submittal requirements.

All redundant services are to be stripped out during the works. A schedule of redundant services is to be issued to the Infrastructure Manager prior to commencing work.

BMS supervisor graphics are to be based on the building record drawings. The BMS designer must issue to the principal contractor a schedule of drawings required and copy to the Infrastructure Manager.

8 Materials Standards

Electrical installations associated with BMS shall accord with the standards set out in BLU 11 Electrical Distribution.

9 Workmanship Standards

Electrical installations associated with BMS shall accord with the standards set out in BLU 11 Electrical Distribution.

All control panel installations and wiring shall be installed in accordance with all current legislation, regulations, applicable British

Standards, wiring regulations, manufacturer's installation guidelines.

Space humidity or temperature detectors shall be mounted away from any heat generating machinery, direct sunlight, draughts and diffuser air streams which could affect their operation to a height of 1.5 m.

External sensors shall be located to avoid undue influence by localised conditions such as turbulence, direct sunlight and localised over heating.

10 Testing & Commissioning

Carry out commissioning of installation with the procedures, checks and tolerances given in the BSRIA Application Guide for air systems to achieve the standards set in the CIBSE Commissioning Codes.

All control components shall be set up and commissioned in accordance with the manufacturer's recommendations.

A systematic record of all tests and commissioning procedures is to be kept. Provide copies to the TfL Infrastructure Manager on request.

11 Handover

Reference should be made to the Manual to the Standards for general requirements for handover and submissions required for the Operation and Maintenance Manual.

System drawings, schematics and schedules for record shall be of the complete system. Where the works comprise alteration or

additions to existing systems then the existing record information is to be amended to reflect the changes. Partial record information will not be accepted.

Back up of BMS configuration files on CD is required as part of the Operation and Maintenance (O&M) Manuals.

12 Maintenance

When new equipment is added or alterations are made to existing installations there shall be no detrimental impact on the ease of maintenance of existing facilities unless through dispensation from the Infrastructure Manager.

The contractor shall provide full maintenance during the defects liability period in accordance with the TfL maintenance model. Any departure from this requirement will require the grant of dispensation from the Infrastructure Manager.

The contractor shall create and maintain a maintenance log recording all reported defects, problems and maintenance issues and their resolution. Upon completion of the rectification of defects the log shall be issued to the Infrastructure Manager, prior to the release of any retention monies.

13 Further Information

13.1 Legislation

- Building Regulations Part L2 Conservation of Fuel & Power
- Building Regulations Part P Electrical Safety
- BS 7671 Requirements for electrical installations.

- Energy Technology Criteria List - www.eca.gov.uk.
- Non-Domestic Heating, Cooling and Ventilation Compliance Guide
- Tier 2 document to Part L2, Dept. for Communities and Local Government.

13.2 Codes of Practice

CIBSE Commissioning Code C: Automatic Controls

13.3 Design Guidance

CIBSE Guide F Energy Efficiency in Buildings

CIBSE Guide H Building Control Systems

TfL Data Logging Technical Note

Controls for End Users - Building Controls

Industry Association.

Revision History:

Issue	Date	Description
1	December 2010	This standard supersedes standard M009 Building Management Systems.

Relevant British / European Standards

BS 7671	Requirements for electrical installations.
prEN 13646:1999	Building control systems – equipment characteristics
prEN 16484-2:	Building control systems part 2 – HVAC control system functionality
BS EN 15232: 2007	Energy Performance of Buildings. Impact of Building Automation, Controls and Building Management.
BS EN 60439-1	Low-voltage switchgear and controlgear assemblies. Type-tested and partially type-tested assemblies.

01

Central Heating Plant

Issue 1 — December 2010



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01 Central Heating Plant

1 Scope

This Standard sets out requirements for central heating plant, e.g. boilers heat pumps etc. in non-operational premises intended for use as offices by Transport for London (TfL).

This Standard supersedes standard LUF-M001-S Heating Systems.

- Requirements for space heating and heat utilisation are set out in BLU 02 Space Heating.
- Requirements for ventilation and air-conditioning are set out in BLU 03 Mechanical Ventilation and BLU 04 Air Conditioning.
- Requirements for refrigeration and air cooling are set out in BLU 05 Refrigeration and Cooling.
- For natural gas installations please refer to BLU 08 Natural Gas.
- Requirements for control and monitoring are set out in BLU 17 Building Management Systems.
- Requirements for metering are set out in BLU 18 Metering.

All works shall comply with the requirements of non-domestic heating, cooling and ventilation compliance guide.

2 References

This Standard should be read in conjunction with the accompanying Manual to the Standards and TfL standards GRN 01, 02, 03 BLU 02,03,04,05,08,17,18.

It shall be the responsibility of the designer/installer to reference and comply with all the above and any other standards where necessary.

Relevant British Standards referred to in the text are listed on the rear cover. Unless otherwise stated, references are to the latest editions and revisions.

3 Definitions / Abbreviations

For a list of general abbreviations and definitions used within the Standards please see the accompanying Manual to the Standards.

4 Construction Design and Management Regulations (CDM)

Reference should be made to the Manual to the Standards for requirements under the CDM regulations.

5 Performance Standards

5.1 General Standards

All heating systems shall be designed in accordance with current CIBSE Guides, Guidance Notes and other publications in addition to complying with the requirements of The Building Regulations.

The heating system shall be designed to minimise energy consumption, operate efficiently, and provide adequate heating without undue hot or cold spots throughout the occupied hours.

Water-based heating systems shall be designed and installed to BS EN 12828 & Building Regulations L2 compliance requirements.

The designer shall make due allowance for the space heating contribution from environmental and casual heat gains. The occupancy heat gains shall be derived from GRN 02 Design Criteria.

The designer shall make due allowance for the affects of solar radiation, both generally and locally, in the overall design.

The designer must assess any existing heating system within the building when calculating the proposed heating and cooling loads. Any imbalance in the capacities of the central

plant and distribution systems shall be determined and corrected so as to meet the expected needs efficiently and economically. A full building heat load calculation shall be undertaken for any heating plant renewal. Replacing systems like for like shall not be permitted unless justified by calculation and approved by the Infrastructure Manager.

The heating system shall be appropriately zoned to allow for differing uses, locations, orientations and occupancy periods.

The design of the heating system shall acknowledge the requirements of the BMS Standard.

Where heating to occupied spaces within a building is provided by a central system supplying standard heat emitters, systems shall incorporate appropriate mechanisms to enable localised control to be exercised within all parts of the building.

6 Equipment Standards

6.1 General Requirements

Where a product or component required for the works appears in any category on the Energy Technology Criteria List then the product or component selected for the installation shall comply fully with the relevant criteria.

With the exception of items designed to be disposable, the design life of the materials and equipment used shall be not less than five years. For materials and equipment whose replacement is not expected between major refurbishments, the design life shall be a minimum of fifteen years.

Unusual, non-standard and non-proprietary components, substances and materials shall not be used.

Where working with an existing system, ensure that all insulation is in a good state of repair where it is not it shall be replaced to current standards.

Where multiple heat sources are installed these shall be connected via a reverse return header, and controlled by the manufacturer's cascade controller.

All equipment and assemblies which fall within the scope of the Pressure Equipment Directive (PED) 97/23/EC, implemented in the UK through the Pressure Equipment Regulations 1999, must be tested by the manufacturers, and be certified as compliant with the Directive. Such compliance shall be evidenced by displaying the appropriate CE Mark on the equipment and assemblies.

Heating systems must be designed and installed so as not to allow any products of combustion to enter the workplace.

6.2 Specific Requirements for Boiler Installations

The boiler plant room shall be provided with adequate ventilation at high and low level in accordance with BS 6644.

Ensure that ventilation to boiler room complies with CIBSE Guide B and Local Authority recommendations.

Comply with manufacturer's instructions and recommendations for the installation of boiler(s).

Locate boiler with adequate surrounding space for service and maintenance.

Boilers shall be selected with minimum seasonal efficiency of 87% and NO_x emissions not exceeding 40 mg/kWh.

Gas boilers rated from 60 kW to 2 MW shall comply with safety and performance of gas fired hot water boilers in accordance with BS 5978.

6.3 Heat Source

The system designer shall undertake an appraisal of the building energy uses in order to determine the most appropriate heat source in accordance with the LDA Sustainable Development Guide.

Heating systems should utilise readily available technologies. The preferred heat sources are, in order of preference:

- Ground source heat pump
- Combined heat and power
- Condensing gas boiler
- Air source heat pump
- Biofuel boiler

Schemes considering a heat source other than conventional gas boiler should be referred to the Sustainable Buildings Team for guidance.

Where new gas fired boilers are being installed these shall be condensing and equivalent to SEDBUK rating A.

Direct electric heating systems should not be used except in existing buildings and only then if no possible alternative is available.

Table 1. Heat Distribution. Flow / Return Temperatures.

Installation Type	Flow/Return Temperatures
Retrofit installations	82/71°C
New installations with Combined Heat & Power as the primary heat source	82/71°C
New installations with condensing boilers as the primary heat source	70/50°C
New installations with heat pumps as the primary heat source	60/40°C

Immersion heaters may be installed into thermal stores as a backup only. These shall be interlocked with the heating control system to only be activated when the boiler's system has failed.

6.4 Heat Distribution

Heat distribution within head office buildings shall be by Low Temperature Hot Water (LTHW). The system flow and return temperatures shall be selected to maximise the efficient operation of the heat source (see Table 1).

All LTHW systems shall be configured as primary/secondary with a low loss header to decouple flow on the demand side from flow through the heat source.

New and existing wet systems must be fully pumped. Gravity system shall be converted to fully pumped systems to allow control. Primary pumps shall be selected to suit the characteristics of the heat source. Secondary pumps shall be provided with inverter speed controls.

The pipework distribution system shall not exceed a pressure drop of more than 300 Pa/m in order to minimise the size of the pump and reduce energy consumption.

6.5 Zoning

The heating system should be zoned to allow for differing uses, locations, orientations and operating times using variable temperature circuits. Where 24 hour operation is required to a zone within a non-24 hour building the systems shall be designed to avoid unnecessary operation of central plant.

Where heating to occupied spaces within a building is provided by a central system supplying standard heat emitters, systems shall incorporate appropriate mechanisms to enable localised control to be exercised within all parts of the building.

As a minimum, programmable room thermostats shall be used to match demand patterns within each zone.

6.6 Fill & Expansion

All new installations shall be pressurised using a purpose designed pressurisation unit and matched expansion vessel.

The design shall ensure that a minimum hydraulic pressure of 0.2 bar(g) is achieved at any point in the system to prevent the ingress of air.

The pressurisation unit shall incorporate means to monitor the water supply to the LTHW system as an aid to identifying system faults and leaks.

6.7 Controls

The heating system shall incorporate optimum start and optimum stop controls to ensure that the space temperatures specified in standard BLU 02 Space Heating is achieved throughout the occupied period without any unnecessary operation of the heat source.

The heating flow temperature to all radiator and natural convector circuits shall be compensated to outside temperature to maximize efficiency.

The heating system shall shut down if the external temperature exceeds a specified set point.

Heat emitter zones, heater batteries, heating coils in equipment, underfloor heating manifolds and like equipment shall all be controlled with two port valves achieving tight shut off.

All demand all where appropriate primary pumps, shall be speed controlled to provide variable flow in response to system demands.

7 Design / Contractor Submittal Requirements

Reference should be made to the Manual to the Standards for general requirements for drawing and sample submittal requirements.

All redundant services are to be stripped out during the works. A schedule of redundant services is to be issued to the Infrastructure Manager prior to commencing work.

8 Materials Standards

All materials must be specified / sourced and installed in accordance with the parameters set out in TfL standard GRN 01, which includes details of requirements for minimum recycled content.

Heating pipework in new installations shall be steel throughout, screwed up to and including 40mm, welded at 50mm and above. Copper pipework may only be used to match existing installations.

Plastic pipework may be used at sizes up to 25mm only with the consent of the Infrastructure Manager. Plastic pipework must be electro-welded or utilise manipulative compression joints requiring a tool to assemble.

Push fit jointing will not be permitted on any pipe material under any circumstances.

All heating pipework shall be insulated using mineral fibre pipe insulation, to BS 3958-4, with nominal density 80 kg/m³ to 120 kg/m³. Thermal conductivity shall not exceed 0.038 W/mK at a mean temperature of 50°C.

Provide insulation of thickness as derived from the requirements of the Building Regulations (England and Wales) Part L Approved Documents, and the calculation methods given in BS EN ISO 12241.

For pressure & altitude gauges ensure dial graduation is from zero to between 1.5 and 3.0 times normal working pressure. Graduate in bar (gauge) on gauges reading head or working pressure, or in Pascals where pressure differences across plant items are to be established.

9 Workmanship Standards

Arrange all exposed pipe work to run in a neat and presentable appearance, parallel with other pipe or service runs and building structure, subject to gradients for draining or venting.

Ensure all vertical pipes are plumb or follow building line.

Provide valves, cocks and stop taps for isolation and regulation:

- On mains to isolate major sections of distribution.
- The base of all risers and drops except in cases where one item of apparatus only is served which has its own local valve or stop tap.
- At points of pipe connection of all items of apparatus and equipment except where the item; could conveniently be isolated or regulated by valves provided for other adjacent items.

Enclose pipes passing through building elements (walls, floors, partitions, etc.) concentrically within purpose made sleeves.

Do not apply thermal insulation until installation has been fully tested and all joints proved sound.

Ensure that all materials are kept dry. Apply insulants, facings, coatings and protection strictly in accordance with manufacturer's instructions.

Heating pipework is to be identified by coloured bands and legends identifying circuit and direction of flow return at maximum 15m intervals.

10 Testing & Commissioning

Carry out Hydraulic Pressure Testing as described in HVCA TR/6 Guide to Good Practice for Site Pressure Testing of Pipework.

Carry out flushing of water systems in accordance with BSRIA Application Guide 1/2001 Pre-commission Cleaning of Pipework Systems.

Commission boilers in accordance with the procedures laid down by the boiler manufacturer. With boiler operating check and adjust all equipment and controls. Balance system to give approximately equal return temperatures from all heat emitters. Carry out commissioning of installations in accordance with the procedures, checks and tolerances given in the BSRIA Application Guides for water systems and air systems to achieve the standards set in the CIBSE Commissioning Codes.

Demonstrate the proper performance of heating installations including single, standby, multi-duty plants and systems.

Keep a systematic record of all tests and commissioning procedures. Provide copies to the TfL Infrastructure Manager on request.

11 Handover

Reference should be made to the Manual to the Standards for general requirements for handover and submissions required for the Operation and Maintenance Manual.

Axonometric or full 3D drawings shall be provided for all plant rooms clearly identifying the equipment and interconnecting services.

Procedures for preventative measures against the effects of aerobic bacteria, *Pseudomonas*, shall form part of the hand over documentation.

12 Maintenance

The contractor shall provide full maintenance during the defects liability period in accordance with the TfL maintenance model. Any departure from this requirement will require the grant of dispensation from the Infrastructure Manager.

When new equipment is added or alterations are made to existing installations there shall be no detrimental impact on the ease of maintenance of existing facilities unless through dispensation from the Infrastructure Manager.

The contractor shall create and maintain a maintenance log recording all reported defects, problems and maintenance issues and their resolution. Upon completion of the rectification of defects the log shall be issued to the Infrastructure Manager, prior to the release of any retention monies.

13 Further Information

13.1 Legislation

- Building Regulations Part L2 Conservation of Fuel & Power
- Building Regulations Part J Combustion appliances and fuel storage systems
- Pressure Equipment Regulations 1999
- Energy Technology Criteria List - www.eca.gov.uk.
- Non-Domestic Heating, Cooling and Ventilation Compliance Guide - Dept. for Communities and Local Government. (Tier 2 document to Part L2)

13.2 Design Guidance:

- LDA Sustainable Development Guide
- CIBSE Guide B1 Heating Systems
- CIBSE Guide F Energy Efficiency in Buildings
- CIBSE Guide M Maintenance Engineering & Management
- BSRIA Application Guide 16/2002 Variable flow water systems: design, installation and commissioning guidance
- HVCA Guide to Good Practice for Site Pressure Testing of Pipework HVCA TR/6
- BSRIA Application Guide Pre-commission cleaning of pipework systems AG 1
- CIBSE Commissioning Code B: Boilers
- BSRIA Guide: A Practical Guide to Building Services Calculations G30

Revision History:

Issue	Date	Description
1	December 2010	This standard supersedes standard LUF-M001-S Heating Systems.

Relevant British / European Standards

BS 1710	Specification for identification of pipelines and services.
BS 3958-4	Thermal insulating materials. Bonded preformed man-made mineral fibre pipe sections.
BS 5410-1	Code of practice for oil firing. Part 1 Installations up to 45 kW output capacity for space heating and hot water supply purposes.
BS 5410-2	Code of practice for oil firing. Part 2 Installations of 45 kW and above output capacity for space heating, hot water and steam supply services.
BS 5440-2	Installation and maintenance of flues and ventilation for gas appliances of rated input not exceeding 70 kW net (1st, 2nd and 3rd family gases). Part 2 Specification for installation and maintenance of ventilation for gas appliances.
BS 5970	Code of practice for thermal insulation of pipework and equipment in the temperature range of -100°C to +870°C.
BS 5854	Code of practice for flues and flue structures in buildings.
BS 5978	Safety and performance of gas-fired hot water boilers (60 kW to 2 MW input). Specification for general requirements.
BS 6644	Specification for installation of gas-fired hot water boilers of rated inputs between 70 kW (net) and 1.8 MW (net) (2nd and 3rd family gases).
BS 6798	Specification for installation of gas-fired boilers of rated input not exceeding 70 kW net.
BS 8207	Code of practice for energy efficiency in buildings
BS EN 230	Automatic burner control systems for oil burners.
BS EN 656	Gas-fired central heating boilers. Type B boilers of nominal heat input exceeding 70kW but not exceeding 300 kW. Partially replaces BS 5978-1, -2, -3 which remain current.
BS EN 677	Gas-fired central heating boilers. Specific requirements for condensing boilers with a nominal heat input not exceeding 70 kW.
BS EN ISO 4126-1	Safety devices for protection against excessive pressure. Part 1 Safety valves.
BS EN ISO 12241	Thermal insulation for building equipment and industrial installations. Calculation rules.
BS EN 12828	Heating systems in buildings. Design for water-based heating systems.
BS EN 12831	Heating systems in buildings. Method for calculation of the design heat load. Partially replaces BS 5449:1990 which remains current.
BS EN 14336	Heating systems in buildings. Installation and commissioning of water based heating systems. Partially replaces BS 5449:1990 which remains current.

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Electrical Distribution

Issue 1 — December 2010



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11 Electrical Distribution

1 Scope

This Standard sets out requirements for low voltage electrical distribution in non-operational premises intended for use as offices by London Regional Transport and London Underground Limited.

This Standard part supersedes standard LUF-M005-ST Electrical Systems.

- Requirements for small power installations are set out in BLU 12 Small Power Installations
- Requirements for lighting installations are set out in BLU 13 Lighting Installations
- Requirements for control and monitoring are set out in BLU 17 Building Management Systems
- Requirements for metering are set out in BLU 18 Metering

2 References

This Standard should be read in conjunction with the accompanying Manual to the Standards and TfL Standards GRN 01, 02, 03 BLU 08, 12, 13.

It shall be the responsibility of the designer/installer to reference and comply with all the above and any other Standards where necessary.

Relevant British Standards referred to in the text are listed on the rear cover. Unless otherwise stated, references are to the latest editions and revisions.

3 Definitions / Abbreviations

For a list of general abbreviations and definitions used within the Standards please see the accompanying Manual to the Standards.

Abbreviations specific to this standard are:

- IEE: Institute of Electrical Engineers.
- BESA: British Electrical Systems Association.
- CPC's: Circuit Protective Conductor
- MCCB: Moulded Case Circuit Breaker
- MCB: Miniature Circuit Breaker
- HRC: High Rupture Capacity
- C.T: Current Transformer

- BASEC: British Approvals Service for Cables
- MICC: Mineral Insulated Cable
- XLPE: Cross Linked PolyEthylene
- SWA: Steel Wire Armoured Cable

4 Construction Design and Management Regulations (CDM)

Reference should be made to the Manual to the Standards for requirements under the CDM regulations.

5 Performance Standards

New electrical distribution systems shall be designed, installed and tested in accordance with current Requirements for Electrical Installations (IEE Wiring Regulations), CIBSE Guides, Guidance Notes and other publications and shall comply with the requirements of The Building Regulations Part P.

The designer shall make due allowance for space capacity for future expansion within any new installation. At all points in new systems 25% spare capacity shall be allowed for expansion. Where an existing system is being extended the designer does not need to allow for further spare capacity unless the works would result in the spare capacity falling below 5%. If the proposed works would result in the system spare capacity falling below 5% then the designer will advise the Infrastructure Manager and provide the cost to re-instate the system to 25% spare capacity. The Infrastructure Manager will then confirm the requirement for the project.

In existing installations the designer must assess and take account of existing electrical distribution loads when assessing the revised maximum demand.

A full discrimination study shall be prepared for the complete electrical network. The study shall include the REC protection settings and shall verify the discrimination performance through the complete electrical system.

Final distribution boards shall be provided at each main floor level to be served. Final distribution shall be segregated for essential power, light and non-essential power. Each service shall be separately metered in compliance with the metering standard.

For new installations in multi-floor buildings rising bus bar systems are preferred. In smaller installations or alterations cable distribution may be used with the approval of the Infrastructure Manager.

Where required by the Fire Certificate for the premises or The Building Regulations, emergency power supplies for fire fighting purposes shall be provided.

The designer shall consider and make allowance for Electromagnetic Compatibility in selection of equipment and implement mitigation measures to control electromagnetic interference.

Main electrical distribution systems shall incorporate power factor correction and harmonic filtration equipment as required to meet the requirements of EA Engineering Recommendation G5/4.

Main electrical distribution systems shall incorporate surge protection.

Electrical distribution systems shall incorporate metering and sub-metering in accordance with standard BLU 18 Metering.

The designer shall ensure main earthing is provided to the requirements of the Electrical Supply Authority, the wiring regulations and codes of practice.

All circuits shall be provided with a separate Circuit Protective Conductor (CPC). Metallic containment and the wire armour of cables may not be used in lieu of a CPC.

All metalwork which may provide a path to the earth such as components of cold water systems, metallic pipes, duct work etc., shall be earth bonded having impedance to earth of not more than 1 Ohm.

6 Equipment Standards

6.1 General Requirements

Where a product or component required for the works appears in any category on the Energy Technology Criteria List then the product or component selected for the installation shall comply fully with the relevant criteria.

With the exception of items designed to be disposable, the design life of the materials and equipment used shall be not less than five years. For materials and equipment whose replacement is not expected between major refurbishments, the design life shall be a minimum of 15 years.

All of the switchgear, distribution boards, protective devices and control components in any installation shall be obtained from a single manufacturer.

Control components and ancillaries shall be DIN rail mounting where appropriate. Unusual, non-standard and non-proprietary components, substances and materials shall not be used.

6.2 Main and Sub-Main Switchgear

Main and sub-main switchgear shall be installed to provide the primary means of distributing power to final distribution boards and fixed loads. The boards shall be rated to suit the calculated design loads, plus 25% spare capacity, and the maximum fault current.

All new switchgear shall be modular composite switchboards or panel boards IEC 60439-1 Form 3b Type 2. Meters and control components shall be mounted within spare sections of the main panel board.

Where different wiring classes terminate within the same enclosure, clearances and barriers shall be in accordance with BS 7671.

Protective devices shall be either Moulded Case Circuit Breaker (MCCB) or Miniature Circuit Breaker (MCB). BS88 High Rupture Capacity (HRC) fuses may be used to extend existing installations or in exceptional circumstances subject to approval of the Infrastructure Manager.

All equipment shall be type tested. The equipment shall be clearly identified

and grouped in locations accessible only to skilled or instructed persons. Designated circuit chart, schematic distribution diagram, statutory signage and notices shall be provided adjacent to the switchgear.

6.3 Rising Busbar Systems

Rising busbars shall conform with the requirements of BS EN 60439-2.

The systems shall be enclosed, complete with a separate copper earth bar, with all tap offs fitted with protective devices and with space to add integral Current Transformers (C.T.s) for metering.

6.4 Distribution Boards

Final circuit distribution boards shall be installed to provide final circuits for general power, lighting and fixed equipment. The boards shall be rated to suit the calculated design load and fault current, number of circuits, plus 25% spare capacity.

Final circuit distribution boards shall be 3 Phase Type B.

All distribution boards shall be supplied complete with integral isolator, protective devices, blank plates for spare ways, two spare protective devices for each rating used, circuit chart, lockable front cover and lock.

Meters shall be integral to the distribution board or housed within an attached DIN rail enclosure. Where appropriate the boards shall be supplied with split busbar for power and lighting and separate metering for each section. Meter displays shall be panel mounted on the distribution board or enclosure.

Final circuit arrangements and protection shall be as specified in BLU 12 Small Power Installations and BLU 13 Lighting Installations.

7 Design / Contractor Submittal Requirements.

Reference should be made to the Manual to the Standards for general requirements for drawing and sample submittal requirements.

All redundant services are to be stripped out during the works. A schedule of redundant services is to be issued to the Infrastructure Manager prior to commencing work.

8 Materials Standards

8.1 Cabling

This cabling standard covers all low voltage and extra low voltage cables within voltage band I and band II.

All insulation wiring and cables shall be low-smoke zero halogen (LSOH), installed within metallic containment or on metallic support systems.

The uses of PVC insulated cables are prohibited.

All cabling shall be BASEC approved. Insulation to all cabling shall be LSOH.

Cables rated for fire safety shall be MICC to comply with BS 6387 and BS EN 60702.

Soft sheath fire resisting cables shall not be used.

Where approved for use, main and sub-main distribution cables shall be 600/1000V steel wired armoured (XLPE/SWA/LSOH) to BS 6724, installed on medium duty galvanised cable tray.

Where cable lengths are short, such as switchgear interconnections, these may be installed using LSOH single cables in galvanised steel trunking.

CPCs shall be installed in LSOH single insulated green and yellow cable.

8.2 Cable Tray

All cable tray is to be manufactured by a member of BESA in accordance with BS EN 61537.

Cable tray shall be perforated hot dipped galvanised mild steel, with a return edge flange medium duty and a gauge of not less than 1.5mm. The tray shall be rigidly fixed and supplied complete with purpose made fittings, connectors and fixing brackets.

All cable tray tees, intersections and sets shall be propriety items supplied by the manufacturer of the tray. Where proprietary items are not available suitable fittings may be fabricated subject to the approval of the Infrastructure Manager.

Cable ladder and steel wire cable tray can be considered as an alternative to cable tray subject to the approval of the Infrastructure Manager. Cable ladder and steel wire cable tray shall be manufactured by a member of BESA in accordance with BS EN 61537. All fittings shall be propriety items supplied

by the manufacturer. Where proprietary items are not available suitable fittings may be fabricated subject to the approval of the Infrastructure Manager.

8.3 Cable Trunking

All trunking is to be manufactured by a member of BESA in accordance with BS EN 50085.

Cable trunking shall be hot dipped galvanised mild steel with internal return edge flange. The lid shall be fastened by turnbuckles to the flange.

All tees, intersections and sets shall be propriety items supplied by the manufacturer of the trunking.

The system shall be rigidly fixed and supplied complete with purpose made fittings, connectors and fixing brackets.

Aluminium dado trunking with electrical accessories shall be used where trunking is visible, wall mounted and electrical services outlets are required. All fittings shall be propriety items supplied by the manufacturer.

9 Workmanship Standards

9.1 Equipment

All equipment shall be installed in accordance with the manufacturer's requirements, relevant standards and code of practice.

All installation works shall be carried out in accordance with the IEE wiring regulations on site.

All equipment and installations shall be capable of being maintained, inspected and tested to prevent danger.

9.2 Cable Installation

Armour cables installed direct in ground shall be laid in prepared trenches and suitably backfilled with warning tape. Where cables are run below areas likely to be cultivated, such as gardens, they shall be protected with interlocking cable tiles. Cables installed below hard finished areas shall be laid in 'Hepduct' clay conduits.

Distribution cables shall be fixed cable tray system using either metal cable cleats or LSOH plastic cable cleats. Cable ties and bands are not permitted.

SWA cables shall not be installed under tension and allowance must be made for movement of the structure and changes in direction of the cable route. The radius or curvature shall be within the specified limits recommended by the manufacturer.

SWA cables shall be terminated into cable spreader boxes at every switch and isolator.

Heavy gauge mechanical protection shall be provided to exposed cables where installed up to a height of 1800mm.

Vertical cable trunking shall be fitted with cable pin racks at 5.0m centres to avoid straining cables and their insulation.

Circuits for safety services as designated by building control shall be routed outside of fire risk areas, where this is not possible cables shall be suitably fire rated.

9.3 Labelling and Identification

All equipment shall be clearly and permanently labelled in a comprehensive manner with type-written circuit lists and ratings together with any warning, safety and operating signage.

All cables and their cores shall be labelled. Individual core labelling should be by the cable identifier sheath numbering method only. All cable labels shall be installed within 100mm of termination point at both ends and at every change of direction.

All items of electrical plant shall be provided with permanently fixed Traffolyte labels depicting the equipment reference and description corresponding to the distribution chart and schematic diagram installed at the point of supply.

Final circuit designation charts shall be typed and mounted in a suitable manner adjacent to every final circuit distribution board installed throughout the installation.

9.4 Earthing

Main equipotential bonding shall be carried out using LSOH single insulated green and yellow cable run from the main earthing terminal and terminating on the consumers side of the incoming water & gas services and building structural frame.

Supplementary bonding in accordance with BS 7430 and BS 7671 is to be carried out to all extraneous metalwork throughout the installation, using suitably sized LSOH single green and yellow cable.

All earthing cables are to be labelled with the conductor size and equipment or area served.

9.5 Fire Stopping

In locations where the busbar trunking passes through fire compartments the manufacturer's fire rated collar/seal shall be installed to achieve the same fire rating as the surrounding compartment.

10 Testing & Commissioning

Testing, commissioning and certification of all works and installations shall be conducted in accordance with BS 7671.

Inspection and progressively full testing, during erection and/or completion, before the installation is put into service, and inspection and test to verify, so far as is reasonable practicable, that the requirements of BS 7671 have been met. Completing and submitting the test certificates and affording the opportunity of the Project Engineer to witness such tests.

To avoid possible damage to equipment, insulation resistance testing shall be carried out before fittings or equipment are connected, but at a stage where circuits are complete and connected to porcelain connector blocks, or similar approved connections, at fitting positions.

Continuity testing shall be carried out as prescribed in the BS 7671 before supplies are connected. Once supplies are connected, polarity, earth fault loop impedance and RCD operation shall be completed and recorded. All control components shall be set up and commissioned in accordance with the manufacturer's recommendations.

Full completion and inspection certificates shall be prepared and issued as prescribed in Appendix 6 of BS 7671. Provide copies to the TfL Infrastructure Manager on request.

11 Handover

Reference should be made to the Manual to the Standards for general requirements for handover and submissions required for the Operation and Maintenance Manual.

Complete system schematics shall be provided at handover. Where the works involve the alteration of part of a service, the entire schematic shall be revised and issued for record.

A designation chart and schematic diagram of the distribution system is mounted in a suitable frame fixed adjacent to the distribution equipment

12 Maintenance

The contractor shall provide full maintenance during the defects liability period in accordance with the TfL maintenance model. Any departure from this requirement will require the grant of dispensation from the Infrastructure Manager.

When new equipment is added or alterations are made to existing installations there shall be no detrimental impact on the ease of maintenance of existing facilities, unless through dispensation from the Infrastructure Manager.

The contractor shall create and maintain a maintenance log recording all reported defects, problems and maintenance issues and their resolution. Upon completion of the rectification of defects the log shall be issued to the Infrastructure Manager, prior to the release of any retention monies.

13 Further Information

13.1 Legislation

- Building Regulations Part P Electrical Safety
- Energy Technology Criteria List - www.eca.gov.uk.

13.2 Design Guidance

- CIBSE Guide K Electricity in Buildings
- IEE On Site Guide (BS7671 Wiring Regulations 17th Edition)

Revision History:

Issue	Date	Description
1	December 2010	This standard part supersedes standard LUF-M005-ST Electrical Systems

Relevant British / European Standards

BS 88	Cartridge fuses for voltages up to 1000Vac and 1500Vdc.
BS 6387	Specification for the performance requirements for cables required to maintain circuit integrity under fire conditions.
BS 6724	Electric cables. Thermosetting insulated, armoured cables for voltages of 600/1000V and 1900/3300V, having low emission of smoke and corrosive gases when affected by fire.
BS 7211	Electric cables. Thermosetting insulated, non armoured cables for voltages up to and including 450/750V, for electric power, lighting and internal wiring and having low emission of smoke and corrosive gases when affected by fire.
BS 7430	Code of practice for earthing.
BS 7671	Requirements for electrical installations.
BS EN 50085	Cable trunking and cable ducting systems for electrical installations.
BS EN 60439	Low voltage switchgear and control gear assemblies.
BS EN 60439 -2	Low voltage switchgear and control assemblies- Particular requirements for busbar trunking systems.
BS EN 60702-1	Mineral insulated cable and their terminations with a rated voltage not exceeding 750v cables.
BS EN 60947-2	Low voltage switchgear and control gear assemblies - Part 2 circuit breakers.
BS EN 61537	Cable tray systems and cable ladder systems for cable management.
IES 60439-1	Low voltage switchgear and control gear assemblies - Part 1 Type tested assemblies.

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Emergency Generators

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10 Emergency Generators

1 Scope

This Standard sets out requirements for emergency generators in non-operational premises intended for use as offices by Transport for London (TfL).

- Requirements for control and monitoring are set out in BLU 17 Building Management Systems.
- Requirements for metering are set out in BLU 18 Metering.

All works shall comply with the requirements of non-domestic heating, cooling and ventilation compliance guide.

2 References

This Standard should be read in conjunction with the accompanying Manual to the Standards and TfL Standards GRN 01, 02,03, BLU 11, 18.

It shall be the responsibility of the designer/installer to reference and comply with all the above and any other Standards where necessary.

Relevant British Standards referred to in the text are listed on the rear cover. Unless otherwise stated, references are to the latest editions and revisions.

3 Definitions / Abbreviations

For a list of general abbreviations and definitions used within the Standards please see the accompanying Manual to the Standards.

4 Construction Design and Management Regulations (CDM)

Reference should be made to the Manual to the Standards for requirements under the CDM regulations.

5 Performance Standards

Where there is a requirement to install a backup electrical generator in head office premises the project shall be referred to the Sustainable Buildings Team for consideration as a possible CHP installation.

Generating sets shall be supplied complete with acoustic treatment or enclosure to ensure that the design noise levels contained in GRN 02 Design Criteria are not exceeded in any occupied space.

6 Equipment Standards

Where a product or component required for the works appears in any category on the Energy Technology Criteria List then the product or component selected for the installation shall comply fully with the relevant criteria.

Generators sets shall be designed, supplied and installed in accordance with BS ISO 8528.

Power supplies from, and the fuel input to, all generator sets shall be separately metered in accordance with BLU 18 Metering. Where a generator set is configured for CHP the heat output and heat rejection shall also be metered.

7 Design / Contractor Submittal Requirements

Reference should be made to the Manual to the Standards for general requirements for drawing and sample submittal requirements.

All redundant services are to be stripped out during the works. A schedule of redundant services is to be issued to the Infrastructure Manager prior to commencing work.

8 Materials Standards

Electrical installations associated with generator installations shall accord with the standards set out in BLU 11 Electrical Distribution.

9 Workmanship Standards

Electrical installations associated with generator installations shall accord with

the standards set out in BLU 11 Electrical Distribution.

All control panel installations and wiring shall be installed in accordance with all current legislation, regulations, applicable British Standards, wiring regulations, manufacturer's installation guidelines.

Any emergency generator connected to a grid supply shall be provided with protection in accordance with G59 standards.

10 Testing & Commissioning

Carry out commissioning of installation with the procedures, checks and tolerances given in the BSRIA Application Guide for air systems to achieve the standards set in the CIBSE Commissioning Codes.

All control components shall be set up and commissioned in accordance with the manufacturer's recommendations.

Keep a systematic record of all tests and commissioning procedures. Provide copies to the TfL Infrastructure Manager on request.

11 Handover

Reference should be made to the Manual to the Standards for general requirements for handover and submissions required for the Operation and Maintenance Manual.

Axonometric or full 3D drawings shall be provided for all plant rooms and congested areas of distribution, clearly identifying the equipment and interconnecting services.

12 Maintenance

The contractor shall provide full maintenance during the defects liability period in accordance with the TfL maintenance model. Any departure from this requirement will require the grant of dispensation from the Infrastructure Manager.

When new equipment is added or alterations are made to existing installations there shall be no detrimental impact on the ease of maintenance of existing facilities unless through dispensation from the Infrastructure Manager.

The contractor shall create and maintain a maintenance log recording all reported defects, problems and maintenance issues and their resolution. Upon completion of the rectification of defects the log shall be issued to the Infrastructure Manager, prior to the release of any retention monies.

13 Further Information

13.1 Legislation

- Building Regulations Part L2 Conservation of Fuel & Power
- Building Regulations Part J Combustion appliances and fuel storage systems
- Energy Technology Criteria List - www.eca.gov.uk.
- Non-Domestic Heating, Cooling and Ventilation Compliance Guide - Tier 2 document to Part L2, Dept. for Communities and Local Government.

13.2 Design Guidance

- CIBSE Application Manual AM12 Small-scale combined heat and power for buildings

Revision History:

Issue	Date	Description
1	December 2010	New standard created for TfL Head Office Standards

Relevant British / European Standards

BS 7671 Requirements for electrical installations.

BS ISO 8528 Reciprocating internal combustion engine driven alternating current generating sets.

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Fire Alarm Systems

Issue 4 — December 2010



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14 Fire Alarm Systems

1 Scope

This Standard sets out requirements for Fire Alarm Systems in non-operational premises intended for use as offices by Transport for London (TfL). This Standard has also been designed to be used for offices and control centres.

- Requirements for control and monitoring are set out in BLU 17 Building Management Systems.
- Requirements for metering are set out in BLU 18 Metering.

The purpose of this document is to give guidance for renovations of existing and new building projects for TfL. The Standard is designed for:

- Persons reviewing the proposed renovations to a building;
- Designers and;
- Installers

The document is designed to allow persons responsible for any works, to assess the necessary outline fire safety requirements in terms of the fire alarm and detection system (although the details of the design should be provided by specialists). The document also makes recommendations to the designer and installer regarding the minimum standards of work.

This document will also apply in the event of any modifications of the system

2 References

This standard must be read in conjunction with the Manual to the Standards and TfL

Head Office Standards RED 10, GRE 01, 02,03, BLU 02, 07, 08, 09, 10, 15, 16, 17.

It shall be the responsibility of the designer / installer to reference and comply with all the above and any other TfL Standards where necessary.

The information on fire alarm and detection systems in Section 1 of Section B1 of Approved Document B, should be read in conjunction with any Standard relevant to the works being completed including those above, together with British Standards referred to in the text and listed on the rear cover. Unless otherwise stated, references are to the latest editions and revisions.

3 Definitions / Abbreviations

For a list of general abbreviations and definitions used within the standards please see the accompanying Manual to the Standards.

Definitions specific to this standard are:

- **Loop interface unit:**
A unit, enabling devices and systems, not directly compatible with the MFCP, to be addressed by the MFCP, and supply relevant input and output information. These units may also be capable of generating their own interrupt backup.
- **Coincidence connection:**
For the purposes of this Standard a coincidence connection is a method of connection designed such that an output is obtained only when at least two independent detection inputs are present at the same time.

Abbreviations specific to this standard are:

- **BFPSA:** British Fire Protection Systems Association
- **MCP:** Manual Call Point
- **MFCP:** Main Fire Control Panel

4 General guidance

4.1 Background Information

Information on the mandatory risk assessments can be found in the Manual to the Standards.

In most buildings a manual system comprising break glass units and an audible alarm is usually sufficient. The principle being that the persons discovering the fire can push a

manual call point which will sound an alarm throughout the whole building, alerting persons to evacuate.

On larger, more complex buildings an automatic system with detector heads can have significant advantages, as it does not rely on persons discovering a fire to give warning to evacuate the building. An automatic system with detector heads can also significantly increase the fire safety of smaller buildings.

Generally detection of fire will result in the whole of the building being evacuated. On some buildings, a smaller section (zone) of the building containing the fire will be evacuated first, whilst the remainder of the building awaits an alert to evacuate after a predetermined time period. In some instances it is acceptable for persons to remain in place indefinitely. This is known as a phased evacuation.

When reviewing alterations in the building, the type of system already provided should be maintained and extended to all new areas.

As a general guide for new or upgraded systems it is recommended that the alarm system is designed to a category L2 standard. The system should signal a simultaneous evacuation from the building on the activation of a single smoke detector, heat detector or manual call point, where no investigation period is provided.

In some instances an investigation period will be provided before the building goes into full evacuation. Careful consideration should be given to whether this system can be managed by the occupiers of the building (due to the

greater onus on staff responding to the alarm and being adequately trained to manage the scenario effectively). An investigation period will normally be provided where:

- False alarm could result in disruption to the building
- Where the primary use of the building is for members of the public
- Where there is a history of false alarms or
- Where it is considered there may be a likelihood of false alarms

In a double knock system, a control panel will provide a local alarm which will give persons a defined time period in which to acknowledge the local alarm (approximately 10-20 seconds), there will then be an investigation period of approximately 2-3 minutes (although different periods can be agreed with the Regulatory Authorities for practical operations purposes). A fire will be confirmed, triggering the full evacuation signal if:

- Two detector heads are activated
- A heat detector is activated
- The acknowledgement period is exceeded
- The investigation period is exceeded
- A call point is activated

4.2 Automatic Detection

There are levels of automatic detection known as categories L1 to L5; where L1 provides the most coverage and L4 provides the least coverage in terms of the number of detector heads to provide facilitate the fire alarm:

- L1: Systems installed throughout the protected building (i.e. all areas)
- L2: Installed in escape routes, rooms off the escape routes and risk rooms
- L3: Installed in escape routes, rooms off the escape routes
- L4: Installed in escape routes (i.e. stairs and corridors)
- L5: Systems provided specifically to protect a particular fire safety issue (e.g. a detector to open a vent)

A type P system is purely for property protection.

4.3 Heat / Smoke Detectors

Both heat and smoke detector heads are used for detecting the products of fire. Whilst smoke detection gives earlier detection times, heat detectors are provided where false alarms may occur. For example heat detection may be provided in bin stores or kitchens where dust or cooking fumes may otherwise cause an alarm to be triggered.

4.4 MFCP (Main Fire Control Panel)

MFCPs are used on some more advanced systems to:

Note:

The call point will not be included in this list where it is considered they could be used maliciously or where there is a history of false alarms. In this scenario the call point will only signal a local alarm at an agreed management point to allow the management to investigate the cause of the alarm

- Show faults in the systems
- Co-ordinate the detection system
- Allow testing
- Reset the alarm etc.

The MFCP is normally provided at the main fire service access point to the building. Repeater panels are often provided which mirror the information on the MFCP to other parts of the building without additional controls.

4.5 Visual Alarms

There are certain circumstances where visual alarms should be considered. Where there are likely to be persons with impaired hearing or persons working in areas of the building with a high level of back ground noise. For persons with impaired hearing, beacons can be used or vibrating pagers can be issued to them which are integrated with the fire alarm system and vibrate on activation of the fire alarm.

4.6 Considerations for renovation and development

When making changes to an existing building or designing a new one the level and type of detection should be considered. Reference should be made to the Manual to the Standards which refers to levels of refurbishment. Considerations for each of these levels are as follows;

For minor refurbishments, generally no changes to the detection system will be required. There are some general guidelines to consider however:

- Detector heads should not be painted over, covered or moved.

- Call points should not be covered over, painted over or moved. Call points should remain conspicuous and easily identifiable.
- Measures should be put in place to reduce the impact of false alarms during the any works.
- When installing high level racking they should not be provided within 500mm of a detector head.
- Light fittings or other projections should not be provided within 2xD of the detector (where D is the depth of the fixture from the ceiling).

For intermediate levels of refurbishment there is the potential that the works will impact on the fire detection systems and affect their operation. The following should be taken into consideration, in addition to the guidance above work of a minor refurbishment level:

- Where partitions are moved, they should not be moved to within less than 500mm of a detector.
- Where partitions or walls are moved, there should still be adequate coverage either side of the moved partitions (i.e. a space should not be created without detector heads that previously had them).

For major refurbishment works and new buildings a Building Regulation application will have to be made. Specialist fire safety advice should be sought from professionals when this level of work is being performed.

4.7 General Guidance

Fire alarm and detection systems along with any associated equipment shall comply with

the requirements of the Building Regulations 2000.

The installer should ensure that they have all the relevant information in order to suitably complete the design. The Infrastructure Manager should be contacted in the event that further information is required to complete the works.

5 Construction Design and Management Regulations (CDM)

Reference should be made to the Manual to the Standards for requirements under the CDM regulations.

6 Design Standards

Systems shall be 'two stage' unless circumstances dictate otherwise. Exceptions shall be agreed with the Infrastructure Manager.

The exact details of the 'two stage' alarm will be in line with the specific design requirements of this aspect of the building. Where the evacuation is 'two stage,' then:

- A voice alarm should be provided to give information to occupants.
- It should be ensured that the zones that stay in place are fire separated from the fire zone in all cases and have adequate protected escape routes available.
- It should be ensured that all lifts and stairs are lobbied where they pass through zones.
- The zones which are not evacuated should be put on alert.

6.1 Point detection

All point detectors shall be capable of supplying at least the following information to the MFCP either directly or via processing within the MFCP:

- Alarm – a condition indicating that the preset sensitivity levels for alarm conditions have been met.
- Self-calibration – a feature that automatically adjusts the sensitivity of the device taking account of changes in the monitoring element caused by the environment.
- Maintenance warning – a condition or conditions where the detector has, or is about to, reach preset levels of over or under sensitivity due to the self-calibration feature.

6.2 Radio Systems

Radio systems shall be installed in accordance with the relevant requirements of BS 5839: Part 1. Care must be taken to ensure that any processes carried out within an area protected by a radio system do not adversely affect its operation. Radio systems shall not be used where their operation could be affected by other radio systems or vice versa.

6.3 Portable alarms and indicating equipment

Portable alarm devices and indicating equipment should be designed in accordance with the recommendation of BS5839 Part 1:2002.

7 Equipment standards

All systems, control panels, devices, software and other associated equipment

shall be installed in accordance with the manufacturer's recommendations.

Where appropriate, systems shall be installed in accordance with BS 5839 2002: Part 1, Fire detection and alarm systems for buildings: Code of practice for system design, installation and servicing.

Electronic data processing installations shall be protected in accordance with BS 6226, Fire protection for electronic data processing installations.

All electrical systems shall be designed, installed and tested in accordance with TfL Standard BLU 10, Electrical Distribution.

All point detectors shall be capable of supplying status and address back to the MFCP either directly or via processing within the MFCP.

Control and indicating equipment for use in any offices shall be of a type approved by the Infrastructure Manager.

Control and indicating panels shall be approved or certified to the standard identified by an independent third party, unless specifically designed and manufactured for TfL use, where the Infrastructure Manager will be responsible for approving the equipment.

MCPs (Manual Call Points) shall be of a resettable type (i.e. not break glass type).

Cables rated for fire safety shall comply with BS 6387, Specification for performance requirements for cables required to maintain circuit integrity under fire conditions.

All equipment, components and fittings shall be readily available, of proprietary manufacture, and shall be installed in accordance with the manufacturer's instructions and recommendations.

Smoke detectors and automatic release mechanisms used to actuate fire/smoke dampers should conform to BSEN 54-7: 2001 and BS5839-3:1998.

The designer shall make due allowance for space capacity for future expansion within any new installation. At all points in new systems 25% spare capacity shall be allowed for expansion. Where an existing system is being extended the designer does not need to allow for further spare capacity unless the works would result in the spare capacity falling below 5%. If the proposed works would result in the system spare capacity falling below 5% then the designer will advise the Infrastructure Manager and provide the cost to re-instate the system to 25% spare capacity. The Infrastructure Manager will then confirm the requirement for the project.

Where a product or component required for the works appears in any category on the Energy Technology Criteria List then the product or component selected for the installation shall comply fully with the relevant criteria.

8 Design / Contractor Submittal Requirements.

Reference should be made to the Manual to the Standards for general requirements for drawing and sample submittal requirements.

The following shall be provided as part of the installation:

- A completed handover checklist
- All test certificates

All redundant services are to be stripped out during the works. A schedule of redundant services is to be issued to the Infrastructure Manager prior to commencing work.

9 Material Standards

All materials must be specified / sourced and installed in accordance with the parameters set out in TfL standard GRN 01, which includes details of requirements for minimum recycled content.

With the exception of items designed to be disposable, the design life of the materials and equipment used shall be not less than five years. For materials and equipment whose replacement is not expected between major refurbishments, the design life shall be no less than 15 years. Non-standard and non-proprietary components, substances and materials shall not be used.

10 Installation / Workmanship Standards

10.1 Cable Runs

Conduit / cable runs should be provided within the building fabric where possible. If they are surface mounted, the conduit run and position must be agreed with the Infrastructure Manager. All making good must be completed as part of the works.

10.2 Point Detectors

Point fire detectors shall be installed in

accordance with BS 5839: Part 1 and any special requirements of the manufacturer.

Point smoke, point heat or point multi-criteria/sensor detectors shall be located in all areas as indicated in the specification.

Where detectors are sited on curved or inclined surfaces, cable tray or a suitable bracket may be used to provide a horizontal mounting surface provided the sensing element meets the siting arrangements and complies with the requirements of BS5839: Part 1. The Infrastructure Manager should be consulted to agree unusual arrangements for the siting of detectors in these areas.

Point detectors incorporating smoke sensors should be used as standard. The smoke sensor shall be configured to be sensitive to the expected products of combustion for the monitored area. The sensitivity range shall be agreed with the Infrastructure Manager. Heat detectors shall comply with the requirements of BS EN 54-5, Components of automatic fire detection systems: Heat sensitive detectors – point detectors containing a static elements.

Smoke detectors shall comply with the requirements BS EN 54-5, Specification for point-type smoke detectors using scattered light, transmitted light or ionization.

Multi-criteria / sensor detectors shall comply with the requirement of the relevant parts of BS EN 54-5 or BS EN 54-7, where appropriate to the sensing properties.

Other methods of fire detection (e.g. carbon monoxide fire detectors), where applicable to

specific applications, may be used with the approval of the Infrastructure Manager. Other methods of detection may still require smoke or heat detection where it is not considered adequate in isolation (this is especially true with carbon monoxide fire detection).

Detector bases shall not incorporate any electronic components which could be damaged as a result of the cable and insulation testing required by BS 7671, Requirements for electrical installations.

10.3 Beam Smoke Detection Systems

Beam smoke detectors shall generally be permitted only in areas where point smoke detection may be inappropriate or impractical.

Beam smoke detectors, together with any separate control equipment, shall comply with the requirements of BS 5839: Part 5, Specification for optical beam smoke detectors.

Beam smoke detectors may, with the approval of the Infrastructures Manager, be capable of being directly interfaced with the MFCP. In such cases they shall be capable of indicating fire and fault conditions (including common fault) and of being reset from the MFCP.

Beam smoke detectors shall be installed in accordance with BS 5839: Part 1. Beam smoke detectors shall be used in conjunction with point detectors shall be installed in accordance with BS 5839: Part 1 and BS 6266.

10.4 Aspirating Smoke Detection Systems

For the purposes of this Standard an Aspirating Smoke Detection System is a fire detection system that monitors a protected space for

the presence of smoke by drawing an air sample from the protected space to a central detection point. The air sample is tested for the quantity of smoke present and an alarm condition signalled if the predetermined response level is exceeded.

Aspirating smoke detection systems shall be used where increased sensitivity to smoke products is required or where the environment is such that other forms of detection may not perform as designed (i.e. in areas of fast air movement) or where the maintenance of a detector head may be difficult.

Aspirating smoke detection systems shall comply with the guidance given in the BFPSA Code of practice for Category 1 aspirating systems.

Systems shall be installed in accordance with the BFPSA Code of Practice.

10.5 Radio Fire Detection and Alarm Systems

Radio fire detection and alarm systems will not generally be permitted unless there is a sound technical and commercial case for their inclusion, or where an existing system is installed.

Radio alarm systems should be used only where:

- A system using cable interconnections cannot be reasonably installed and maintained.
- Aesthetic considerations or restrictions prevent the installation of cables.
- The system is to be used on a temporary basis.

The control, indicating equipment, detectors and alarm devices shall be certified to the appropriate British Standard for equivalent cabled system. As detailed elsewhere in this document for each component.

Radio link equipment should be provided with a backup power supply.

10.6 Manual Call Points

MCPs shall be provided for manual initiation of a fire warning by building users. MCPs shall be certified to BS 5839: Part 2, Specification for manual call points.

Hinged covers shall be considered to MCPs

MCPs shall be sited and installed in accordance with the BS 5839 Part 1.

When locating MCP the zone of operation should be taken into consideration. This is especially important where there is a phased evacuation or 'two stage' alarm. Call points should be located adjacent to the stair door and not inside the stair, so that it is clear what floor the fire is on.

10.7 Voice Alarm Systems

Voice alarm systems should be installed in accordance with BS 5839-8:1998

10.8 Control Inputs and Outputs

The inputs and outputs for the fire detection and alarm systems will be dependent on the chosen alarm and evacuation strategy for the premises and the passive and active measures adopted as part of the fire protection strategy. As buildings, their occupancies and needs vary, the Infrastructure Manager should be

consulted so that the most effective strategy can be developed.

10.9 Control Equipment, Indicating Equipment and Power Supplies.

For the purposes of this standard the MFCP is the fire detection, alarm, control and indicating equipment used as the central source for input and output functions. A loop interface unit is a unit enabling devices and systems, not directly compatible with the MFCP, to be addressed by the MFCP and supply relevant input and output information. These units may also be capable of generating their own interrupt information.

The MFCP shall be designed, constructed and installed in accordance with either BS5839 Part 4 or BS EN 54-2 & BS EN 54-4.

MFCPs shall be fully compatible with any existing fire protection hardware either directly or via loop interface units.

The panel processors shall be capable of processing the information provided by the input devices, e.g. fire detectors, manual call points and interface units.

MFCPs shall have sufficient hardware and software capacity to cater for possible future enhancement. The amount of spare capacity provided shall be as stated in the specification.

MFCPs shall be capable of providing the full range of control outputs required in the specification.

MFCPs shall be capable of supporting a minimum of 10 repeater panels.

MFCPs shall be provided with an internal printer, or be capable of directing output data to a separate printer as required in the specification.

MFCPs shall be protected against unauthorised access.

A dedicated port within the panel enclosure to allow transfer of site specific information, such as device identification/messages, shall be provided.

MFCPs shall be sited in accordance with the recommendations given in BS 5839: Part 1.

All control panels shall be installed in prominent positions and at a height that will allow for controls and indications to be clearly visible and accessible to a standing person. The siting of panels shall also take into account local operational and logistical needs. Where necessary, precautions shall be taken to avoid the possibility of damage to the equipment caused by maintenance and cleaning processes.

All control panels shall be fixed to walls only by methods approved by the Infrastructure Manager. Where mounting against the wall surface may lead to deterioration of the panels or may affect their operation, they shall be mounted proud of the wall using permanent fixing. The installation shall restrict access to the rear of the panel, as far as is practicable. Panels shall not be fixed to temporary structures without the prior approval of the Infrastructure Manager.

10.10 Repeater Panels

Repeater panels (panels designated for repeating audible and visual indicators) shall

not normally incorporate any live control functions other than a facility to test audible and visual indicators. However, where stated in the Specification, the following features may be required:

- Silence alarm
- Reset
- Evacuate
- Enable
- Printer, or a dedicated printer output
- Full main panel emulation
- Isolation
- Auxiliary isolation

Communication between repeater panels and the MFCP shall be via a suitable and compatible link.

Repeater panels shall be sited to provide information to appropriate premises staff and to the fire brigade where the MFCP is not readily accessible. Positions and numbers shall be agreed with the Infrastructure Manager.

It shall be possible to electrically isolate the release mechanism and associated alarm outputs by means of a control within the panel. Isolation shall result in a visual indication at the panel together with a local audible indication. The fault shall also be signalled remotely to the MFCP as part of the common fault output.

It shall be possible to silence the control sounder and external sounder circuits by means of an appropriate control.

10.11 Remote Monitoring Equipment

Where required in the specification, a facility

shall be provided to allow remote monitoring and interrogation of the MFCP and to allow information to be exchanged with it. This facility may be provided within the MFCP or within an auxiliary remote modem panel as detailed in the specification.

10.12 Other Control and Indicating Equipment

There may be a requirement for additional or alternative control and indicating equipment to that described in this section. Examples include:

- Linear heat detection panels
- Gaseous extinguishing control panels
- Remote audio/visual driver units
- Trace heating panels
- Interfaces between systems
- Beam smoke detection control panels (see Section 7)
- Aspirating smoke detection system control panels (see Section 8)
- Radio fire detection and alarm systems (see Section 9)

Where specific British Standards exist for such equipment they shall be complied with. Where standards do not exist, the design and construction equipment shall comply with the requirements of BS 5839: Part 4.

10.13 Power Supplies for Control and Indicating Equipment

All control and indicating equipment shall incorporate power supplies which shall be in accordance with the relevant requirements of either BS5839: Part 4: or BS EN 54-2 & BS EN 54-4. This should take account of local power supply conditions (e.g. voltage fluctuations,

noise etc.). Power supplies to control and indicating equipment shall be connected via a lockable isolation switch that shall clearly indicate its position. The switch shall be of a type approved by the Infrastructure Manager. BS 6387, Specification for performance requirements for cables required to maintain circuit integrity under fire conditions.

Mains power shall be taken only from supplies complying with the requirements of BS 5839: Part 1.

Standby power supplies shall comply with the relevant requirements of BS 5839: Part 1. The standby power duration shall be sufficient to provide 24 hours operation without mains power, with sufficient capacity to power all alarm sounders for a further 30 minutes at the end of the standby period. In addition, a facility shall be provided to prevent low power from causing spurious indications prior to complete failure.

Where standby power supplies cannot be housed within the main panel, they shall be located in a panel of equivalent construction or as a specified by BSEN 54: Part 4. External power supplies shall be located next to the main panel with the feed protected by metal conduit.

10.14 Circuit Design

Fire detection and alarm circuits shall be designed such that:

- The consequences of a single and double loop circuit fault are strictly limited to manageable levels.
- The number and types of devices installed directly and indirectly on the circuit do

not have an adverse effect to the intended system operation.

Zoning: Systems shall be zoned in accordance with BS 5839: Part 1 and in line with any fire/evacuation strategy for the building.

Loop circuitry: Fire detection loops shall be designed in accordance with BS 5839: Part 1. Loop sizes shall be restricted to ensure that the consequence of a loop failure is limited and to allow further devices to be added at a later date.

Supply and return conductors serving the same main loop shall not be run within the same cable.

Loop circuit conductors shall be identifiable at every point of connection. The positive and negative poles shall be identified with red and black sleeving respectively. Sub-loop installations shall be avoided wherever possible. Where necessary, they shall meet the same criteria as the main loop circuit. Sub-loops shall be connected to a junction box in close proximity of the main loop. Consideration shall be given to any adverse effects of the proposed loop/sub-loop configuration.

Loop interface units shall be compatible with the installed fire detection and alarm systems. Units shall be housed in suitable boxes where they cannot be mounted within a panel or device.

Short-circuit isolators: Short-circuit isolators, certified for the use with the system, shall be incorporated within loop circuits to limit the consequences of a failure in the loop. Short-circuit isolators shall be spaced in accordance

with BS 5839 : Part 1, i.e. at the perimeters of zones.

Identification of devices: All devices connected directly or indirectly to a detection loop shall be identifiable with at least the loop and device address number, and where required in the Specification, the zone number. Devices shall be identified by the use of a permanent label. The label shall be attached directly to the base of a device or to the box housing the loop interface unit. The Infrastructure Manager shall be consulted with respect to the procedure for identification and commissioning of circuit devices.

Coincidence connection of fire detectors shall be utilised for the provision of an output to actuate a fire suppression system or other system as required in the Specification. The application of coincidence connection shall be in accordance with the guidance given in BS 7273, Code of practice for the operation of fire protection measures and BS 6266.

11 Testing and Commissioning

All making good, including any builder's works, will be completed prior to handover and will be considered an integral part of the installation. The completed installation and its component parts shall be tested and commissioned in accordance with:

- All relevant British Standards
- The recommendations of the manufacturer or supplier
- The requirements of the Specification

The fitted installation shall be fully functional and fit for purpose prior to handover

12 Handover

Reference should be made to the Manual to the Standards for general requirements for handover and submissions required for the Operation and Maintenance Manual.

The following information shall be provided specifically for Fire Alarm Systems in good time for inclusion in the building's Operation and Maintenance records;

- Manufacturer's datasheets
- A written sequence of operation
- A full set of as-fitted drawings, circuit diagrams, logic diagrams, cable schedules, parts list, etc. in .pdf and .dwg format.
- Calibration certificated for all instruments used during certification minimum required testing and maintenance frequencies
- Signed certification for the installation.

13 Maintenance

When new equipment is added or alterations are made to existing installations there shall be no detrimental impact on the ease of maintenance of existing facilities unless through dispensation from the Infrastructure Manager.

The contractor shall provide full maintenance during the defects liability period in accordance with the TfL maintenance model. Any departure from this requirement will require the grant of dispensation from the Infrastructure Manager.

The whole fire alarm and detection system should be maintained and tested in accordance with BS5839 Part 1. Individual

equipment should be tested in accordance with the manufacturer's instructions.

Any faults registered on the panel should be identified and corrected as soon as possible. Correction of faults will be completed by a competent person and will be the responsibility of the Infrastructure Manager or nominated responsible person to either personally reset the panel (on minor faults) or to arrange for competent persons to complete the works in good time.

In systems with staged alarms that incorporate an 'Alert' and an 'Evacuation' signal; both signals need to be operated in order to ensure they work correctly and allow the regular occupants of the building to become familiar with them.

Periodic testing should be completed in accordance with BS5839 Part 1: 2002.

The ease of maintenance should be considered when installing equipment which will require maintenance.

14 Further Information

- The Building Regulations 2000
- Approved Document B; Volume 2, 2006 Edition.
- The Electricity at Work Regulations 1989
- London Building Act 1939
- The Building (Inner London) Regulations 1985
- Fire Precautions Act 1971
- Fire Precautions (Sub-surface Railway Stations) Regulations 1989

- The Regulatory Reform (Fire Safety) Order 2005
- BFPSA Code of practice for category 1 aspirating systems
- Energy Technology Criteria List - www.eca.gov.uk.

Revision History:

Issue	Date	Description
1		Preliminary issue
2	20th November 1999	Minor revisions
3	18th September 2000	Reformatted - LU Facilities
4	December 2010	Reformatted and revised as TfL Head Office Standards

Relevant British / European Standards

BS 1363	13A plugs, socket-outlets and adapters
BS 5839	Fire detection and alarm systems for buildings Part 1 – Code of practice for system design, installation and servicing Part 2 – Specification for manual call points Part 5 – Specification for optical beam smoke detectors. Part 8 - Code of practice for the design, installation, commissioning and maintenance of voice alarm systems.
BS 6004	Specification for pvc-insulated cables (non-armoured) for electric power and lighting.
BS 6207-3	Mineral insulated cables with a rated voltage not exceeding 750 V. Guide to use
BS 6266	Fire protection for electronic data processing installations
BS 6387	Specification for performance requirements for cables required to maintain circuit integrity under fire conditions.
BS 6500	Specification for insulated flexible cords and cables.
BS 6724	Specification for armoured cables for electricity supply having thermosetting insulation with low emission of smoke and corrosive gases when affected by fire.
BS 7211	Specification for thermosetting insulated cables (non-armoured) for electric power and lighting with low emission of smoke and corrosive gases when affected by fire
BS 7273	Code of practice for the operation of fire protection measures
BS 7629	Specification for thermosetting insulated cables with limited circuit integrity when affected by fire
BS 7671	Requirements for electrical installations. IEE Wiring Regulations. Sixteenth Edition
BS EN 54-2	Fire detection and fire alarm systems. Control and indicating equipment
BS EN 54-4	Fire detection and fire alarm systems. Power supply equipment
BS EN 54-5	Components of automatic fire detection system. Heat sensitive detectors - point detectors containing a static element
BS EN 54-5	Specification for point-type smoke detectors using scattered light, transmitted light or ionization
BS EN 60439-3	Low-voltage switchgear and control gear assemblies
BS EN 60702-2:2002	Mineral insulated cables with a rated voltage not exceeding 750 V. Terminations.

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Fire Protection Installations

Issue 1 — December 2010



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09 Fire Protection Installations

1 Scope

This Standard sets out requirements for Fire Protection Installations in non-operational premises intended for use as offices by Transport for London (TfL). This Standard has also been designed to be used for offices and control centres.

- Requirements for control and monitoring are set out in BLU 17 Building Management Systems.
- Requirements for metering are set out in BLU 18 Metering.

The purpose of this document is to give guidance for renovations of existing and new building projects for TfL. The Standard is designed for:

- Persons reviewing the proposed renovations to a building;
- Designers and
- Installers.

The document is designed to allow persons responsible for any works, to assess the necessary outline fire safety requirements in terms of the fire protection installations (although the details of the design should be provided by specialists). The document also makes recommendations to the designer and installer regarding minimum standards of work.

This document will also apply in the event of any modifications of the installations.

2 References

This standard must be read in conjunction with the Manual to the Standards and TfL Head Office Standards RED 10, GRE 01, 02,03, BLU 02, 07, 08, 09, 10, 15, 16, 17. It shall be the responsibility of the designer/

installer to reference and comply with all the above and any other TfL Standards where necessary.

The information on fire alarm and detection systems in Section 1 of Section B1 of Approved Document B, should be read in conjunction with any Standard relevant to the works being completed including those above, together with British Standards referred to in the text which are listed on the rear cover. Unless otherwise stated, references are to the latest editions and revisions.

3 Definitions / Abbreviations

For a list of general abbreviations and definitions used within the Standards

please see the accompanying Manual to the Standards.

4 General guidance

4.1 General Requirements

Fire protection measures are those which aid persons in safely evacuating the building, before the products of combustion can prevent them from doing so; as well as decreasing the likelihood of fire spread internally and externally and aiding fire service in accessing the building.

This document gives the outline recommendations for all fire protection installations but the other Standards within the manual cover specific installations as detailed above in Section 2.

Fire protection installations include a very broad range of facilities as highlighted below:

- Fire stopping and fire resisting construction
- Fire dampers and fire & smoke dampers
- Smoke curtains and fire curtains
- Fire alarm and detection systems
- Sprinklers and suppression systems
- Ventilators and actuators
- Smoke exhaust fans
- Fire fighting installation for the fire service
- Portable extinguishes
- Refuge communications
- Fire doors
- Emergency lighting

It is important that fire protection measures do not conflict with each other and should work together to aid the overall fire safety

standards of the building. A more complex building will have a fire strategy. Before any works are completed the contractor should either have a suitably detailed brief or have familiarised themselves with the relevant parts of the fire strategy. At all stages of work the Infrastructure Manager or suitably responsible persons should be aware of the implications of the installations.

5 Construction Design and Management Regulations (CDM)

Reference should be made to the Manual to the Standards for requirements under the CDM regulations.

6 Design Standards

Systems shall be designed to take into consideration the ease of service, maintenance and replacing of the installations.

The installations shall be designed so they work with the principles of the fire strategy and/or fire evacuation procedures. Systems shall comply with the relevant British Standards.

The installation design should meet all of the requirements of the Regulatory Authorities for the relevant elements of works where necessary.

The designer should communicate with the Infrastructure Manager at all stages of the design, installation and commissioning process.

7 Equipment Standards

All systems, devices and installations and other associated equipment shall be installed in accordance with the manufacturer's recommendations.

Where a product or component required for the works appears in any category on the Energy Technology Criteria List then the product or component selected for the installation shall comply fully with the relevant criteria.

8 Design / Contractor Submittal Requirements

Reference should be made to the Manual to the Standards for general requirements for drawing and sample submittal requirements.

All redundant services are to be stripped out during the works. A schedule of redundant services is to be issued to the Infrastructure Manager prior to commencing work.

9 Material Standards

Environmental impact should be taken into consideration in the selection of material for the building and TfL Standard GRE 01 Environmental Guidelines for general guidance on materials should be consulted.

With the exception of items designed to be disposable, the design life of the materials and equipment used shall be not less than five years.

For materials and equipment whose replacement is not expected between major refurbishments, the design life shall be no less

than 15 years. Unusual, non-standard and non-proprietary components, substances and materials shall not be used.

10 Installation/ Workmanship Standards

10.1 General Requirements

In general any design should be completed in accordance with any design brief provided. The Infrastructure Manager should be liaised with when completing the works. The installation should meet all of the requirements of the Regulatory Authorities for the relevant elements.

A Health and Safety brief should be completed by the contractor to assess the risks involved in the installation work before the work is commenced. The Infrastructure manager should be made aware of any risks and any requirements or measure included to reduce these risks to an acceptable level.

Where services are provided in ducts they should be designed in accordance with BS8313: 1997.

10.2 Fire Stopping and Fire Resisting Construction

Document YEL 03, should be consulted when installing these elements.

10.3 Fire Dampers and Fire and Smoke Dampers

Document YEL 03, should be consulted when installing these elements.

10.4 Smoke Curtains and Fire Shutters / Curtains

Fire and smoke curtains should be installed

so that they can drop to the required height. Where necessary they should be linked to the fire alarm system to drop automatically on the operation of the fire alarm system. It should be ensured that the curtains drop on activation of relevant detector heads or on activation of a detector in the relevant zone. Where necessary, a time delay should be incorporated to delay the drop of the curtain in accordance with the design brief.

Fire curtains / shutters and smoke curtains should be fixed to a supportive element capable of supporting their weight. The supportive elements should be fire rated or capable of withstanding elevated temperatures equal to the performance rating of the fire or smoke curtains or the minimum limits of the design.

Fire curtains and fire shutters should be fitted with guide rails to elements of structure capable of providing a fire resistant barrier to the minimum required design standard.

The following design standard should be used for smoke curtains; BS 7346-3:1990 Components for smoke and heat control systems. Specification for smoke curtains. Fire curtains and shutters should be designed in accordance with BS EN 1634-3:2001; or BS EN 1634-3:2004

10.5 Fire Alarm and Detection Systems
TfL Standard BLU 13 should be consulted when installing these elements.

10.6 Sprinklers and Suppression Systems
Sprinklers should be designed in accordance with BS EN 12845:2004, for the necessary areas specified by the design brief.

Gaseous flooding systems should be installed with BS7273-2:1992. It should be ensured that suitable time delays are incorporated into the design to allow persons to leave the area and access control measures on exit doors should allow them adequate time to exit the space. Suitable extraction should also be provided.

At the time of writing of this document there were no specific standards for water mist systems. On this basis they should only be installed where a specific design brief is available and it should be ensured that the manufacturer, Infrastructure Manager and any necessary Regulatory Authority are satisfied with the protection provided by the system before installation.

10.7 Ventilators and Actuators

When installing automatic ventilators, it should be ensured that the aerodynamic free area can be achieved. The vents should be hung in the correct orientation and fitted in accordance with the manufacturer's instructions.

Where automatic ventilation is required, then actuators should be integrated with the fire alarm and detection system.

Actuators should be fail safe or of a suitable fire rating.

Cables for actuation of ventilation systems should be designed in accordance with BS7346-6:2005.

10.8 Smoke Exhaust Fans

Smoke exhaust fans should be installed in accordance with the manufacturer's

instructions and the required design detail. They should be fixed to an element of structure capable of supporting their weight for at least the required run time of the fans.

The fans shall be connected to the fire alarm and detection system to operate as detailed in the design specification.

Where the fans are used for a pressurisation or de-pressurisation system they should be designed in accordance with BS EN 12101-6:2005.

10.9 Fire Fighting Installation for the Fire Service

Dry risers and wet risers should be installed in accordance with BS 9990:2006

Fire fighting installations should be designed in accordance with BS5588-5:2004 or BS9999:2008, Section 6.

10.10 Refuge Communication

Refuge communications should be installed in accordance with BS5839-9:2003 or BS9999:2008 Annex G.

10.11 Fire Doors

Fire doors should be fitted in accordance with the manufacturer's instructions and assembled and tested to achieve the required fire rating. Fire doors should only be fitted where they possess certification for the required performance. Doors should also be provided with a label to identify the fire rating of the door.

Doors should be provided with all door closers where detailed in the design brief.

Cold smoke seals should be provided where detailed in the manufacturer's brief. All other intumescent pads etc., should be provided in accordance with the manufacture's testing procedures.

Fire Doors should have been tested in accordance with BS 8214:1990 or BS EN 1634-3:2001;

10.12 Emergency Lighting

Emergency lighting should be installed in accordance with BS 5266-1:2005; the design brief and Approved Document B; B1, Section 5.36 and Table 9.

11 Testing and Commissioning

All making good, including any builder's works, will be completed prior to handover and will be considered an integral part of the installation.

Any wall finishes will comply with the relevant surface spread flame ratings for that area of the building, as defined in accordance with Approved Document B, Section B3.

The completed installation and its component parts shall be tested and commissioned in accordance with:

- All relevant British Standards
- The recommendations of the manufacturer or supplier
- The requirements of the specification

The fitted installation shall be fully functional and fit for purpose prior to handover.

12 Handover

Reference should be made to the Manual to the Standards for general requirements for handover and submissions for the Operation and Maintenance Manual.

The following information shall be provided specifically for Fire Protection Installations in good time for inclusion in the buildings Operation and Maintenance records;

- A completed handover checklist
- All test certificates
- Operating and maintenance manuals including:
 - Manufacturer's datasheets
 - A written sequence of operation
 - A full set of as-fitted drawings, circuit diagrams, logic diagrams, cable schedules, parts list, etc. in .pdf and .dwg format.
 - Calibration certificated for all instruments used during certification minimum required testing and maintenance frequencies
 - Signed certification for the installation.

Axonometric or full 3D drawings shall be provided for all plant rooms and congested areas of distribution, clearly identifying the equipment and interconnecting services.

13 Maintenance

When new equipment is added or alterations are made to existing installations there shall be no detrimental impact on the ease of maintenance of existing facilities unless through dispensation from the Infrastructure Manager.

Fire protection installations shall be designed and installed allowing for the ease of maintenance. The maintenance of the installations should be in accordance with the relevant guidance and manufacturer's instructions.

The ease of maintenance must be considered when installing equipment which will require maintenance.

The contractor shall provide full maintenance during the defects liability period in accordance with the TfL maintenance model. Any departure from this requirement will require the grant of dispensation from the Infrastructure Manager.

14 Further Information

- The Building Regulations 2000
- Approved Document B; Volume 2, 2006 Edition.
- The Electricity at Work Regulations 1989
- London Building Act 1939
- The Building (Inner London) Regulations 1985
- Fire Precautions Act 1971
- Fire Precautions (Sub-surface Railway Stations) Regulations 1989
- The Regulatory Reform (Fire Safety) Order 2005
- BFPSA Code of practice for category 1 aspirating systems
- ECA Scheme Water Energy Technology Criteria List - www.eca.gov.uk.

Revision History:

Issue	Date	Description
1	December 2010	New standard created for TfL Head Office Standards

Relevant British / European Standards

BS 1363	13A plugs, socket-outlets and adapters
BS 5588-5	Fire precautions in the design construction and use of buildings; Access and facilities for fire fighting.
BS 5839	Fire detection and alarm systems for buildings Part 1 – Code of practice for system design, installation and servicing Part 2 – Specification for manual call points Part 5 – Specification for optical beam smoke detectors.
BS 6004	Specification for pvc-insulated cables (non-armoured) for electric power and lighting.
BS 6207-3	Mineral insulated cables with a rated voltage not exceeding 750 V. Guide to use
BS 6266	Fire protection for electronic data processing installations
BS 6387	Specification for performance requirements for cables required to maintain circuit integrity under fire conditions.
BS 6500	Specification for insulated flexible cords and cables.
BS 6724	Specification for armoured cables for electricity supply having thermosetting insulation with low emission of smoke and corrosive gases when affected by fire.
BS 7211	Specification for thermosetting insulated cables (non-armoured) for electric power and lighting with low emission of smoke and corrosive gases when affected by fire
BS 7273	Code of practice for the operation of fire protection measures
BS 7346-3	Components for smoke and heat control systems. Specification for smoke curtains.
BS 7346-6	Components for smoke and heat control systems. Specification for cable
BS 7629	Specification for thermosetting insulated cables with limited circuit integrity when affected by fire
BS 7671	Requirements for electrical installations. IEE Wiring Regulations. Sixteenth Edition
BS 8313	Code of practice for accommodation of building services in ducts.
BS 8214	Code of practice for fire door assemblies with non-metallic leaves.
BS 9990	Code of practice for non-automatic fire-fighting systems in buildings
BS 9999	Code of practice for the fire safety in the design, management and use of buildings.
BS EN 54-2	Fire detection and fire alarm systems. Control and indicating equipment
BS EN 54-4	Fire detection and fire alarm systems. Power supply equipment
BS EN 54-5: 2001	Components of automatic fire detection system . Heat sensitive detectors - point detectors containing a static element
BS EN 54-5: 2001	Specification for point-type smoke detectors using scattered light transmitted light or ionization
BS EN 1634-3: 2001	Fire resistance tests for door and shutter assemblies. Smoke control tests for doors and shutter assemblies.
BS EN 1634-3: 2004	Fire resistance and smoke control tests for door and shutter assemblies, openable windows and elements of building hardware. Smoke control test for door and shutter assemblies
BS EN 12101-6	Smoke and heat control systems. Specification for pressure differential systems.
BS EN 60439-3	Low-voltage switchgear and control gear assemblies
BS EN 60702-2	Mineral insulated cables with a rated voltage not exceeding 750 V. Terminations.

16

Lift Installations

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16 Lift Installations

1 Scope

This Standard sets out requirements for passenger, goods and platform lifts in non-operational premises intended for use as offices by Transport for London (TfL).

This standard supersedes standard LUF-M007-ST.

- Requirements for control and monitoring are set out in BLU 17 Building Management Systems.
- Requirements for metering are set out in BLU 18 Metering.

2 References

This Standard should be read in conjunction with the accompanying Manual to the Standards and TfL Standards GRN 01, 02, 03, BLU 12.

It shall be the responsibility of the designer/installer to reference and comply with all the above and any other standards where necessary.

Relevant British Standards referred to in the text are listed on the rear cover. Unless otherwise stated, references are to the latest editions and revisions.

3 Definitions / Abbreviations

For a list of general abbreviations and definitions used within the Standards please see the accompanying Manual to the Standards.

4 Construction Design and Management Regulations (CDM)

Reference should be made to the Manual to

the Standards for requirements under the CDM regulations.

5 Performance Standards

The installation shall be designed, installed and tested in accordance with current Requirements for Electrical Installations (IEE Wiring Regulations), The Electricity at Work Regulations, Health and Safety at Work Act, CIBSE Guides, Guidance Notes, British Standards and other publications and shall comply with the requirements of The Building Regulations Part P, Part M and Part L.

Passenger and goods lift installations shall be designed and installed in accordance with BS EN 81-1 and BS EN 81-2.

Fire fighting lift installations shall be designed and installed to BS EN 81-72. Where fire lifts are to be refurbished the designer shall consult with the LFCDA and the local enforcing authority at the design stage, to confirm the acceptability of 'like for like' replacement and agree any enhancements required.

Platform lift installations shall be designed and installed in accordance with the Machines Directive 2006/ 42 EC.

Access to lifts for persons including persons with disability shall be designed and installed in accordance with BS EN 81-70. The Infrastructure Manager shall be advised at design stage of any works outside the normal scope of the lift installation that may be required to provide suitable access for persons with disability. This is particularly relevant on lift refurbishments and replacement. Refurbished lift installations shall be designed and installed in accordance with BS EN 81-80. The designer shall inform the Infrastructure Manager where compliance with the Standards cannot be achieved at design stage for refurbished or replacement lifts due to site restrictions.

New and refurbished lift installations are to be provided with programmable control systems with the facility for performance monitoring to allow evaluation and continuous improvement of the lift system operation.

Lift control systems are to be integrated with the BMS for the transmission of alarms, fire control etc.

Lift control systems shall incorporate features to minimise energy consumption when lifts are not in use e.g. switching off the lights and fans, reducing the number of lifts in service etc.

Installations comprising three or more lifts shall be designed by a lift consultant to demonstrate the most efficient mode of operation.

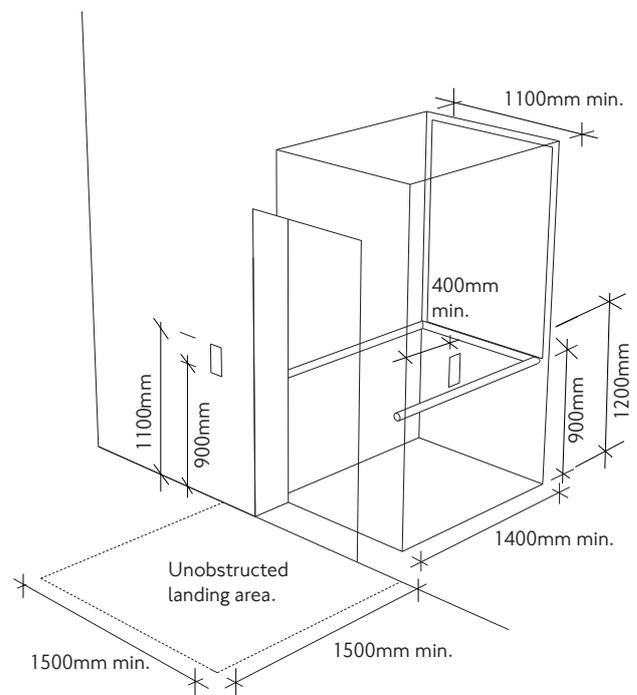


Fig. 1 Lift car dimensions.

New lift installations and lift refurbishment works shall be designed for arrival rates between 12% and 15% and intervals of under 30 seconds. The Infrastructure Manager must be advised where the minimum arrival rates cannot be achieved due to limitations imposed by existing facilities.

Consideration should be given to the use of 'Hall Call' systems where multiple lifts serve multiple floors.

New lift installations should be designed for a minimum 10 person car size.

New lift installations shall use variable speed drives.

The designer shall include for load testing and certifying all lifting beams, existing beams shall

be tested at design stage to confirm suitability for refurbished or replacement lifts.

Lift car controls should be mounted between 900mm and 1100mm from floor level and at least 400mm from a return wall (See Fig 1). Lift call buttons should have symbols in relief (embossed) to enable tactile reading. Call buttons should also contrast visually with the surrounding face plate and the face plate should similarly contrast with the wall on which it is mounted.

Mechanical and electrical services shall be provided to the lift machine room, lift shaft and lift well in accordance with the standards. General lighting and emergency lighting shall be provided to each landing entrance and at the controller position in accordance with the standards.

An audio announcement of lift arrival and direction of travel shall be provided both within the lift car and lift lobby.

Passenger lifts should be fitted with an emergency communication system that conforms to BS EN 81-28

A sign indicating the number of the floor should be provided in each lift lobby on the wall opposite all the lift landing doors.

Passenger lifts shall be fitted with fixings to facilitate the attachment of protective coverings allowing the lift to be used for goods transportation.

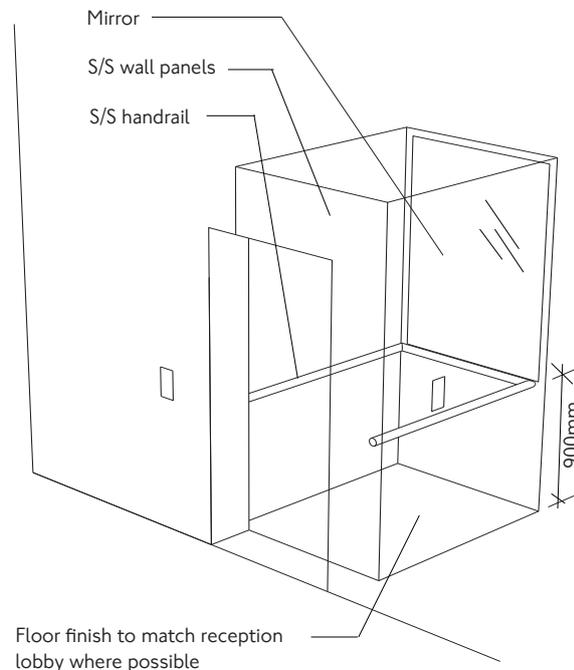


Fig. 2 Lift Car Finishes

All equipment and electronic systems shall be generic and open protocol to allow servicing and maintenance by any competent engineer without the use of closed protocol specialist tools or equipment.

6 Equipment Standards

Where a product or component required for the works appears in any category on the Energy Technology Criteria List then the product or component selected for the installation shall comply fully with the relevant criteria.

All Lift installations shall comply with BS EN 81.

All lift installations shall incorporate remote monitoring in addition to any in-house alarms and monitoring.

Power supplies to each group of lifts within a building shall be separately metered in accordance with BLU 18 Metering.

7 Design / Contractor Submittal Requirements.

Reference should be made to the Manual to the Standards for general requirements for drawing and sample submittal requirements.

All redundant services are to be stripped out during the works. A schedule of redundant services is to be issued to the Infrastructure Manager prior to commencing work.

8 Materials Standards

All materials must be specified / sourced and installed in accordance with the parameters set out in TfL standard GRN 01, which includes details of requirements for minimum recycled content.

All colours shall be approved by the Infrastructure Manager prior to commencement of works.

Stainless Steel wall panels and handrails shall be provided to the interior of the lift car with a mirror provided on the opposite wall to the lift entrance to enable wheelchair users to reverse out more safely. The mirror shall not extend below 900mm above floor level. (See Fig 2)

Floor finishes shall match that of the reception lobby or where this is not possible rubber flooring as classified in RED 02 Floor Finishes shall be used.

Electrical installations associated with lifts shall accord with the standards set out in BLU 11 Electrical Distribution.

9 Workmanship Standards

Electrical installations associated with lifts shall accord with the standards set out in BLU 11 Electrical Distribution. Lighting shall be in accordance with BLU 13 lighting.

All control panel installations and wiring shall be installed in accordance with all current legislation, regulations, applicable British Standards, wiring regulations, manufacturer's installation guidelines.

10 Testing & Commissioning

Before the lift is put into service the complete lift installation and its component parts shall be examined, tested and verified in accordance with the lift standard BS EN 81 and recommendations of the manufacturer or supplier.

11 Handover

Reference should be made to the Manual to the Standards for general requirements for handover and submissions required for the Operation and Maintenance Manual.

All wiring diagrams and technical manuals shall be made freely available to the client and shall remain the property of client.

12 Maintenance

When new equipment is added or alterations are made to existing installations there shall be no detrimental impact on the ease of maintenance of existing facilities unless through dispensation from the Infrastructure Manager.

The contractor shall provide full maintenance during the defects liability period in accordance with the TfL maintenance model. Any departure from this requirement will require the grant of dispensation from the Infrastructure Manager.

The contractor shall create and maintain a maintenance log recording all reported defects, problems and maintenance issues and their resolution. Upon completion of the rectification of defects the log shall be issued to the Infrastructure Manager, prior to the release of any retention monies.

13 Further Information

13.1 Legislation

- Building Regulations Part M Access to and use of Buildings
- Energy Technology Criteria List - www.eca.gov.uk.

13.2 Codes of Practice

- Machinery Directive 2006/42 EC.

13.3 Design Guidance

- CIBSE Guide D Transportation systems for buildings.

Revision History:

Issue	Date	Description
1	December 2010	New standard created for TfL Head Office Standards

Relevant British / European Standards

BS EN 81-1	Safety rules for the construction and installation of lifts – Electric Lifts.
BS EN 81-2	Safety rules for the construction and installation of lifts – Hydraulic Lifts.
BS EN 81-70	Safety rules for the construction and installation of lifts – Accessibility to lifts for persons including persons with disability.
BS EN 81-72	Safety rules for the construction and installation of lifts – Fire fighting lifts.
BS EN 81-80	Safety rules for the construction and installation of lifts – Rules for the improvement of safety of existing passenger and passenger goods lifts.

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Lighting Installations

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13 Lighting Installations

1 Scope

This Standard sets out requirements for lighting installations in non-operational premises intended for use as offices by Transport for London (TfL).

This Standard part supersedes standard LUF-M005-ST Electrical Systems.

- Requirements for electrical distribution are set out in BLU 11 Electrical Distribution.
- Requirements for power installations are set out in BLU 12 Small Power Installations.
- Requirements for control and monitoring are set out in BLU 17 Building Management Systems.
- Requirements for metering are set out in BLU 18 Metering.

2 References

This Standard should be read in conjunction with the accompanying Manual to the Standards and TfL Standards GRN 01, 02, 03, BLU 11, 12, 18

It shall be the responsibility of the designer/installer to reference and comply with all the above and any other standards where necessary.

Relevant British Standards referred to in the text are listed on the rear cover. Unless otherwise stated, references are to the latest editions and revisions.

3 Definitions / Abbreviations

For a list of general abbreviations and definitions used within the standards

please see the accompanying Manual to the Standards.

4 Construction Design and Management Regulations (CDM)

Reference should be made to the Manual to the Standards for requirements under the CDM regulations.

5 Performance Standards

Preference shall be given to lighting office spaces by daylight, with artificial light only used when daylight is insufficient. Daylight design shall be undertaken in accordance with BS 8206-2.

Electrical installations shall be designed, installed and tested in accordance with current

Requirements for Electrical Installations (IEE Wiring Regulations), The Electricity at Work Regulations, Health and Safety at Work Act, CIBSE Guides, Guidance Notes, British Standards and other publications and shall comply with the requirements of The Building Regulations Part P, Part M and Part L.

General lighting shall be provided in accordance with CIBSE Lighting Guides and Code for Lighting, calculations shall be carried and lighting provided to achieve the maintained illuminance values as required by the CIBSE Code for Lighting and as stated in GRN 02 Design Criteria. In office premises lighting shall be provided in accordance with CIBSE Lighting Guide 7.

Emergency lighting shall be provided in accordance the British Standard BS 5266 and BS EN 1838. Emergency lighting calculations shall be carried out and lighting provided to achieve the horizontal illuminance levels as required by the standard.

External lighting and security lighting shall be provided in accordance with CIBSE Lighting Guide 6, lighting shall be controlled via photo-cells and overriding time switches.

The effects of glare must be taken into consideration;. The Glare Index in any area shall not exceed the maximum recommended in CIBSE Technical Memorandum TM10, calculation of glare indices.

Lamps shall be selected for their colour rendering in accordance with current CIBSE guidelines for their particular application and the task performed by the user of the space.

All final circuits are to be derived from a distribution board on the floor being served. Metering shall be provided in accordance with standard BLU 18 Metering.

The designer shall undertake all cable calculations in accordance with BS 7671. Cables shall be sized for the required duty in accordance with BS 7671. The minimum cable sizes shall not be less than 1.5mm² for lighting.

Individual areas, including cellular offices and zoned open plan areas, shall be provided with separate, dedicated lighting control. In areas with adequate daylight, automatic daylight control shall be provided to adjust the artificial lighting level. In areas without adequate daylight the lighting shall automatically switch off, when the space is unoccupied using presence detection. Local manual switches to override automatic controls shall not be provided unless agreed with the Infrastructure Manager. The only exceptions are meeting rooms where a manual override is permitted to override OFF only.

The automated lighting system shall be a programmable, intelligent self contained system with all luminaires having high frequency electronic digital dimmable ballast. All light switching shall be by activation of passive infra-red (PIR) detectors either mounted as an integral part of the light fitting or mounted remote. Where detectors are remote a maximum of 4 luminaires shall be controlled from a single detector.

The lighting control system shall provide and maintain the initial design luminance level

throughout the system operation for the proposed space. Daylight response dimming down to 5% output is to be provided coupled with presence/absence detection dimming to switch off at a pre-set level.

Light switching shall be by the use of passive infra-red (PIR) detectors and hand-held controllers unless approved otherwise by the Infrastructure Manager. The occupancy pattern for the area must also be taken into consideration and care should be taken to ensure that automatic switching off of lighting does not render an area dark whilst partly used.

High frequency electronic dimmable ballast shall be provided to all installed luminaires, including luminaires where the output is not automatically controlled, to allow the lighting to be manually pre-set down to appropriate levels at commissioning stage.

Risk assessments shall be undertaken for all areas to confirm the suitability of automatically switched lighting. In areas where automatic switching is not appropriate and where agreed with the Infrastructure Manager, manual switching shall be provided. The manual switches shall be located within the maximum distance of 6 m, or twice the height of the luminaire above the floor, to meet the requirements of Part L.

In open plan areas, regardless of the switching method employed, no single switched circuit shall control a floor area of more than 30 m², unless approved otherwise by the Infrastructure Manager.

Where a space is a day lit space served by side windows, the perimeter row of luminaires shall be separately switched.

A lighting track busbar system shall be the preferred method of final circuit wiring of office area lighting systems. Written approval from the Infrastructure Manager must be sought if an alternative wiring system is proposed for a particular installation.

Where possible emergency luminaires shall be the inverter type forming part of the general lighting luminaire, where this is not possible luminaires shall be self contained. In certain cases it may be appropriate to use slave luminaires connected to central battery system. The type of system shall be discussed and agreed with the Infrastructure Manager.

In installations with more than 50 emergency luminaires, automated test and reporting system shall be provided to test luminaires. In installations with less than 50 emergency luminaires, luminaires shall be manually tested using secret key D.P. switches.

All circuits shall be provided with a separate circuit protective conductor (CPC). Metallic containment and the wire armour of cables may not be used in lieu of a CPC.

The designer shall carry out a design load assessment and ensure the revised load capacity does not exceed the existing capacity of the distribution system including the agreed supply capacity.

The designer shall make due allowance for space capacity for future expansion within

any new installation. At all points in new systems 25% spare capacity shall be allowed for expansion. Where an existing system is being extended the designer does not need to allow for further spare capacity unless the works would result in the spare capacity falling below 5%. If the proposed works would result in the system spare capacity falling below 5% then the designer will advise the Infrastructure Manager and provide the cost to re-instate the system to 25% spare capacity. The Infrastructure Manager will then confirm the requirement for the project.

The designer shall consider and make allowance for electromagnetic compatibility in selection of equipment and implement mitigation measures to control electromagnetic interference.

6 Equipment Standards

6.1 General Requirements

Where a product or component required for the works appears in any category on the Energy Technology Criteria List then the product or component selected for the installation shall comply fully with the relevant criteria.

With the exception of items designed to be disposable, the design life of the materials and equipment used shall be not less than five years. For materials and equipment whose replacement is not expected between major refurbishments, the design life shall be a minimum of 15 years.

Unusual, non-standard and non-proprietary components, substances and materials shall not be used.

6.2 Final Circuit Protective Devices

Protective devices shall be either miniature circuit breaker (MCB) or residual current circuit breakers with over current protection (RCBOs) as required by the regulations.

6.3 Busbar Lighting Trunking

Busbar lighting trunking systems shall conform with the requirements of BS 4678 and BS EN 60439.

Busbar lighting systems shall be rated at 25 Amp.

The busbar lighting trunking system having "tap-off" points every 500mm throughout its length. A separate fused "tap-off" shall be provided for each luminaire.

The busbar lighting trunking system is to be complete with all necessary components, including end blanking pieces, terminal end feed boxes and flexible links to clear obstacles and changes in direction of the busbar system.

6.4 Luminaires

General lighting Luminaires shall conform to BS 4533.

Emergency Luminaires shall conform to BS 5266, BS EN 1838, BS EN 60598 2-22.

External luminaires shall be selected to minimise pollution of the night sky, glare and nuisance. Column mounted luminaires shall be installed on mid-hinged columns; columns over 14 meters shall be installed on base hinged columns.

Luminaires and lamps shall meet the energy efficiency requirements as stated in GRN 02 Design Criteria.

6.5 Lighting Columns

General lighting luminaires shall conform to BS 4533.

Emergency luminaires shall conform to BS 5266, BS EN 1838, BS EN 60598 2-22.

External luminaires shall be selected to minimise pollution of the night sky, glare and nuisance.

6.6 Electrical Accessories

Electrical accessories such as plate switches and key switches shall be mounted on brushed aluminium or stainless steel metal face plates. Face plates shall contrast visually with their backgrounds and rocker switches shall be suitably sized where required by Part M.

Accessories shall be installed flush on metallic back boxes.

Where surface mounted, accessory back boxes shall be metal, finished to match the accessories, and drilled for conduit connection without “knockouts”.

All the accessories in any building are to be obtained from a single manufacturer’s range.

7 Design / Contractor Submittal Requirements.

Reference should be made to the Manual to the Standards for general requirements for drawing and sample submittal requirements.

All redundant services are to be stripped out during the works. A schedule of redundant services is to be issued to the Infrastructure Manager prior to commencing work.

The designer shall provide a summary statement, in a format to be agreed with the Infrastructure Manager, to demonstrate how the lighting has been designed to comply with CIBSE LG7 Office Lighting.

8 Materials Standards

8.1 Final Circuit Wiring

All final circuit wiring shall be LSOH single insulated, unsheathed stranded copper cables installed in a re-wirable metallic conduit / trunking containment system.

Cables rated for fire safety shall be MICC to comply with BS 6387 and BS EN 60702.

Where it is not possible or appropriate to install a containment system, subject to the approval of the Infrastructure Manager, the installation may be made with Steel Wire Armour cables on galvanized cable tray. Refer to BLU 11 Electrical Distribution for specification.

Lighting busbar systems shall be fed by Steel Wire Armour cables on galvanized cable tray. Refer to BLU 11 Electrical Distribution for specification.

External lighting columns shall be fed by Steel Wire Armour cables on galvanized cable tray. Refer to BLU 11 Electrical Distribution for specification.

All cables shall be BASEC approved.

8.2 Conduit

All conduit shall be hot dipped galvanised steel manufactured by a member of BESA to BS EN 61386.

8.3 Cable Trunking

All cable trunking shall be hot dipped galvanised mild steel with internal return edge flange. The lid shall be fastened by turnbuckles to the internal return flange. The system shall be rigidly fixed and supplied complete with purpose made fittings, connectors and fixing brackets.

All tees, intersections and sets shall be propriety items supplied by the manufacturer of the trays.

8.4 Final Connections

All final connections to luminaires installed on suspended tile ceilings, shall be made using heat resistant flexible cables and plug-in "Klik" ceiling roses. Final connections to luminaires with integral emergency lighting shall be made using a 4 pin plug-in rose with a red plug connector.

9 Workmanship Standards

9.1 General Requirements

All equipment shall be installed in accordance with the manufacturer's requirements, relevant standards and code of practice.

Electrical Installation works are to be undertaken in accordance with the IEE Guidance Notes and On Site Guide to the Wiring Regulations.

Circuits for safety services as designated by building control shall be routed outside of fire

risk areas, where this is not possible cables shall be suitably fire rated.

9.2 Electrical Accessories

Provide switches for lighting control and key switches for testing of emergency luminaires at appropriate heights between 900mm and 1200mm from finished floor level, in accordance with Building Regulations Approved Document M and BS 8300.

Ensure there is no damage to accessories during installation.

Protect surface mounted accessories from painting. Install front plates of flush mounted accessories after painting.

Align accessories to building finishes. Mount grouped accessories in line, parallel and equidistant.

9.3 Conduit & Trunking

Use maximum practical lengths to minimise number of joints and remove burrs from cut ends.

Use bends and/or junction boxes at changes of direction in conduit. Form conduit bends by machine. Do not use elbows or tees of any sort.

Use couplers and externally screwed brass bushes to connect conduit to loop-in circular conduit boxes.

Tightly screw all joints to ensure electrical continuity.

Use expansion couplings where containment crosses movement joints in structure.

All systems shall be installed to allow future rewiring without disturbance of the building.

9.4 Wiring

No joints in cables will be permitted. Install cables without joints other than at equipment and terminal fittings.

Use cable circuit protective conductors throughout. The use of used conduit or trunking as protective conductors is not permitted.

Support cables in vertical trunkings with pin racks or cleats at each floor level or at 5m vertical centres, whichever is less.

9.5 Busbar Lighting Trunking

The system shall be securely fixed to the soffit above the suspended ceiling.

9.6 Earthing

Install CPCs in the same containment as the circuit being protected.

Provide CPCs between earth lug on metal back box and accessories.

9.7 Fire Stopping

Where trunking passes through fire resisting floors, ceilings, cavity barriers, etc., seal internally with packed rock fibre.

10 Testing & Commissioning

Testing, commissioning and certification of all works and installations shall be conducted in accordance with BS 7671.

Inspection and progressively full testing, during erection and/or completion, before the installation is put into service, and inspection and test to verify, so far as is reasonable practicable, that the requirements of BS 7671 have been met. Completing and submitting the test certificates and affording the opportunity of the Project Engineer to witness such tests.

To avoid possible damage to equipment, insulation resistance testing shall be carried out before fittings or equipment are connected, but with circuits complete connected to porcelain connector blocks or similar approved connections at fittings position.

Continuity testing shall be carried out as prescribed in the BS 7671 before supplies are connected. Once supplies are connected, polarity, earth fault loop impedance and RCD operation shall be completed and recorded.

All control components shall be set up and commissioned in accordance with the manufacturer's recommendations.

Full completion and inspection certificates shall be prepared and issued as prescribed in Appendix 6 of BS 7671. Provide copies to the TfL Infrastructure Manager on request.

Emergency lighting shall be tested and verified in accordance with BS 5266.

11 Handover

Reference should be made to the Manual to the Standards for general requirements for

handover and submissions required for the Operation and Maintenance Manual

A complete circuit chart is to be framed and mounted adjacent to each distribution board.

An emergency lighting completion certificate shall be provided, including declarations of conformity for design, installation and verification, together with photometric design data and test log book.

12 Maintenance

The contractor shall provide full maintenance during the defects liability period in accordance with the TfL maintenance model. Any departure from this requirement will require the grant of dispensation from the Infrastructure Manager.

When new equipment is added or alterations are made to existing installations there shall be no detrimental impact on the ease of maintenance of existing facilities, unless through dispensation from the Infrastructure Manager.

The contractor shall create and maintain a maintenance log recording all reported defects, problems and maintenance issues and their resolution. Upon completion of the rectification of defects the log shall be issued to the Infrastructure Manager, prior to the release of any retention monies.

13 Further Information

13.1 Legislation

- Building Regulations Part P Electrical Safety

- BS 7671 Requirements for electrical installations.
- CIBSE Code for Interior Lighting
- CIBSE Commissioning Code L Lighting
- Energy Technology Criteria List - www.eca.gov.uk.

13.2 Design Guidance

- CIBSE Lighting Guide 6 External Lighting.
- CIBSE Lighting Guide 7 Office Lighting.
- CIBSE TM 10 – Calculation of glare indices.
- CIBSE TM12 Emergency Lighting
- BRE Guide 2/99 Photoelectric control of lighting.
- BSRIA Building Applications Guide BG 3/2006 Design checks for electrical services. A quality control framework for electrical engineers
- IEE On Site Guide (BS7671 Wiring Regulations 17th Edition).

Revision History:

Issue	Date	Description
1	December 2010	This standard part supersedes standard LUF-M005-ST Electrical Systems.

Relevant British / European Standards

BS 4533 -102.1	Luminaires. Particular requirements. Specification for fixed general purpose luminaires.
BS 5266-1	Emergency Lighting Part 1: Code of practice for the emergency lighting of premises.
BS 7671	Requirements for electrical installations.
BS 8207	Code of practice for energy efficiency in buildings
BS 8300	Design of buildings and their approaches to meet the needs of disabled people
BS 8206	Lighting for Buildings: Code of Practice for Daylighting
BS EN 1838:1999/BS 5266-7	Lighting applications – Emergency lighting.
BS EN 5017:2001	Central power supply systems.
BS EN 50172:2004/BS 5266-8:2004	Emergency escape lighting systems.
BS EN 60598-2-22:1998	Luminaires. Particular requirements for emergency lighting.
IEC 62034	Automatic test systems for battery powered emergency escape lighting.

03

Mechanical Ventilation

Issue 1 — December 2010



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03 Mechanical Ventilation

1 Scope

This Standard sets out requirements for mechanical ventilation systems in non-operational premises intended for use as offices by Transport for London (TfL)

This Standard part supersedes standard LUF-M003-ST Ventilation and Air Conditioning.

- Requirements for central heating plant and distribution are set out in BLU 01 Central Heating Plant.
- Requirements for air-conditioning are set out in BLU 04 Air Conditioning.
- Requirements for refrigeration and cooling are set out in BLU 05 Refrigeration and Cooling.
- Requirements for control and monitoring are set out in BLU 17 Building Management Systems.
- Requirements for metering are set out in BLU 18 Metering.

All works shall comply with the requirements of non - domestic heating, cooling and ventilation compliance guide.

2 References

This Standard should be read in conjunction with the accompanying Manual to the Standards and TfL standards GRN 01, 02, 03, BLU 01,03,04,05,08.

It shall be the responsibility of the designer/installer to reference and comply with all the above and any other Standards where necessary.

Relevant British Standards referred to in the text are listed on the rear cover. Unless otherwise stated, references are to the latest editions and revisions.

3 Definitions / Abbreviations

For a list of general abbreviations and definitions used within the Standards please see the accompanying Manual to the Standards.

4 Construction Design and Management Regulations (CDM)

Reference should be made to the Manual to the Standards for requirements under the CDM regulations.

5 Performance Standards

5.1 General Standards

Mechanical Ventilation shall be provided to maintain indoor air quality where sufficient fresh air cannot be achieved by natural means. Ventilation systems shall be implemented in the following order of preference:

- Natural Ventilation
- Mixed mode with air quality control
- Variable mechanical ventilation with air quality control
- Fixed mechanical ventilation

Natural ventilation systems shall be assessed or designed in accordance with CIBSE Application Manual AM10 Natural ventilation in non-domestic buildings.

Mechanical ventilation systems shall be designed in accordance with current CIBSE Guides, Guidance Notes and other publications and shall comply with the requirements of The Building Regulations Part F. The designer shall undertake ventilation calculations in accordance with BS EN 13779.

The mechanical ventilation system shall be designed to minimise energy consumption, operate efficiently, and provide adequate ventilation throughout the occupied hours. The system shall not operate beyond occupied hours, except where the conditioning strategy calls for night cooling.

Mechanical ventilation to occupied spaces shall be a balanced supply and extract system to deliver a minimum of 8l/s of fresh air per person during occupied hours.

Ductwork systems shall be designed as far as is possible to be self balancing without resorting to the use of balancing dampers. (See Fig. 1)

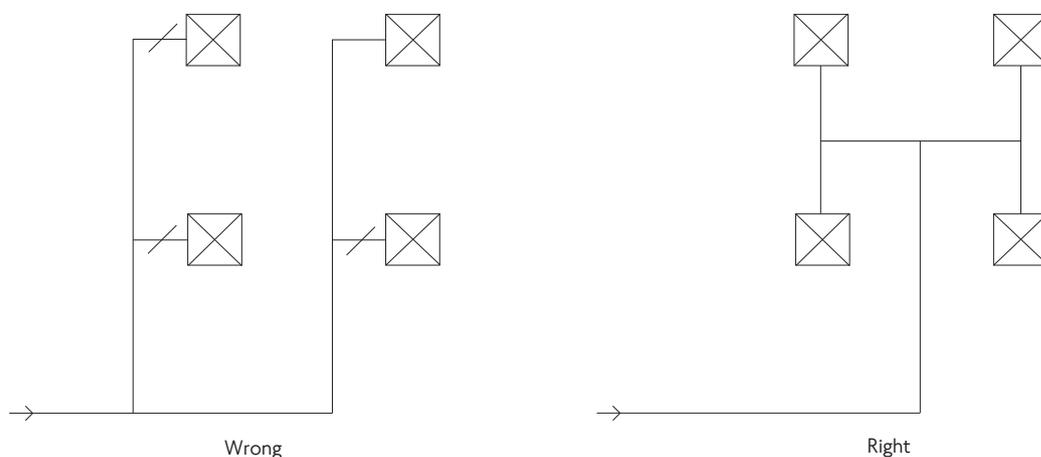


Fig. 1

Mechanical ventilation systems to sanitary and kitchen accommodation shall be designed in accordance with best practice, but as a minimum to achieve the ventilation requirements of the Building Regulations Part F. Such areas shall be maintained at a negative pressure relative to surrounding spaces.

If a mechanical ventilation system is designed to provide space heating or cooling in addition to fresh air supply then the system shall be designed and installed additionally in accordance with TfL Standard BLU 04 Air Conditioning.

All mechanical ventilation systems shall incorporate appropriate mechanisms to enable localised control to be exercised within all parts of the building.

The designer must assess the capacity of any existing mechanical ventilation system that is proposed to be retained and demonstrate that it is adequate to meet the requests of this standard.

Cross talk attenuators shall be provided where necessary to attenuate noise transfer between rooms which are linked by air paths or ventilation systems.

All fresh air supply systems shall include filtration to control external pollutants and air tempering to avoid cold draughts in winter.

All mechanical ventilation systems shall be fully monitored and controlled by the BMS system.

6 Equipment Standards

6.1 General Requirements

Where a product or component required for the works appears in any category on the Energy Technology Criteria List then the product or component selected for the installation shall comply fully with the relevant criteria.

With the exception of items designed to be disposable, the design life of the materials and equipment used shall be not less than five years. For materials and equipment whose replacement is not expected between major refurbishments, the design life shall be a minimum of 15 years.

Unusual, non-standard and non-proprietary components, substances and materials shall not be used.

Fresh air systems to occupied spaces shall be provided with filtration to F8 (EU8) Efficiency 90-95%, using bag filters with panel pre-filters as necessary. Fresh air to ancillary spaces shall be provided with filtration to G4 (EU4) Arrestance >90%.

Grilles and diffusers shall be selected to ensure that air movement in the occupied zone is less than 0.2m/s. Grilles and diffusers shall be labelled indicating: reference number (as indicated on drawings); supply or extract.

All ventilation must have heat recovery with a minimum efficiency in accordance with the Energy Technology List, unless agreed by the Infrastructure Manager and only via application of a dispensation form.

All ventilation systems shall be designed and installed to achieve specific fan power not more than 75% of the limiting specific fan power for the system type given in the Non - Domestic Heating, Cooling and Ventilation Compliance Guide.

The location of air intakes shall be at least 20m from sources of external pollution and 10m from building ventilation exhausts to minimise recirculation of exhaust air.

Ventilation system fans shall have variable speed control based on internal CO₂ sensors to provide fresh air in proportion to the occupancy. The CO₂ set-point for the design fresh air volume will be 800ppm.

7 Design / Contractor Submittal Requirements

Reference should be made to the Manual to the Standards for general requirements for drawing and sample submittals.

All redundant services are to be stripped out during the works. A schedule of redundant services is to be issued to the Infrastructure Manager prior to commencing work.

8 Materials Standards

The ductwork system shall be designed with low loss lines in accordance with DW 144 for low pressure systems. Ductwork leakage shall be designed in accordance with Class C of DW 144.

Ductwork shall be selected according to the following preference:

- Circular
- Flat Oval
- Square or rectangular

Radiused bends shall be used on flat oval, square or rectangular ducts unless dispensation is granted by the Infrastructure Manager in extenuating circumstances.

All ductwork shall be capable of being readily cleaned on the inside.

All ductwork fire dampers shall be provided with access hatches and an external 'activated indicator'.

Grilles and diffusers shall be labelled with references which match the as installed drawings. Each terminal shall also be labelled to indicated Supply/Extract.

Supply grilles shall have a swirl pattern, extract grilles should be fitted with a face plate to match.

Where noise control is required the ductwork system shall be sized and installed to avoid regenerated noise.

All attenuators shall have aerodynamic fairings at both ends.

9 Workmanship Standards

All ductwork shall be fabricated and installed to DW144.

All ductwork and equipment supports shall utilise unistrut, steel angle and threaded rods or similar arrangements. Straps and cable suspensions are not permitted.

10 Testing & Commissioning

Carry out commissioning of installation with the procedures, checks and tolerances given in the BSRIA Application Guide for air systems to achieve the standards set in the CIBSE Commissioning Codes.

Any ductwork covered up without a pressure test witnessed by the Infrastructure Manager will be entirely at the contractor's risk. Advise the Infrastructure Manager, at least five days in advance, of the time that pressure tests may be witnessed.

All control components shall be set up and commissioned in accordance with the manufacturer's recommendations.

All traverse holes shall be plugged upon completion of commissioning. The locations of all holes to be indicated on the record drawings.

Keep a systematic record of all tests and commissioning procedures. Provide copies to the TfL Infrastructure Manager on request.

11 Handover

Reference should be made to the Manual to the Standards for general requirements for handover and submissions required for the Operation and Maintenance Manual.

Axonometric or full 3D drawings shall be provided for all plant rooms clearly identifying the equipment and interconnecting services for incorporation into the BMS.

Commissioning certificates shall state the ductwork air leakage rates.

All systems shall be identified in accordance with BS 1710.

12 Maintenance

The contractor shall provide full maintenance during the defects liability period in accordance with the TfL maintenance model. Any departure from this requirement will require the grant of dispensation from the Infrastructure Manager.

When new equipment is added or alterations are made to existing installations there shall be no detrimental impact on the ease of maintenance of existing facilities unless through dispensation from the Infrastructure Manager.

The contractor shall undertake planned preventative maintenance of all systems, including any retained existing systems, during the defects liability period.

The contractor shall create and maintain a maintenance log recording all reported defects, problems and maintenance issues and their resolution. Upon completion of the rectification of defects the log shall be issued to the Infrastructure Manager prior to the release of any retention monies.

13 Further Information

13.1 Legislation

- Building Regulations Part L2 Conservation of Fuel & Power
- Building Regulations Part F Ventilation Offices Shops & Railways Premises Act
- Energy Technology Criteria List - www.eca.gov.uk

- Non - Domestic Heating, Cooling and Ventilation Compliance Guide - Dept. for Communities and Local Government. (Tier 2 document to Part L2,)

13.2 Design Guidance

- CIBSE Guide B2 Ventilation & Air Conditioning
- CIBSE Guide B3 Ductwork
- CIBSE Guide F Energy Efficiency in Buildings
- CIBSE Application Manual AM10 Natural ventilation in non-domestic buildings
- CIBSE TM8 Design notes for ductwork
- CIBSE TM21 Minimising pollution at air intakes
- CIBSE TM30 Improved life cycle performance of mechanical ventilation systems
- CIBSE TM42 Fan application guide
- BSRIA Guide: A Practical Guide to Building Services Calculations G30
- CIBSE Commissioning Code A: Air Distribution Systems
- HVCA Specification DW144 Specification for sheet metal ductwork: low, medium and high pressure/velocity air systems (Appendix M revision 2002)

Revision History:		
Issue	Date	Description
1	December 2010	This Standard part supersedes standard LUF-M003-ST Ventilation and Air Conditioning.

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Relevant British / European Standards

- BS 476-24:** Fire tests on building materials and structures. Part 24 Method for determination of the fire resistance of ventilation ducts.
- BS 1710** Specification for Identification of Pipelines and Services.
- BS 8207** Code of practice for energy efficiency in buildings
- BS EN 13779** Ventilation for non-residential buildings. Performance requirements for ventilation and room-conditioning systems

18

Metering

Issue 1 — December 2010



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18 Metering

1 Scope

This Standard sets out requirements for energy and water metering in non-operational premises intended for use as offices by Transport for London (TfL).

- Requirements for control and monitoring are set out in BLU 17 Building Management Systems.

All installations shall comply with the requirements of CIBSE TM37 Building Energy Metering.

2 References

This Standard should be read in conjunction with the accompanying Manual to the Standards and TfL Standards GRN 01, 02, 03, BLU 12

It shall be the responsibility of the designer/installer to reference and comply with all the above and any other Standards where necessary.

Relevant British Standards referred to in the text are listed on the rear cover. Unless otherwise stated, references are to the latest editions and revisions.

3 Definitions / Abbreviations

For a list of general abbreviations and definitions used within the Standards please see the accompanying Manual to the Standards.

4 Construction Design and Management Regulations (CDM)

Reference should be made to the Manual to the Standards for requirements under the CDM regulations.

5 Performance Standards

Metering and sub-metering is to be provided to allow efficient monitoring and management of the energy and water consumption in TfL Head Office buildings.

Energy metering installations should be designed in accordance with CIBSE TM39 to meet the requirements of the Building Regulations Part L.

Separate main meters (including water, gas, LPG and electricity as appropriate) shall be installed for any individual building or tenancy greater than 500m².

Within buildings or tenancies, sub-meters shall be installed to all of the following services and installations:

Gas or other heating fuel:

- Central heating plant.
- Central cooling plant (absorption chillers).
- Central hot water generation plant.
- Kitchens and catering facilities.
- CHP plant.

Electricity:

- Central heating plant (electric heat pumps).
- Immersion heaters in thermal stores / accumulators.
- Central cooling plant.
- HVAC motor control centre.
- Plant items exceeding 10kw rated power input to be separately metered.
- Central computer and telecommunications equipment rooms.
- Concession areas.
- Kitchens and catering facilities (excluding local tea making points).
- Small power metered on a floor by floor basis.
- Lighting metered on a floor by floor basis.
- External power & lighting.
- Lifts or groups of lifts.
- Any on-site generation.

Water:

- Domestic hot water cold fill.
- Kitchens and catering facilities.
- Laundry facilities.
- Automatic fill for heating / cooling system or any other circulating water system.
- Make up water for open cooling towers.
- Irrigation systems and external water supplies.
- Recovered rainwater supply or mains top up to rainwater harvesting tanks.

- Usage from rainwater harvesting tanks.
- Dumped process water (e.g. from cooling towers).
- Grey water.

Heat:

- Main heating and cooling generation plant.
- Domestic hot water.
- Sub-tenancy areas heating & cooling.
- Charging and consumption from thermal stores.

All meters shall be networked with a system to automatically provide half hourly data to TfL's aM&T software in the most cost efficient manner. This system shall be independent to the building BMS unless specific dispensation is granted by the Infrastructure Manager. In order for dispensation to be granted the meter system designer must demonstrate the method of data collection and interface between the BMS and the aM&T software.

6 Equipment Standards

Metering equipment interposed in pipework or ductwork, installed in switchgear, control panels etc. shall conform to the requirements set out in the relevant TfL Head Office Standards for the installations.

All electrical installations associated with the metering installation shall comply with the requirements for containment and wiring set out in BLU 12 Small Power Installations.

All meters shall be suitable for connecting to required data collection systems.

Status and alarms to be signalled via the BMS, whilst half hourly meter data to be sent to the aM&T system together with status and

live streaming data for the main electricity incomes, any on site generation and any server / communications rooms. Further project specific requirements for live streaming meter data will be advised by the Infrastructure Manager.

All equipment shall be type tested. The equipment shall be clearly identified and grouped in locations accessible only to skilled or instructed persons.

Where a product or component required for the works appears in any category on the Energy Technology Criteria List then the product or component selected for the installation shall comply fully with the relevant criteria.

All metering equipment shall be served from an independent, un-switched power supply, such that the shutdown of the service being metered does not result in loss of supply to the meter.

All meters shall be installed so as to be capable of maintenance or replacement without shutting down the metered service or equipment.

7 Design / Contractor Submittal Requirements.

Reference should be made to the Manual to the Standards for general requirements for drawing and sample submittal requirements.

All redundant services are to be stripped out during the works. A schedule of redundant services is to be issued to the Infrastructure Manager prior to commencing work.

The contractor is to generate and maintain a tracking register to record the on going status of the metering installation. The register is to identify meters by serial number and reference, cross reference to the metering schematic and is to record the status of the installation plus any relevant information such as calibration settings.

8 Testing & Commissioning

Meters shall be commissioned in accordance with the manufacturer's instructions in order to ensure accurate operation.

Meters connected to the required data collection systems shall be calibrated to ensure that the system reports an accurate measure of the metered quantity.

9 Handover

Reference should be made to the Manual to the Standards for general requirements for handover and submissions required for the Operation and Maintenance Manual.

Record information shall comprise a metering schematic to TM 39, comprising sheets, the metering status tracking register, system schematics indicating the meters and floor plans with meter locations, all cross referenced. Record information shall be provided for the complete system. Where the works comprise alteration or additions to existing systems then the record information is to be amended to reflect the changes. Record information for partial systems will not be accepted.

10 Maintenance

When new equipment is added or alterations are made to existing installations there shall be no detrimental impact on the ease of maintenance of existing facilities unless through dispensation from the Infrastructure Manager.

The contractor shall provide full maintenance during the defects liability period in accordance with the TfL maintenance model. Any departure from this requirement will require the grant of dispensation from the Infrastructure Manager.

The contractor shall create and maintain a maintenance log recording all reported defects, problems and maintenance issues and their resolution. Upon completion of the rectification of defects the log shall be issued to the Infrastructure Manager, prior to the release of any retention monies.

11 Further Information

11.1 Legislation

- Building Regulations Part L2 Conservation of Fuel & Power
- Energy Technology Criteria List - www.eca.gov.uk.

11.2 Design Guidance

- CIBSE TM39: Building Energy Metering

Revision History:

Issue	Date	Description
1	December 2010	New standard created for TfL Head Office Standards

Relevant British / European Standards

BS 8431 Code of practice for electrical static metering for secondary or sub-metering.

08

Natural Gas

Issue 1 — December 2010



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08 Natural Gas

1 Scope

This Standard sets out requirements for natural gas services in non-operational premises intended for use as offices by Transport for London (TfL).

This Standard part supersedes standard LUF-M004-ST Water and Gas Services.

- Requirements for central heating plant and distribution are set out in BLU 01 Central Heating Plant.
- Requirements for control and monitoring are set out in BLU 17 Building Management Systems.
- Requirements for metering are set out in BLU 18 Metering.

All works shall comply with the requirements of non-domestic heating, cooling and ventilation compliance guide.

2 References

This Standard should be read in conjunction with the accompanying Manual to the Standards and TfL Standards GRN 01, 02, 03, BLU 01, 02, 03, 04, 05, 18.

It shall be the responsibility of the designer/installer to reference and comply with all the above and any other standards where necessary.

Relevant British Standards referred to in the text are listed on the rear cover. Unless otherwise stated, references are to the latest editions and revisions.

3 Definitions and Abbreviations

For a list of general abbreviations and

definitions used within the Standards please see the accompanying Manual to the Standards.

4 Construction Design and Management Regulations (CDM)

Reference should be made to the Manual to the Standards for requirements under the CDM regulations.

5 Performance Standards

5.1 General Standards

All equipment and assemblies which fall within the scope of the Pressure Equipment Directive (PED) 97/23/EC, implemented in the UK through the Pressure Equipment Regulations 1999, must be tested by the

manufacturer, and be certified as compliant with the Directive. Such compliance shall be evidenced by displaying the appropriate CE Mark on the equipment and assemblies.

Only relevant equipment and assemblies (i.e. those with a maximum allowable) certified as compliant will be permitted under this specification, and any substitution put forward must also be compliant with the Directive.

New gas systems shall be designed in accordance with current CIBSE Guides, Guidance Notes and other publications and shall comply with the requirements of The Building Regulations and HSE Gas Safety Regulations.

All installers must be on the Gas Safe Register. The designer shall undertake gas calculations in accordance with BS EN 12831.

Safety diaphragm to comply with Pressure Equipment Directive (PED) 97/23/EC, implemented in the UK through the Pressure Equipment Regulations 1999, must be tested by the manufacturer, and be certified as compliant with the Directive. Such compliance shall be evidenced by displaying the appropriate CE Mark on the equipment and assemblies.

6 System Requirements

6.1 General Requirements

Where a product or component required for the works appears in any category on the Energy Technology Criteria List then the product or component selected for the installation shall comply fully with the relevant criteria.

With the exception of items designed to be disposable, the design life of the materials and equipment used shall be not less than five years. For materials and equipment whose replacement is not expected between major refurbishments, the design life shall be a minimum of 15 years.

Unusual, non-standard and non-proprietary components, substances and materials shall not be used.

Provide a fail-safe automatic shut off valve at the point of entry to the building to be linked to the fire alarm. Valve is to be pressure-proving manual reset.

Provide an automatic shut-off valve with 24hr battery back up and shielded emergency stop button, installed in the gas supply to any catering equipment. The stop button shall be readily accessible, near to the exit from the catering area. The valve shall be interlocked with the ventilation to the kitchens (such that the ventilation system operation must be proved before the gas service can be opened).

Provide a drop weight fire valve with fusible links and a manual activation or a solenoid shut off valve linked to rate of rise heat detectors and an emergency knock off button in all boiler rooms.

In the event of a shut-down occurring, the system shall require manual resetting such that an automatic check is performed to prove that all downstream gas isolation valves are closed.

Where catering appliances are not fitted with full flame safeguards, the gas supply shall also

be fitted with a system to prove closure of all valves prior to establishment or restoration of the gas supply. The system shall be in accordance with BG IM/20.

At all locations where either a manual gas isolation valve is fitted, or where an automatic gas valve system can be reset, a notice shall be affixed stating:

“In the event of an emergency the gas isolation valve must be closed. All downstream burners and pilot valves on appliances must be turned off before attempting to restore the supply.”

Within buildings or tenancies, sub-meters shall be installed to all branches. Please refer to BLU 18 - Metering.

7 Design / Contractor Submittal Requirements.

Reference should be made to the Manual to the Standards for general requirements for drawing and sample submittal requirements.

All redundant services are to be stripped out during the works. A schedule of redundant services is to be issued to the Infrastructure Manager prior to commencing work.

8 Materials Standards

Pipework in new installations shall be steel throughout, screwed up to and including 40mm, welded at 50mm and above. Copper pipework may only be used to match existing installations.

9 Workmanship Standards

Install equipment in accordance BS EN 1775 and with manufacturer’s recommendations. Comply with IGE/UP/10 installation of gas appliances in industrial and commercial premises.

Arrange all exposed pipe work to run in a neat and presentable appearance, parallel with other pipe or service runs and building structure. Ensure all vertical pipes are plumb or follow building line.

10 Testing & Commissioning

Carry out Hydraulic Pressure Testing as described in HVCA TR/6 Guide to Good Practice for Site Pressure Testing of Pipework.

Any pipework covered up without a pressure test witnessed by the Infrastructure Manager will be entirely at the contractor’s risk. Advise the Infrastructure Manager at least 5 days in advance of the time that pressure tests may be witnessed.

Carry out commissioning of installations in accordance with the procedures, checks and tolerances given in the BSRIA Application Guides for water systems to achieve the standards set in the CIBSE Commissioning Codes.

All control components shall be set up and commissioned in accordance with the manufacturer’s recommendations.

Keep a systematic record of all tests and commissioning procedures. Provide copies to the TfL Infrastructure Manager on request.

Commission gas fired plant on industrial and commercial premises in accordance with IGE/UP/4.

Commission gas supply systems in accordance with BS EN 12327.

Comply with IGE/UP/1 strength and tightness testing and direct purging of industrial and commercial gas installations.

Comply with IGE/UP/1A strength and tightness testing and direct purging of small low pressure industrial and commercial Natural Gas installations.

Carry out pressure testing in accordance with BS EN 12327.

11 Handover

Reference should be made to the Manual to the Standards for general requirements for handover and submissions required for the Operation and Maintenance Manual.

Axonometric or full 3D drawings shall be provided for all plant rooms and congested areas of distribution, clearly identifying the equipment and interconnecting services.

Procedures for preventative measures against the effects of aerobic bacteria and Pseudomonas shall form part of the hand over documentation.

12 Maintenance

The contractor shall provide full maintenance during the defects liability period in accordance with the TfL maintenance model.

Any departure from this requirement will require the grant of dispensation from the Infrastructure Manager.

When new equipment is added or alterations are made to existing installations there shall be no detrimental impact on the ease of maintenance of existing facilities unless through dispensation from the Infrastructure Manager.

The contractor shall create and maintain a maintenance log recording all reported defects, problems and maintenance issues and their resolution. Upon completion of the rectification of defects the log shall be issued to the Infrastructure Manager, prior to the release of any retention monies.

13 Further Information

13.1 Legislation

- Building Regulations Part J Combustion appliances and fuel storage systems.
- HSE Gas Safety Regulations 1988.
- Pressure Equipment Regulations 1999.
- Energy Technology Criteria List - www.eca.gov.uk.
- Non Domestic Heating, Cooling and Ventilation Compliance Guide - Tier 2 document to Part L2, Dept. for Communities and Local Government.

13.2 Codes of Practice

- HVCA TR/6 Guide to Good Practice for Site Pressure Testing of Pipework.
- IGE/UP/10 Installation of gas appliances in industrial and commercial premises.
- IGE/UP/4 Commissioning of gas fired plant on industrial and commercial premises.

- IGE/UP/1 Strength and tightness testing and direct purging of industrial and commercial gas installations.
- IGE/UP/1A Strength and tightness testing and direct purging of small low pressure industrial and commercial gas installations.
- IGE/TD /4 Gas services.
- IGE/UP/2 Gas installation pipework, boosters and compressors on industrial and commercial premises.
- IGE/GM/4 Flow metering practice.
- IGE/GM/5 The installation and use of electronic gas meter conversion systems.
- IGE/GM/8 Non-domestic gas meter installations.

13.3 Design Guidance

- CIBSE Guide B1 Heating Systems.
- CIBSE Application Manual AM14 Non-domestic hot water heating systems.

Revision History:		
Issue	Date	Description
1	December 2010	This standard part supersedes standard LUF-M004-ST Water and Gas Services.

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Relevant British / European Standards

BS 6173	Specification for installation of gas-fired catering appliances for use in all types of catering establishments (2nd and 3rd family gases).
BS 6891	Installation of low pressure gas pipework of up to 35 mm (R1.25) in domestic premises (2nd family gas). Specification.
BS EN 1775	Gas supply. Gas pipework for buildings. Maximum operating pressure less than or equal to 5 bar. Functional recommendations.
BS EN 12007	Gas supply systems. Pipelines for maximum operating pressure up to and including 16 bar.
BS EN 12279	Gas supply systems. Gas pressure regulating installations on service lines. Functional requirements.
BS EN 12327	Gas supply systems. Pressure testing, commissioning and decommissioning procedures. Functional requirements.

06

Plumbing and Drainage

Issue 2 — December 2010



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06 Plumbing and Drainage

1 Scope

This Standard sets out requirements for foul water and surface water drainage systems in non-operational premises intended for use as offices by Transport for London (TfL).

This Standard supersedes standard LUL LTF-M010-ST Plumbing and Drainage.

- Requirements for ventilation and air-conditioning are set out in BLU 03 Mechanical Ventilation and BLU 04 Air Conditioning.
- Requirements for Water Services in BLU 07 Water Services.
- Requirements for control and monitoring are set out in BLU 17 Building Management Systems.
- Requirements for metering are set out in BLU 18 Metering.

2 References

This Standard should be read in conjunction with the accompanying Manual to the Standards and TfL standards GRN 01, 02, 03 BLU 01,03,04, 05, 07, 08.

It shall be the responsibility of the designer/installer to reference and comply with all the above and any other Standards where necessary.

Relevant British Standards referred to in the text are listed on the rear cover. Unless otherwise stated, references are to the latest editions and revisions.

3 Definitions and Abbreviations

For a list of general abbreviations and definitions used within the Standards

please see the accompanying Manual to the Standards.

4 Construction Design and Management Regulations (CDM)

Reference should be made to the Manual to the Standards for requirements under the CDM regulations.

5 Performance Standards

5.1 General Standards

The pipework services systems within the premises shall comply with the requirements of the Building Regulations 1985, approved document H: Drainage and Waste Disposal. Also the current relevant British Standards and the recommendations of the Institute of Plumbing – Plumbing Engineers Services

Design Guide, and CIBSE Guide Public health engineering. Where applicable the local authority Building Control Department should be consulted to ensure compliance with any local requirements.

The design shall be carried out in accordance with BS EN 752-4 & BS EN 12056-2.

6 System Requirements

6.1 General Requirements

Where a product or component required for the works appears in any category on the Energy or Water Technology Criteria List then the product or component selected for the installation shall comply fully with the relevant criteria.

With the exception of items designed to be disposable, the design life of the materials and equipment used shall be not less than five years. For materials and equipment whose replacement is not expected between major refurbishments, the design life shall be a minimum of 15 years.

Unusual, non-standard and non-proprietary components, substances and materials shall not be used.

6.2 Soil and Waste Systems

The use of “air admittance” will be accepted only if an anti-siphon or vent pipe terminating to atmosphere cannot be accommodated and subject to a dispensation being granted by the TfL Infrastructure Manager.

Traps (other than integral W.C. traps) shall be the deep seal tubular variety with a 75 mm

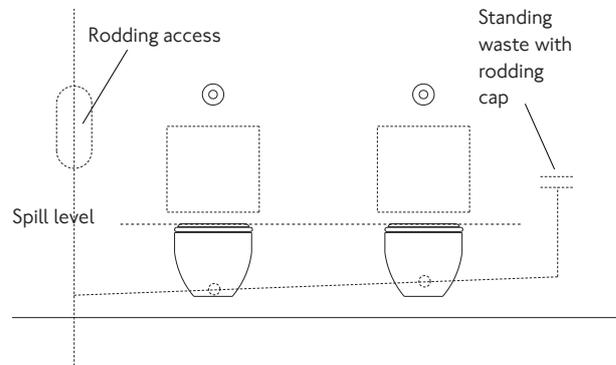


Fig. 1

water seal. Where traps are exposed, chrome plated bottle traps will be considered, but may not be accepted on urinal bowls when the “water less urinal” system is used. Generally a deep seal tubular trap will be required, but the advice of the supplier of the water less system should be sought.

Install pipework fittings and accessories to ensure that:

- Appliances drain quickly, quietly and completely at all times without nuisance or risk to health.
- Discharge is conveyed without cross flow, back fall, leakage or blockage.
- Air from drainage systems does not enter the building.
- Pressure fluctuations in pipework do not vary by more than ± 38 mm water gauge and traps retain a water seal of not less than 25mm.
- The system can be adequately tested, cleaned and maintained.

Access covers and cleaning eyes shall be provided in convenient locations as necessary and in accordance with Local Authority

requirements to permit adequate testing and cleaning of pipework. Cleaning access on soil pipes shall be above the spill level of the connected pans. (See Fig. 1)

Adequate access arrangements shall be made, especially where drainage serves catering facilities. Consideration of the positioning of the access points must include avoiding the disruption to the circulation of occupants within the building, and also avoiding the release of unwelcome odours.

The design of any new system shall ensure that rainwater and foul drainage are kept separate within the building. Consideration shall be given to future rainwater harvesting.

It shall be the designer's responsibility to endeavor that in all situations the drainage is discharged by gravity alone. Pumped waste or sewage systems require dispensation from the TfL Infrastructure Manager.

6.3 Surface Water Systems

The pipework, if replaced or re configured, shall be of the same material as the original, especially if exposed on an external face of the building. The replacement of special profile pipes, gutters and hopper heads should be considered in all cases but in particular the designer's attention is drawn to the existence of various English Heritage preservation orders that are imposed on certain buildings in the TfL Head Office portfolio. It shall be the designer's responsibility to ensure that any new or repair works are in compliance with such preservation orders.

Where new or additional pipework is required to service any revised building layout, it is

preferable that pipework shall be run internally within service risers or ducts rather than on external walls.

Any rainwater outlet or floor gullies shall be fit for the loads expected to be imposed upon them.

When surface water systems are connected to subsurface drains at lower levels within buildings the designers shall consider the possibility of surcharge causing flooding into the building through open outlets, and design the system to preclude this eventuality.

Where a new building is being developed measures shall be included to attenuate rainwater run off from the site as SUDs or the inclusion of Green Roofs.

7 Design / Contractor Submittal Requirements.

Reference should be made to the Manual to the Standards for general requirements for drawing and sample submittal requirements.

All redundant services are to be stripped out during the works. A schedule of redundant services is to be issued to the Infrastructure Manager prior to commencing work.

8 Materials Standards

There shall be a sympathetic consideration of environmental issues when considering materials and their application. The use of uPVC pipes and fittings in plumbing installations within TfL Head Office buildings is not acceptable.

The unnecessary mixing of different materials within an installation will not be accepted.

Where refurbishment entails the replacement or addition of pipework and fittings, the introduction of different materials from the originals shall be avoided unless financial, physical or environmental issues or restrictions give no alternative.

9 Workmanship Standards

Ensure pipe routes are as short as practicable, with as few bends as possible and no bends in the wet portion of soil stacks, unless indicated otherwise on drawings.

Install soil and waste pipes, fittings and accessories in accordance with BS EN 12056-2 and manufacturer's recommendations. Obtain all components for each type of pipework from the same manufacturer, unless otherwise agreed.

Inspect components carefully before fixing and reject any which are defective.

Allow for thermal and building movement when jointing and fixing.

Fix pipes at centres not greater than those specified in BS 8000-13. Provide additional supports as necessary at junctions and changes in direction. Fix every length of soil vent pipe at, or close below, the socket collar.

Install rainwater pipes in accordance with BS 8000-13 and manufacturer's recommendations to ensure complete discharge of rainwater from building without leaking. Obtain all components for each

type of pipework and guttering from same manufacturer, unless otherwise indicated.

Installations of cleaning eyes should be located above the flood level of items served to avoid flooding when access cap is removed.

Before commencing work ensure that below ground drainage is ready to receive rainwater or that the discharge can be dispersed by approved means to prevent damage or disfigurement of the building fabric.

Set out to a true line and even gradient to ensure no ponding or back fall. Position high points of gutters as close as practical to roof and low points not more than 50mm below roof.

Overlap joints in direction of fall and seal as specified to make watertight.

10 Testing & Commissioning

Carry out Hydraulic Pressure Testing as described in HVCA TR/6 Guide to Good Practice for Site Pressure Testing of Pipework.

Any pipework covered up without a pressure test witnessed by the Infrastructure Manager will be entirely at the contractor's risk. Advise the Infrastructure Manager, at least five days in advance of the time that pressure tests may be witnessed.

Carry out commissioning of installations in accordance with the procedures, checks and tolerances given in the BSRIA Application Guides for water systems to achieve the standards set in the CIBSE Commissioning Codes.

All control components shall be set up and commissioned in accordance with the manufacturer's recommendations.

Keep a systematic record of all tests and commissioning procedures. Provide copies to the TfL Infrastructure Manager on request.

11 Handover

Reference should be made to the Manual to the Standards for general requirements for handover and submissions required for the Operation and Maintenance Manual.

Axonometric drawings shall be provided for all gravity drainage systems showing cleaning points.

Procedures for preventative measures against the effects of aerobic bacteria and *Pseudomonas* shall form part of the hand over documentation.

12 Maintenance

The contractor shall provide full maintenance during the defects liability period in accordance with the TfL maintenance model. Any departure from this requirement will require the grant of dispensation from the Infrastructure Manager.

When new equipment is added or alterations are made to existing installations there shall be no detrimental impact on the ease of maintenance of existing facilities, unless through dispensation from the Infrastructure Manager.

The contractor shall create and maintain a maintenance log recording all reported defects, problems and maintenance issues and their resolution. Upon completion of the rectification of defects the log shall be issued to the Infrastructure Manager, prior to the release of any retention monies.

13 Further Information

13.1 Legislation

- Building Regulations Part H Drainage & Waste Disposal.
- ECA Scheme Water Energy Technology Criteria List - www.eca.gov.uk.

13.2 Design Guidance

- CIBSE Guide G Public Health Engineering.
- BSRIA Application Guide 2/2006 Design checks for public health engineering. A quality control framework for public health engineers.
- BS 5572 Superseded Code of Practice for Sanitary Pipework.

Revision History:

Issue	Date	Description
1		Draft Issue - LU Facilities
2	December 2010	Reformatted and revised as TfL Head Office Standards

Relevant British / European Standards

BS EN 752-4	Drain and sewer systems outside buildings Part 4: Hydraulic design and environmental considerations.
BS EN 12056-1	Gravity drainage systems inside buildings. Part 1 General and performance requirements.
BS EN 12056-2	Gravity drainage systems inside buildings. Part 2 Sanitary pipework, layout and calculation.
BS EN 12056-3:	Gravity drainage systems inside buildings. Part 3 Roof drainage, layout and calculation.
BS EN 12056-5:	Gravity drainage systems inside buildings. Part 5 Installation and testing, instructions for operation, maintenance and use.

05

Refrigeration and Cooling

Issue 4 — December 2010



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05 Refrigeration and Cooling

1 Scope

This Standard sets out requirements for cooling systems in non-operational premises intended for use as offices by Transport for London (TfL).

This Standard supersedes standard LUF-M003-S Refrigeration and Cooling.

- Requirements for central heating plant and distribution are set out in BLU 01 Central Heating Plant.
- Requirements for space heating are set out in BLU 02 Space Heating.
- Requirements for ventilation and air-conditioning are set out in BLU 03 Mechanical Ventilation and BLU 04 Air Conditioning.
- Requirements for control and monitoring are set out in BLU 17 Building Management Systems.
- Requirements for metering are set out in BLU 18 Metering.

All works shall comply with the requirements of non-domestic heating, cooling and ventilation compliance guide.

2 References

This Standard should be read in conjunction with the accompanying Manual to the Standards and TfL standards GRN 01, 02, 03, BLU 01,02,03,04.

It shall be the responsibility of the designer / installer to reference and comply with all the above and any other Standards where necessary.

Relevant British Standards referred to in the text are listed on the rear cover. Unless otherwise stated, references are to the latest editions and revisions.

3 Definitions / Abbreviations

For a list of general abbreviations and definitions used within the Standards please see the accompanying Manual to the Standards.

4 Construction Design and Management Regulations (CDM)

Reference should be made to the Manual to the Standards for requirements under the CDM regulations.

5 Performance Standards

5.1 General Standards

New systems shall be designed in accordance with current CIBSE Guides, Guidance Notes and other publications and shall comply with the requirements of The Building Regulations.

The cooling system shall be designed to minimise energy consumption, operate efficiently, and provide adequate heating throughout the occupied hours.

The designer shall make due allowance for the space heating contribution from free cooling due to thermal mass and fresh air ventilation. The occupancy heat gains shall be derived from GRN 02 Design Criteria.

The designer shall calculate the cooling loads taking into account the design criteria in GRN 02 and the actual consumption / heat gain from I.T and small power. Cooling loads in excess of 50W/m^2 will require mitigation in the design of the building fabric, solar shading, lighting etc. and must be referred to the Infrastructure Manager for dispensation.

The designer must assess and make provisions to ameliorate any adverse effects on the building fabric, e.g. condensation close to chilled supply outlets.

The designer must assess any existing systems within the building when calculating the

proposed cooling loads. Any imbalance in the capacities of the central plant and distribution systems shall be determined and corrected so as to meet the requirements efficiently and economically.

Pipework systems shall be designed to be hydraulically self balancing as far as possible without the use of regulating valves. On groups of identical modular devices such as chillers or perimeter fan coil units, reverse or parallel returns shall be used to equalise flow path lengths.

5.2 Temperature Requirements

Cooling systems shall be designed to maintain internal temperatures, with outside air temperatures and insulation values for building fabric as set out in GRN 02 Design Criteria.

6 Equipment Standards

6.1 General Requirements

Where a product or component required for the works appears in any category on the Energy Technology Criteria List then the product or component selected for the installation shall comply fully with the relevant criteria.

With the exception of items designed to be disposable, the design life of the materials and equipment used shall be not less than five years. For materials and equipment whose replacement is not expected between major refurbishments, the design life shall be a minimum of 15 years.

Unusual, non-standard and non-proprietary components, substances and materials shall not be used.

The refrigeration and cooling system within the premises shall comply with current CIBSE Guides, Guidance Notes and other publications and with the requirements of The Building Regulations.

Any installations of, or modifications to, cooling towers and other evaporative condensers shall be carried out in accordance with The Notification of Cooling Towers and Evaporative Condensers Regulations 1992 and a copy of the appropriate documentation passed to the Infrastructure Manager.

New cooling installations over 50kW capacity shall be selected for the most appropriate form of refrigeration / heat rejection, which may include absorption chillers, cooling towers or adiabatic coolers, ground source or open loop groundwater systems.

Chillers rated 300kW and over are to use oil-free magnetic bearing compressors with a pumped low ambient bypass system.

Chilled Water distribution shall utilise 2 port control valves on terminal devices and cooling coils with variable speed control on the pumps.

7 Design / Contractor Submittal Requirements

Reference should be made to the Manual to the Standards for general requirements for drawing and sample submittal requirements.

All redundant services are to be stripped out during the works. A schedule of redundant services is to be issued to the Infrastructure Manager prior to commencing work.

8 Materials Standards

Refrigerant pipework in new installations shall be copper throughout to BS EN 1057 / BS EN 12449, utilising capillary solder joints to BS EN ISO 9453.

Chilled water pipework in new installations shall be steel throughout, screwed up to and including 40mm, welded at 50mm and above. Copper pipework may only be used to match existing installations.

Welded plastic pipework may be used subject to grant of dispensation by the Infrastructure Manager.

Provide insulation of thickness conforming to values derived from the requirements of the Building Regulations (England and Wales) Part L Approved Documents, and the calculation methods given in BS EN ISO 12241.

8.1 Refrigerants

Refrigerants, and the selection of them, shall match the most effective coefficient of performance of the chiller equipment to the application for the best economic return whilst taking energy and environmental factors into consideration.

CFC and HCFC refrigerants are prohibited and must not be used.

Only refrigerants with low or nil Ozone Depletion Potential (ODP) and those with low or nil Global Warming Potential (GWP) will be acceptable.

All installed systems shall be furnished with refrigerant leak detection systems such that

when a leak is detected a suitable responsible person is warned of the alarm.

9 Workmanship Standards

All companies who propose to install, maintain or service refrigeration, air conditioning and / or heat pump equipment shall be registered with REFCOM.

Arrange all exposed pipe work to run in a neat and presentable appearance, parallel with other pipe or service runs and building structure, subject to gradients for draining or venting. Ensure all vertical pipes are plumb or follow building line.

Provide valves, cocks and stop taps for isolation and regulation:

- On mains to isolate major sections of distribution;
- At the base of all risers and drops, except in cases where one item of apparatus only is served which has its own local valve or stop tap;
- At points of pipe connection of all items of apparatus and equipment, except where the item could conveniently be isolated or regulated by valves provided for other adjacent items.

Install pipework with gradients to allow drainage and air release. Provide a means of venting the pipe system at all high points. Grade pipework to allow system to be drained. Provide a means of draining the system at all low points.

Enclose pipes passing through building elements, (walls, floors, partitions, etc.) concentrically within purpose made sleeves.

10 Testing & Commissioning

Carry out Hydraulic Pressure Testing as described in HVCA TR/6 Guide to Good Practice for Site Pressure Testing of Pipework.

Any pipework covered up without a pressure test witnessed by the Infrastructure Manager will be entirely at the contractor's risk. Advise the Infrastructure Manager at least five days in advance of the time that pressure tests may be witnessed.

Carry out commissioning of installations in accordance with the procedures, checks and tolerances given in the BSRIA Application Guides for water systems to achieve the standards set in the CIBSE Commissioning Codes.

All control components shall be set up and commissioned in accordance with the manufacturer's recommendations.

Follow the procedures given for use and handling of refrigerants, pressure and leak testing, evacuation and dehydration, charging and lubrication of refrigerating systems in CIBSE Commissioning Code R and manufacturer's instructions.

Carry out the procedures for pre-commissioning detailed in CIBSE Commissioning Code R, Section R5.

Carry out the procedures for combined pressure and leak testing, including refrigerant charging, detailed in CIBSE Commissioning Code R, Section R6.

Carry out the procedures for setting to work and adjusting detailed in CIBSE Commissioning Code R7.

Use apparatus and instruments detailed in CIBSE Commissioning Code R, Section R8. Apply tolerances defined in Section R8.6

A simulated heat load to ensure effective operation of the refrigerating system during commissioning may be requested. In such instances it is the designer's responsibility to specify and detail:

- The extent of the simulated load to be provided. This may comprise sensible and latent heat load in some cases.
- The type of equipment to be used in simulating the heat load.
- The locations in the accommodation where the heat load should be applied to the system. This could also facilitate testing of associated air conditioning systems.

Keep a systematic record of all tests and commissioning procedures. Provide copies to the TfL Infrastructure Manager on request.

11 Handover

Reference should be made to the Manual to the Standards for general requirements for handover and submissions required for the Operation and Maintenance Manual.

Axonometric or full 3D drawings shall be provided for all plant rooms clearly identifying the equipment and interconnecting services.

Procedures for preventative measures against the effects of aerobic bacteria, Pseudomonas, shall form part of the hand over documentation.

A timetable for inspection of all equipment shall be provided in accordance with Article 9 of the Energy Performance of Buildings Directive (EPBD).

12 Maintenance

The contractor shall provide full maintenance during the defects liability period in accordance with the TfL maintenance model. Any departure from this requirement will require the grant of dispensation from the Infrastructure Manager.

When new equipment is added or alterations are made to existing installations there shall be no detrimental impact on the ease of maintenance of existing facilities unless through dispensation from the Infrastructure Manager.

The contractor shall create and maintain a maintenance log recording all reported defects, problems and maintenance issues and their resolution. Upon completion of the rectification of defects the log shall be issued to the Infrastructure Manager, prior to the release of any retention monies.

13 Further Information

13.1 Legislation

- Building Regulations Part L2 Conservation of Fuel & Power

- Energy Technology Criteria List - www.eca.gov.uk.
- Non-Domestic Heating, Cooling and Ventilation Compliance Guide - Dept. for Communities and Local Government. (Tier 2 document to Part L2,)

13.2 Design Guidance

- CIBSE Commissioning Code R Refrigeration Systems
- CIBSE Guide B2 Ventilation & Air Conditioning
- CIBSE Guide F Energy Efficiency in Buildings
- BSRIA Application Guide 16/2002 Variable flow water systems: design, installation and commissioning guidance
- HVCA RAC80 Design specification for DX packaged air conditioning equipment in buildings
- BSRIA Building Applications Guide BG 7/2009 Heat Pumps: a guidance document for designers
- BSRIA Technical Note TN 10/97 VRF based air conditioning systems - performance, installation and operation notes.

Revision History:

Issue	Date	Description
1		Preliminary Issue
2	20th November 1999	Minor Revisions
3	18th September 2000	Reformatted - LU Facilities.
4	December 2010	Reformatted and revised as TfL Head Office Standards

Relevant British / European Standards

BS 1710	Specification for identification of pipelines and services.
BS 8207	Code of practice for energy efficiency in buildings
BS EN 378-1	Refrigerating systems and heat pumps. Safety and environmental requirements. Part 1 Basic requirements, definitions, classification and selection criteria.
BS EN 378-2	Refrigerating systems and heat pumps. Safety and environmental requirements. Part 2 Design, construction, testing, marking and documentation.
BS EN 378-3	Refrigerating systems and heat pumps. Safety and environmental requirements. Part 3 Installation site and personal protection.
BS EN 378-4	Refrigerating systems and heat pumps. Safety and environmental requirements. Part 4 Operation, maintenance, repair and recovery.
BS EN 12693	Refrigerating systems and heat pumps. Safety and environmental requirements. Positive displacement refrigerant compressors.

15

Security and Access

Issue 1 — December 2010



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15 Security and Access

1 Scope

This Standard sets out requirements for security and access installations in non-operational premises intended for use as offices by Transport for London (TfL)

- Requirements for control and monitoring are set out in BLU 17 Building Management Systems.
- Requirements for metering are set out in BLU 18 Metering.

2 References

This standard should be read in conjunction with the accompanying Manual to the Standards and TfL standards GRN 01, 02, 03, BLU 12

It shall be the responsibility of the designer/installer to reference and comply with all the above and any other TfL Standards where necessary.

Relevant British Standards referred to in the text are listed on the rear cover. Unless otherwise stated, references are to the latest editions and revisions.

3 Definitions / Abbreviations

For a list of general abbreviations and definitions used within the standards please see the accompanying Manual to the Standards.

4 Construction Design and Management Regulations (CDM)

Reference should be made to the Manual to the Standards for requirements under the CDM regulations.

5 Performance Standards

5.1 General Requirements

Where new 230v supplies are required the designer shall refer to BLU 12 Small Power Installations for design, installation and testing requirements.

Installations shall be designed, installed and tested in accordance with current British Standards and other publications and shall comply with the requirements of The Building Regulations Part P, Part M and Part L.

The designer shall consider and make allowance for Electromagnetic Compatibility in selection of equipment and implement mitigation measures to control electromagnetic interference.

5.2 Security

5.2.1 General

Security systems shall include both intruder detection systems and closed circuit television (CCTV) systems.

The designer shall agree the requirement, level and grade of provision with the Infrastructure Manager and the designated security adviser for the project. This agreement shall include

automatic remote alarm monitoring via a designated manned call centre.

5.2.2 Intruder Alarm.

The intruder alarm and detection system shall be designed, installed, commissioned and certified to BS EN 50131-1, CLC/TS 501131-7 and ACPO 2004. The installation shall be carried out by a NSI/NACOSS Gold approved security specialist. The system shall be selected and designed to minimise false alarms and nuisance.

Intruder detection shall be provided to all high risk rooms, perimeter rooms which can be accessed from external ground level and rooms which can be accessed from roof level, where the roof is accessible. Accessible perimeter rooms shall be protected using the “double knock” principle with detection to perimeter windows and doors, and movement detection within the room. Communication spaces including stairs shall be protected.

Movement detection shall be provided using anti-masking, dual technology, ultrasonic PIR detectors to reject false alarms sources.

Consideration shall be given to selection of devices particularly where entry is not possible through windows and where vibration may be an issue due to proximity of traffic or machinery break glass detection may be considered.

Keypads to set and disable the system shall be provided at the nominated access points.

New systems shall be PC based and site programmable and utilise “open protocol”.

The system shall be capable of networking, unsupervised operation and island operation. Graphics and monitors shall be provided for larger systems for control and status, with remote access via WAN / Internet.

5.2.3 Closed Circuit Television System

The closed circuit television system shall be designed to NACOSS code of practice NACP20, BS 8418 for detector activated CCTV systems and BS EN 50132.

CCTV shall be provided to monitor the approach ways, external building perimeter, building entrances, enclosed yards and remote outbuildings.

Cameras shall be high resolution colour, day/night, capable of operating under low ambient light levels of 0.3 lux colour and 0.1 lux monochrome, supplementary infra red lighting to be considered where ambient levels fall below these values.

Cameras shall be complete with motorised positioning devices and telemetry for remote control. External units shall be mounted within vandal proof housings with wiper motors.

The cameras shall be supplied complete with varifocal auto iris lens, suitable for the design application.

In premises with existing CCTV systems, the existing systems shall be adapted to incorporate the additional CCTV components. In premises without existing systems, or where existing systems cannot be extended the provision of new centralised main equipment such as recording and storage devices, viewing

monitors and remote camera controls, shall be agreed with the Infrastructure Manager and nominated security adviser.

Remote monitoring and control of CCTV shall be agreed with the Infrastructure Manager and security adviser.

The quality of stored and retrieved information shall be adequate to obtain a conviction in a court of law. The imagery storage capacity shall be a minimum of 31 days.

5.3 Access Control

The designer shall agree the requirement and level of provision with the Infrastructure Manager and the designated security adviser for the project.

Access control shall be provided to building entrances and access from public areas to staff areas. All rooms designated as sensitive such as containing personal or classified information, together with high risk rooms such as those containing items of high financial or commercial value shall be protected.

In premises with existing access control systems, the existing systems shall be adapted to incorporate the additional components. In premises without existing systems, or where existing systems cannot be extended, the provision of new system shall be agreed with the Infrastructure Manager and nominated security adviser.

Doors shall be controlled by local controllers with integral power supply units and battery backup. The type of electromagnetic lock shall

suit the application and be agreed with the architect and security adviser.

The method of staff entry shall be by ID passes or key fobs to match existing arrangements, or as agreed where new systems are provided. Public access shall be via intercom stations with remote release from a designated control position.

New systems shall be PC based and site programmable and utilise "open protocol". The system shall be capable of networking, unsupervised operation, island operation and interfacing with the fire alarm system. Graphics and monitors shall be provided for larger systems for control and status, with remote access via WAN / Internet.

Door release push buttons shall be provided to the secure side of staff areas. The designer shall consider and incorporate mitigations measures to allow emergency escape from secure areas in the event of fire, electrical and system failure.

The access control system shall be designed, installed, commissioned and certified to NACP30 Code of Practice for Planning, Installation and Maintenance of Access Control systems and BS EN 50133.

6 Equipment Standards

6.1 General Requirements

The designer shall make due allowance for space capacity for future expansion within any new installation. At all points in new systems 25% spare capacity shall be allowed for expansion. Where an existing system is

being extended the designer does not need to allow for further spare capacity unless the works would result in the spare capacity falling below 5%. If the proposed works would result in the system spare capacity falling below 5% then the designer will advise the Infrastructure Manager and provide the cost to re- instate the system to 25% spare capacity. The Infrastructure Manager will then confirm the requirement for the project.

Where a product or component required for the works appears in any category on the Energy Technology Criteria List then the product or component selected for the installation shall comply fully with the relevant criteria.

With the exception of items designed to be disposable, the design life of the materials and equipment used shall be not less than five years. For materials and equipment whose replacement is not expected between major refurbishments, the design life shall be a minimum of 15 years.

Unusual, non-standard and non-proprietary components, substances and materials shall not be used.

6.2 Intruder Alarms

The intruder alarm system shall conform to BS EN 50131 series, BS EN 50136-1-1, Guidelines CLC/TS 50131-7:2006.

6.3 Closed Circuit Television Systems

The closed circuit television system shall conform to BS EN 50132 series, BSA 8418:2003, NACOSS Code of practice NACP 20.

6.4 Access Control

The access control system shall conform to BS EN 50133 Series, NACOSS Code of Practice NACP30.

7 Design / Contractor Submittal Requirements.

Reference should be made to the Manual to the Standards for general requirements for drawing and sample submittal requirements.

All redundant services are to be stripped out during the works. A schedule of redundant services is to be issued to the Infrastructure Manager prior to commencing work.

8 Materials Standards

8.1 Final Circuit Wiring

Where new 230v supplies are required the designer shall refer to BLU 12 Small Power Installations for design, installation and testing requirements.

8.2 Systems Wiring

All systems wiring shall be provided and installed to the relevant system supplier's recommendations.

The minimum cable size shall be 0.75mm²; all cable sheaths shall be LSOH.

All cabling shall be installed in galvanised containment systems, including drops to wall outlets; it is not acceptable to install cabling without containment.

Cabling shall be run in separate containment systems where required in order mitigate the

effects of electromagnetic emissions EMI.
All cables shall be BASEC approved.

8.3 Conduit

The designer shall refer to BLU 12 Small Power Installations for design and installation requirements for galvanised conduit.

8.4 Cable Trunking

The designer shall refer to BLU 12 Small Power Installations for design and installation requirements for galvanised trunking.

9 Workmanship Standards

9.1 General Requirements

All equipment shall be installed in accordance with the manufacturer's requirements, relevant standards and code of practice.

Electrical Installation works are to be undertaken in accordance with the IEE Guidance Notes to the Wiring Regulations.

9.2 User Controls and Accessories

Controls and outlets shall be located in accordance with Building Regulations Approved Document M and BS 8300.

User controls requiring precise hand movements shall be located between 750mm and 1200mm above finished floor level.

Simple push button controls requiring limited dexterity such as door egress buttons shall be located no more than 1200mm above finished floor level.

Desk and control console mounted equipment shall be located to allow ease of vision and control by a person sat in a chair.

Ensure there is no damage to controls and accessories during installation.

Protect surface mounted accessories from painting. Install front plates of flush mounted accessories after painting.

Align accessories to building finishes. Mount grouped accessories in line, parallel and equidistant.

9.3 Conduit & Trunking

Use maximum practical lengths to minimise number of joints and remove burrs from cut ends.

Use bends and/or junction boxes at changes of direction in conduit. Form conduit bends by machine. Do not use elbows or tees of any sort.

Use couplers and externally screwed brass bushes to connect conduit to loop-in circular conduit boxes.

Tightly screw all joints to ensure electrical continuity.

Use expansion couplings where containment crosses movement joints in structure. All systems shall be installed to allow future rewiring without disturbance of the building.

9.4 Wiring

No joints in cables will be permitted. Install cables without joints other than at equipment and terminal fittings.

Use cable circuit protective conductors throughout. The use of use conduit or trunking as protective conductors is not permitted.

All power outlets and connections to equipment shall be wired as ring or radial circuits. Spurs off ring circuits will not be permitted.

Support cables in vertical trunkings with pin racks or cleats at each floor level or at 5m vertical centres, whichever is less.

9.5 Earthing

Install CPCs in the same containment as the circuit being protected.

Provide CPC between earth lug on metal back box and accessories.

9.6 Fire Stopping

Where trunking passes through fire resisting floors, ceilings, cavity barriers, etc., seal internally with packed rock fibre.

10 Testing & Commissioning

Testing, commissioning and certification of all LV works and installations shall be conducted in accordance with BS 7671 and Building Regulations part P, the designer shall refer to BLU 12 Small Power Installations.

Testing and commissioning of intruder alarm systems shall be carried out by the specialist installer to BS EN 50131-1 and CLC/TS 50131-7. All remote links shall be fully tested after making prior arrangements with the remote monitoring centre.

Testing and commissioning of CCTV systems shall be carried out by the specialist installer to BS EN 50132-7 and NCP 104. All remote links shall be fully tested after making prior

arrangements with the remote monitoring centre.

Testing and commissioning of access control systems shall be carried out by the specialist installer to BS EN 50133 -1 and NACP30.

11 Handover

Reference should be made to the Manual to the Standards for general requirements for handover and submissions required for the Operation and Maintenance Manual .

Where new LV circuits are provided or existing circuits modified, a new circuit chart shall be provided for each distribution board. The circuit chart is to be framed and mounted adjacent to each distribution board.

12 Maintenance

When new equipment is added or alterations are made to existing installations there shall be no detrimental impact on the ease of maintenance of existing facilities unless through dispensation from the Infrastructure Manager.

The contractor shall provide full maintenance during the defects liability period in accordance with the TfL maintenance model. Any departure from this requirement will require the grant of dispensation from the Infrastructure Manager.

The contractor shall create and maintain a maintenance log recording all reported defects, problems and maintenance issues and their resolution. Upon completion of the

rectification of defects the log shall be issued to the Infrastructure Manager, prior to the release of any retention monies.

13 Further Information

- Energy Technology Criteria List - www.eca.gov.uk.

Revision History:

Issue	Date	Description
1	December 2010	New standard created for TfL Head Office Standards

Relevant British / European Standards

BS EN 50131-1:2006 Alarm systems- Intrusion and hold-up systems. System requirements

BS EN 50132-7:1996 CCTV Surveillance systems for use in security applications.

BS EN 50133-1:1999 Access control systems for use in security applications.

NCP 104 Code of practice for the design, installation and maintenance of CCTV systems.

12

Small Power Installations

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12 Small Power Installations

1 Scope

This Standard sets out requirements for small power installations in non-operational premises intended for use as offices by Transport for London (TfL).

This Standard part supersedes standard LUF-M005-ST Electrical Systems.

- Requirements for electrical distribution are set out in BLU 11 Electrical Distribution.
- Requirements for lighting installations are set out in BLU 13 Lighting Installations.
- Requirements for control and monitoring are set out in BLU 17 Building Management Systems.
- Requirements for metering are set out in BLU 18 Metering.

2 References

This standard should be read in conjunction with the accompanying Manual to the Standards and TfL Standards GRN 01, 02, 03, BLU 02, 11, 13.

It shall be the responsibility of the designer/installer to reference and comply with all the above and any other Standards where necessary.

Relevant British Standards referred to in the text are listed on the rear cover. Unless otherwise stated, references are to the latest editions and revisions.

3 Definitions / Abbreviations

For a list of general abbreviations and definitions used within the Standards

please see the accompanying Manual to the Standards.

4 Construction Design and Management Regulations (CDM)

Reference should be made to the Manual to the Standards for requirements under the CDM regulations.

5 Performance Standards

Electrical installations shall be designed, installed and tested in accordance with current Requirements for Electrical Installations (IEE Wiring Regulations), The Electricity at Work Regulations, Health and Safety at Work Act, CIBSE Guides, Guidance Notes and other publications and shall comply with the

requirements of The Building Regulations Part P.

In office premises a minimum small power provision of 2 No double switched socket outlets per 2.5m of perimeter wall is required. In open plan spaces the provision should be 2 No double switched sockets for every 6.5m² of working area.

In cellular offices the preferred form of small power provision is perimeter trunking distribution with the trunking integrated with perimeter heating – see BLU 02 Space Heating. In open plan offices the preferred form of provision is by underfloor busbar and floor boxes.

Dedicated single socket outlets shall be provided for cleaning purposes at 10m intervals throughout the building.

All final circuits are to be derived from a distribution board on the floor being served.

The designer shall undertake all calculations in accordance with BS EN 7671. Cables shall be sized for the required duty in accordance with BS 7671. The minimum cable sizes shall not be less than 1.5mm² for lighting and 2.5mm² for small power.

All circuits shall be provided with a separate Circuit Protective Conductor (CPC). Metallic containment and the wire armour of cables may not be used in lieu of a CPC.

The designer shall carry out a design load assessment and ensure the revised load capacity does not exceed the existing capacity

of the distribution system including the agreed supply capacity.

The designer shall make due allowance for space capacity for future expansion within any new installation. At all points in new systems 25% spare capacity shall be allowed for expansion. Where an existing system is being extended the designer does not need to allow for further spare capacity unless the works would result in the spare capacity falling below 5%. If the proposed works would result in the system spare capacity falling below 5% then the designer will advise the Infrastructure Manager and provide the cost to re-instate the system to 25% spare capacity. The Infrastructure Manager will then confirm the requirement for the project.

The designer shall consider and make allowance for Electromagnetic Compatibility in selection of equipment and implement mitigation measures to control electromagnetic interference.

6 Equipment Standards

6.1 General Requirements

Where a product or component required for the works appears in any category on the Energy Technology Criteria List then the product or component selected for the installation shall comply fully with the relevant criteria.

With the exception of items designed to be disposable, the design life of the materials and equipment used shall be not less than five years. For materials and equipment whose replacement is not expected between major

refurbishments, the design life shall be a minimum of 15 years.

Unusual, non-standard and non-proprietary components, substances and materials shall not be used.

6.2 Final Circuit Protective Devices

Protective devices shall be either Miniature Circuit Breaker (MCB) or Residual Current Circuit Breakers with over Current Protection (RCBOs) as required by the regulations.

All circuits serving sockets outlets shall be protected by RCBOs.

6.3 Busbar Trunking

Underfloor busbar trunking systems shall conform with the requirements of BS 5486. Underfloor busbar systems shall be rated at 32 Amp with a 10mm cross section CPC.

6.4 Floor Boxes

Floor boxes shall be proprietary units fabricated in metal, with sufficient depth to accommodate a standard 13A plug with the box lid closed and flush with the floor surface.

Floor boxes shall be sized sufficient to accommodate up to 4No standard double accessory plates and shall be segregated internally so as to accommodate both power and data connections.

6.5 Electrical Accessories

Electrical Accessories shall be mounted on brushed aluminium or stainless steel metal face plates. Accessories shall be installed flush on metallic back boxes.

Where surface mounted, accessory back boxes shall be metal, finished to match the accessories, and drilled for conduit connection without “knockouts”.

All the accessories in any building are to be obtained from a single manufacturer’s range.

7 Design / Contractor Submittal Requirements.

Reference should be made to the Manual to the Standards for general requirements for drawing and sample submittal requirements.

All redundant services are to be stripped out during the works. A schedule of redundant services is to be issued to the Infrastructure Manager prior to commencing work.

8 Materials Standards

8.1 Final Circuit Wiring

All final circuit wiring shall be Low Smoke Zero Halogen (LSOH) single insulated, unsheathed stranded copper cables installed in a re-wirable metallic conduit / trunking containment system.

Cables rated for fire safety shall be Mineral Insulated Cable (MICC) to comply with BS 6387 and BS EN 60702.

Soft sheath fire resisting cables shall not be used

Where it is not possible or appropriate to install a containment system, subject to the approval of the Infrastructure Manager, the

installation may be made with Steel Wire Armour cables on galvanized cable tray. Refer to BLU 11 Electrical Distribution for specification.

All cables shall be BASEC approved.

8.2 Conduit

All conduit shall be hot dipped galvanised steel manufactured by a member of BESA to BS EN 61386.

Use couplers and externally screwed brass bushes to connect conduit to loop into circular conduit boxes.

Tightly screw all joints to ensure electrical continuity, with no thread showing. Use expansion couplings where conduit crosses movement joints in structure.

8.3 Cable Trunking

All cable trunking shall be hot dipped galvanised mild steel with internal return edge flange. The lid shall be fastened by turnbuckles to the internal return flange. The system shall be rigidly fixed and supplied complete with purpose made fittings, connectors and fixing brackets.

All tees, intersections and sets shall be propriety items supplied by the manufacturer of the trays.

9 Workmanship Standards

9.1 General Requirements

All equipment shall be installed in accordance with the manufacturer's requirements, relevant standards and code of practice. Electrical installation works are to be

undertaken in accordance with the IEE Guidance Notes and the on site guide to the Wiring Regulations.

Circuits for safety services as designated by building control shall be routed outside of fire risk areas, where this is not possible cables shall be suitably fire rated.

9.2 Electrical Accessories

Provide socket outlets and switches for lighting and other equipment at appropriate heights between 450mm and 1200mm from finished floor level, in accordance with Building Regulations Approved Document M and BS 8300.

Ensure there is no damage to accessories during installation.

Protect surface mounted accessories from painting. Install front plates of flush mounted accessories after painting.

Align accessories to building finishes. Mount grouped accessories in line, parallel and equidistant.

9.3 Conduit & Trunking

Use maximum practical lengths to minimise number of joints and remove burrs from cut ends.

Use bends and/or junction boxes at changes of direction in conduit. Form conduit bends by machine. Do not use elbows or tees of any sort.

Use couplers and externally screwed brass bushes to connect conduit to loop-in circular conduit boxes.

Tightly screw all joints to ensure electrical continuity.

Use expansion couplings where containment crosses movement joints in structure.

9.4 Wiring

No joints in cables will be permitted. Install cables without joints other than at equipment and terminal fittings.

Use cable circuit protective conductors throughout. The use of use conduit or trunking as protective conductors is not permitted.

All power outlets and connections to equipment shall be wired as ring or radial circuits. Spurs off ring circuits will not be permitted.

Support cables in vertical trunkings with pin racks or cleats at each floor level or at 5m vertical centres, whichever is less.

9.5 Earthing

Install CPCs in the same containment as the circuit being protected.

Provide CPC between earth lug on metal back box and accessories.

9.6 Fire Stopping

Where trunking passes through fire resisting floors, ceilings, cavity barriers, etc., seal internally with packed rock fibre.

10 Testing & Commissioning

Testing, commissioning and certification of all works and installations shall be conducted in accordance with BS 7671.

Inspection and progressively full testing shall be carried out during erection and/or at completion, before the installation is put into service. Testing and inspection shall be carried out to verify, so far as is reasonable practicable, that the requirements of BS 7671 have been met.

Test certificates shall be completed and submitted and the Project Engineer afforded the opportunity to witness such tests.

To avoid possible damage to equipment, insulation resistance testing shall be carried out before fittings or equipment are connected, but with circuits complete connected to porcelain connector blocks or similar approved connections at fittings position.

Continuity testing shall be carried out as prescribed in the BS 7671 before supplies are connected. Once supplies are connected, polarity, earth fault loop impedance and RCD operation shall be completed and recorded.

All control components shall be set up and commissioned in accordance with the manufacturer's recommendations.

Full completion and inspection certificates shall be prepared and issued as prescribed in Appendix 6 of BS 7671. Provide copies to the TfL Infrastructure Manager on request.

11 Handover

Reference should be made to the Manual to the Standards for general requirements for handover and submissions required for the Operation and Maintenance Manual.

A complete circuit chart is to be framed and mounted adjacent to each distribution board.

12 Maintenance

The contractor shall provide full maintenance during the defects liability period in accordance with the TfL maintenance model. Any departure from this requirement will require the grant of dispensation from the Infrastructure Manager.

When new equipment is added or alterations are made to existing installations there shall be no detrimental impact on the ease of maintenance of existing facilities, unless through dispensation from the Infrastructure Manager.

The contractor shall create and maintain a maintenance log recording all reported defects, problems and maintenance issues and their resolution. Upon completion of the rectification of defects the log shall be issued to the Infrastructure Manager, prior to the release of any retention monies.

13 Further Information

13.1 Legislation

- Building Regulations Part P Electrical Safety
- BS 7671 Requirements for electrical installations.
- Energy Technology Criteria List - www.eca.gov.uk.

13.2 Design Guidance

- CIBSE Guide F Energy Efficiency in Buildings
- CIBSE Guide K Electricity in Buildings

- IEE on Site Guide (BS7671 Wiring Regulations 17th Edition)
- BSRIA Building Applications Guide BG 3/2006 Design checks for electrical services. A quality control framework for electrical engineers

Revision History:

Issue	Date	Description
1	December 2010	This Standard part supersedes standard LUF-M005-ST Electrical Systems.

Relevant British / European Standards

BS 6387	Specification for the performance requirements for cables required to maintain circuit integrity under fire conditions.
BS 7211	Electric cables. Thermosetting insulated, non armoured cables for voltages up to and including 450/750V, for electric power, lighting and internal wiring and having low emission of smoke and corrosive gases when affected by fire.
BS 7430	Code of practice for earthing.
BS 7671	Requirements for electrical installations.
BS 8207	Code of practice for energy efficiency in buildings
BS 8300	Design of buildings and their approaches to meet the needs of disabled people
BS EN 50085	Cable trunking and cable ducting systems for electrical installations.
BS EN 60439	Low voltage switchgear and control gear assemblies.
BS EN 60947-2	Low voltage switchgear and control gear assemblies - Part 2 circuit breakers.
BS EN 60702-1	Mineral insulated cables and their terminations.
BS EN 61386	Conduit systems for cable management.

02

Space Heating

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02 Space Heating

1 Scope

This Standard sets out requirements for heating systems in non-operational premises intended for use as offices by Transport for London (TfL)

This Standard supersedes standard LUF-M001-ST Heating Systems.

- Requirements for central heating plant and distribution are set out in BLU 01 Central Heating Plant.
- Requirements for ventilation and air-conditioning are set out in BLU 03 Mechanical Ventilation and BLU 04 Air Conditioning.
- Requirements for refrigeration and air cooling are set out in BLU 05 Refrigeration and Cooling.
- Requirements for control and monitoring are set out in BLU 17 Building Management Systems.
- Requirements for metering are set out in BLU 18 Metering.

All works shall comply with the requirements of non-domestic heating, cooling and ventilation compliance guide.

2 References

This Standard should be read in conjunction with the accompanying Manual to the Standards and TfL standards GRN 01, 02, 03, BLU 01,03,04,05,08.

It shall be the responsibility of the designer/installer to reference and comply with all the above and any other Standards where necessary.

Relevant British Standards referred to in the text are listed on the rear cover. Unless otherwise stated, references are to the latest editions and revisions.

3 Definitions /Abbreviations

For a list of general abbreviations and definitions used within the Standards please see the accompanying Manual to the Standards.

4 Construction Design and Management Regulations (CDM)

Reference should be made to the Manual to the Standards for requirements under the CDM regulations.

5 Performance Standards

5.1 General Standards

New heating systems shall be designed in accordance with current CIBSE Guides, Guidance Notes and other publications and shall comply with the requirements of The Building Regulations.

The heating system shall be designed to minimise energy consumption, operate efficiently, and provide adequate heating throughout the occupied hours.

The designer shall undertake heating calculations in accordance with BS EN 12831.

Water-based heating systems shall be designed and installed to BS EN 12828. The designer shall make due allowance for the space heating contribution from environmental and casual heat gains. The occupancy heat gains shall be derived from GRN 02 Design Criteria.

The designer shall make due allowance for the affects of solar radiation, radiant asymmetry and cold down draughts from windows and large areas of glazing.

The designer must assess and make provisions to ameliorate any adverse effects on the building fabric, e.g. condensation at cold spots.

Heating systems shall incorporate appropriate mechanisms to enable localised control to be exercised within all parts of the building, this shall consist of set point adjustment only of +/- 2°C which shall be labelled as warmer / cooler.

Zones connected to district heating systems shall also be provided with a time clock to allow the system to shut down out of hours.

The designer must assess any existing heating system within the building when calculating the proposed heating and cooling loads. Any imbalance in the capacities of the central plant and distribution systems shall be determined and corrected so as to meet the requirements efficiently and economically.

Full heat load calculations shall be undertaken to justify any alteration to existing systems. Simple like for like replacement is not permitted unless demonstrated by calculation and approved by the Infrastructure Manager.

Pipework systems shall be designed to be hydraulically self balancing as far as possible without the use of regulating valves. On groups of identical modular devices, such as chillers or perimeter fan coil units, reverse or parallel returns shall be used to equalise flow path lengths.

5.2 Temperature Requirements

Heating systems shall be designed to maintain internal temperatures with outside air temperatures and insulation values for building fabric as set out in GRN 02 Design Criteria.

Room temperatures shall be maintained as specified in GRN 02 Design Criteria, throughout normal working hours with variations generally not exceeding +/- 1.5°C.

The temperature variation between floor level and a plane 1.8m above floor level shall not exceed 2°C.

6 Equipment Standards

6.1 General Requirements

Where a product or component required for the works appears in any category on the Energy Technology Criteria List then the product or component selected for the installation shall comply fully with the relevant criteria.

With the exception of items designed to be disposable, the design life of the materials and equipment used shall be not less than five years. For materials and equipment whose replacement is not expected between major refurbishments, the design life shall be a minimum of 15 years.

Unusual, non-standard and non-proprietary components, substances and materials shall not be used.

6.2 Heat Emitters

Heating systems should utilise readily available technologies. The preferred forms of space heating are:

- Cased natural convector
- Trench convector
- Convector radiator
- Fan convector
- Fan coil units where cooling is provided

- Underfloor heating in specific areas such as lobbies

Electric heating systems shall not be used except in retrofit situations where there is no possible alternative and require dispensation from the Infrastructure Manager.

Heat emitters should be located at the perimeter of the building, specifically to deal with building fabric heat loss. If it is not possible to meet the full heating requirement from perimeter heating then additional heat emitters may be located in the building interior provided that these are on a separate zone.

Consideration should be given to local spot heating in large open plan spaces in order to provide adequate distribution.

Where temporary heaters are required if the main system has failed or it is isolated for maintenance, fan heaters must not be used. Instead, oil filled or electric panel heaters with an integrated timer/thermostat shall be provided.

Heat emitters shall be located to provide flexibility of control with due regard to current and potential partition layout and zonal control.

6.3 Temperature & Zone Control

Fit thermostatic radiator valves (TRVs) to all radiators and natural convectors except where these are to be controlled as a group and a separate zone control valve is installed on the branch pipework.

TRVs shall be tamper proof, incorporating a range setting device that limits the range of

adjustment that the user can make. TRVs shall fail to off or to minimal flow rate in the event that the sensing head is removed or fails.

Use temperature sensors with zone valves to control the heating system in spaces where the heating demand is met by more than one heat emitter. Do not use TRVs on the radiators in these areas.

Where it is desirable to provide user control of heating in a zone and a BMS system is installed use temperature sensors / adjusters that allow the set point to be automatically and remotely reset each night rather than devices where the adjustment is hard wired within the sensor.

Where a refurbishment creates a zone on an existing heating system without BMS and the occupancy pattern differs from the remainder of the building use a programmable thermostat linked to the main boiler control to allow zone control without requiring the whole building to be heated.

Internal room sensors / thermostats shall be located:

- Away from sources of draughts
- Not in partitioned offices which may have different conditions than general space
- Away from sources of heat (including heat produced from emitter)
- Out of the reach of direct sunlight
- With control sensors 1200mm from floor
- In a position which is unlikely to be covered, etc.

Sensors and controls shall be labelled to indicate the area or zone controlled

6.4 Flow Control

All new heating systems shall be designed for variable flow control using inverter driven speed controlled pumps for energy efficiency.

All branches in distribution pipework and large heat emitters, such as air handling unit heater batteries, shall be dynamically balanced using automatic differential pressure control valves.

Control valves on heating zones and at heat emitters shall be two-port and provide tight shut off. Control valves and thermostatic radiator valves shall be provided on the flow pipework.

7 Design / Contractor Submittal Requirements.

Reference should be made to the Manual to the Standards for general requirements for drawing and sample submittals.

All redundant services are to be stripped out during the works. A schedule of redundant services is to be issued to the Infrastructure Manager prior to commencing work.

8 Materials Standards

All materials must be specified / sourced and installed in accordance with the parameters set out in TfL standard GRN 01, which includes details of requirements for minimum recycled content.

Convactor heaters for perimeter heating shall be fabricated in powder coated steel, incorporating finned tube convactor elements, with the option to install electrical distribution and accessories flush within the casing.

Radiators shall be rolled top panel convector radiators.

Heating pipework in new installations shall be steel throughout, screwed up to and including 40mm, welded at 50mm and above. Copper pipework may only be used to match existing installations.

Plastic pipework may be used at sizes up to 25mm only via application of a dispensation form in extenuating circumstances. Plastic pipework must be electro-welded or utilise manipulative compression joints requiring a tool to assemble.

Push fit jointing will not be permitted on any pipe material under any circumstances.

Prior to commissioning all systems shall be chemically flushed and have an inhibitor added to preserve it. If the works include the connection to an existing system it shall be cleaned prior to the connection of new plant and pipework.

All heating pipework shall be insulated using foil faced mineral fibre pipe insulation, to BS 3958-4, with nominal density 80 kg/m³ to 120 kg/m³. Thermal conductivity shall not exceed 0.038 W/mK at a mean temperature of 50°C.

9 Workmanship Standards

Install heat emitters in accordance with manufacturer's recommendations to give a neat appearance, with supports out of view where possible. Ensure equipment is firmly fixed and level.

Fit a TRV or isolating valves on flow and a

lock-shield regulating valves on return to all emitters.

Arrange all exposed pipe work to run in a neat and presentable appearance, parallel with other pipe or service runs and building structure, subject to gradients for draining or venting. Ensure all vertical pipes are plumb or follow building line.

Provide valves for isolation and regulation of all branches of the heating distribution.

Heating pipework is to be identified by coloured bands and legends identifying circuit and direction of flow return at maximum 15m intervals.

10 Testing & Commissioning

Carry out Hydraulic Pressure Testing as described in HVCA TR/6 Guide to Good Practice for Site Pressure Testing of Pipework.

Any pipework covered up without a pressure test witnessed by the Infrastructure Manager will be entirely at the contractor's risk. Advise the Infrastructure Manager, at least five days in advance, of the time that pressure tests may be witnessed.

Carry out commissioning of installations in accordance with the procedures, checks and tolerances given in the BSRIA Application Guides for water systems, to achieve the standards set in the CIBSE Commissioning Codes.

All control components including TRVs shall be set up and commissioned in accordance with the manufacturer's recommendations.

Keep a systematic record of all tests and commissioning procedures. Provide copies to the TfL Infrastructure Manager on request.

11 Handover

Reference should be made to the Manual to the Standards for general requirements for handover and submissions required for the Operation and Maintenance Manual.

Axonometric or full 3D drawings shall be provided for all plant rooms and congested areas of distribution, clearly identifying the equipment and interconnecting services.

Procedures for preventative measures against the effects of aerobic bacteria and Pseudomonas shall form part of the hand over documentation.

12 Maintenance

The contractor shall provide full maintenance during the defects liability period in accordance with the TfL maintenance model. Any departure from this requirement will require the grant of dispensation from the Infrastructure Manager.

When new equipment is added or alterations are made to existing installations there shall be no detrimental impact on the ease of maintenance of existing facilities unless through dispensation from the Infrastructure Manager.

The contractor shall create and maintain a maintenance log recording all reported defects, problems and maintenance issues and their resolution. Upon completion of the

rectification of defects the log shall be issued to the Infrastructure Manager prior to the release of any retention monies.

13 Further Information

13.1 Legislation

- Building Regulations Part L2 Conservation of Fuel & Power
- Building Regulations Part J Combustion appliances and fuel storage systems
- Energy Technology Criteria List - www.eca.gov.uk.
- Non - Domestic Heating, Cooling and Ventilation Compliance Guide - Tier 2 document to Part L2, Dept. for Communities and Local Government.

13.2 Design Guidance

- LDA Sustainable Development Guide
- GIBSE Guide B1 Heating Systems
- CIBSE Guide F Energy Efficiency in Buildings
- CIBSE Guide M Maintenance Engineering & Management
- BSRIA Application Guide 16/2002 Variable flow water systems: design, installation and commissioning guidance
- HVCA Guide to Good Practice for Site Pressure Testing of Pipework HVCA TR/6
- BSRIA Application Guide Pre-commission cleaning of pipework systems AG 1
- CIBSE Commissioning Code B: Boilers
- BSRIA Guide: A Practical Guide to Building Services Calculations G30

Revision History:

Issue	Date	Description
1	December 2010	This standard supersedes standard LUF-M001-ST Heating Systems

Relevant British / European Standards

BS 759-1	Valves, gauges and other safety fittings for application to boilers and to piping installations for and in connection with boilers. Part 1 Specification for valves, mountings and fittings.
BS 1710	Specification for identification of pipelines and services.
BS 3958-4	Thermal insulating materials. Part 4 Bonded preformed man-made mineral fibre pipe sections.
BS 7478	Guide to selection and use of thermostatic radiator valves.
BS EN 442-1	Specification for radiators and convectors. Part 1 Technical specifications and requirements.
BS EN 12828	Heating systems in buildings. Design for water-based heating systems partially replaces BS 5449:1990 which remains current.
BS EN 12831	Heating systems in buildings. Method for calculation of the design heat load partially replaces BS 5449:1990 which remains current.
BS EN 14336	Heating systems in buildings. Installation and commissioning of water based heating systems partially replaces BS 5449:1990 which remains current.

07

Water Services

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07 Water Services

1 Scope

This Standard sets out requirements for water systems in non-operational premises intended for use as offices by Transport for London (TfL).

This Standard part supersedes standard LUF-M004-ST Water and Gas Services.

- Requirements for central heating plant and distribution are set out in BLU 01 Central Heating Plant.
- Requirements for control and monitoring are set out in BLU 17 Building Management Systems.
- Requirements for metering are set out in BLU 18 Metering.

All works shall comply with the requirements of non-domestic heating, cooling and ventilation compliance guide.

2 References

This Standard should be read in conjunction with the accompanying Manual to the Standards and TfL Standards GRN 01, 02, 03, BLU 01,18.

It shall be the responsibility of the designer/installer to reference and comply with all the above and any other Standards where necessary.

Relevant British Standards referred to in the text are listed on the rear cover. Unless otherwise stated, references are to the latest editions and revisions.

3 Definitions

For a list of general abbreviations and definitions used within the Standards please see the accompanying Manual to the Standards.

4 Construction Design and Management Regulations (CDM)

Reference should be made to the Manual to the Standards for requirements under the CDM regulations.

5 Performance Standards

5.1 General Standards

Water systems shall be designed in accordance with:

- BS 6700 Specification for design, installation, testing and maintenance of services supplying water for domestic use within buildings and their curtilages.
- BS EN 806 Specifications for Installations Inside Buildings Conveying Water for Human Consumption.
- CIBSE Public Health Engineering Guide G.
- WRAS Water Regulations Guide and Building Regulations Approved Document G.

The system designer shall assess the requirement for cold water storage and advise the TfL Infrastructure Manager accordingly.

The systems shall be designed and installed to protect the potable water supply against both back pressure and back siphonage in accordance with Water Supply (Water Fittings) Regulations 1999 and subsequent amendments.

The water supply system shall be designed to minimise energy consumption, operate efficiently and provide adequate cold, potable and hot water supply throughout the occupied hours and building usage.

All sanitary fittings shall be low water consumption fittings with the pressure and flow rate regulated wherever possible to ensure the design flow rates are maintained. The hot and cold water systems shall incorporate the following water saving features:

- PIR sensors shall control the flushing of urinals (consideration shall be made to the use of waterless urinals).
- Proximity detection to all toilet blocks to shut off water supply.
- Pushbuttons for the operation of showers.
- Low water consumption taps with appropriate aerator fittings to all wash basins and sinks.
- Low water consumption showers.
- Low flush capacity toilets with optional rainwater reclaimed water.
- Dual flush W.C. cistern.

All water meters in water services installations shall be connected to the BMS for monitoring. The BMS shall raise an alarm of potential leak if excessive water consumption is measured out of normal hours.

All new installations shall be evaluated for the inclusion of rainwater harvesting for toilet flushing. Refer to the Sustainable Buildings Team for guidance.

Design all domestic water services with the guidance contained in CIBSE TM13 and HSE's Approved Code of Practice and Guidance L8 - Legionnaires Disease: The control of legionella bacteria in water systems.

The design of water services systems shall ensure that a minimum hydraulic pressure of 1.25 bar is achieved at any point in the system to prevent the ingress of air and a minimum pressure at outlets of 1.5 bar.

Water fittings, or where appropriate, groups of fittings shall be provided with flow regulators to prevent excessive use of water.

The distribution systems shall be designed to achieve the pressures and flow rates as in Table 1.

Table 1. Pressure / flow rates

Fitting	Flow Rate
WC cistern	4-6 litres/flush
Wash Hand Basin	3-6 litres/min
Sink	10-12 litres/min
Shower	6-9 litres/min
Bath	12-15 litres/min

Potable water outlets shall be clearly labelled as "Drinking Water".

Cold and potable water shall be stored and distributed at a temperature not exceeding 20°C.

All water services shall be metered in accordance with standard BLU 18 Metering.

Electronic water conditioners with multiple open ended aerials generating random length waves between 1kHz and 10kHz, shall be installed on all water services systems, strictly in accordance with the manufacturer's recommendations

All points of use shall be provided with a screwdriver operated ball isolation valve or, where outlets are provided in close proximity, with a common isolation valve.

All pipework shall be routed to avoid computer rooms, patch panel rooms, and electrical rooms to eliminate the risk of damage to equipment caused by possible leaks.

Pipe velocities shall be limited to avoid excessive noise, erosion / corrosion, and cavitation within the pipe to between 1.0 to 1.5 m/s.

5.2 Hot Water Systems

Hot water systems shall obtain their heat from the building main heat source.

Electric immersion heaters are to be included as an automatic backup, using the same time control as the main heat source.

Instantaneous electric showers and water heaters can be used only via application for dispensation in extenuating circumstances. In circumstances that they are used each heater shall be provided with a time clock.

All new and retrofit hot water systems shall be evaluated for the inclusion of solar thermal water heating. Refer to the Sustainable Buildings Team for guidance.

Hot water shall be stored at a temperature of 60°C with a minimum temperature of 57°C during distribution and at the point of use.

Hot water systems shall incorporate a secondary return system with in-line pump and automatic thermostatic balancing valves to maintain a return temperature of 57°C at all material times.

Maximum "dead leg" lengths on all hot water pipework shall be 4m including mixing valves on all sizes of pipework.

Thermostatic mixing valves shall be provided to reduce the DHWS outlet water temperature in accordance with a TMV 3 scheme. The HWS

temperature to outlets shall be blended to the following temperatures:

- Wash Hand Basins 43°C
- Sinks 55°C (not blended)

All pipework will be thermally insulated to minimise heat loss, risk of legionella growth, maximise energy efficiency, and comply with building Regulations Part L2.

Unblended hot water outlets shall be clearly labelled with the warning "Hot Water".

5.3 Pressurised Water Systems

Pressurised distribution systems shall be provided with a break tank sized for 30 minutes supply at the full capacity of the pressurisation plant.

Pressurisation plant shall comprise as a minimum two pump stages with inverter control.

Hot water cylinders connected to pressurised systems shall be provided with G3 safety equipment.

6 Equipment Standards

6.1 General Requirements

Where a product or component required for the works appears in any category on the Energy or Water Technology Criteria List then the product or component selected for the installation shall comply fully with the relevant criteria.

With the exception of items designed to be disposable, the design life of the materials

and equipment used shall be not less than five years. For materials and equipment whose replacement is not expected between major refurbishments, the design life shall be a minimum of 15 years.

Unusual, non-standard and non-proprietary components, substances and materials shall not be used.

All equipment and assemblies which fall within the scope of the Pressure Equipment Directive (PED) 97/23/EC, implemented in the UK through The Pressure Equipment Regulations 1999, must be tested by the manufacturer, and be certified as compliant with the Directive. Such compliance shall be evidenced by displaying the appropriate CE Mark on the equipment and assemblies.

Solar thermal systems shall utilise two cylinders: a solar pre-heat cylinder and a primary cylinder in order to allow the connection of re-circulating systems and permit full de-stratification of the primary cylinder whilst maintaining the capacity to absorb solar energy.

Thermostatic mixing valves shall conform to BS EN 1111 and BS 1287.

7 Design / Contractor Submittal Requirements.

Reference should be made to the Manual to the Standards for general requirements for drawing and sample submittals.

All redundant services are to be stripped out during the works. A schedule of redundant

services is to be issued to the Infrastructure Manager prior to commencing work.

8 Materials Standards

All components used in water services systems shall be WRC approved.

Water services pipework shall be copper, jointed with capillary soldered fittings using lead free solder. All fittings and accessories shall be suitable for potable water use, brass fittings and accessories shall be DZR. Mechanical “crimp” joints can be considered to preclude the need for a “Hot Works Permit”, dispensation form will be required prior to use.

Plastic pipework may be used at sizes up to 25mm only via application for dispensation in extenuating circumstances. Plastics pipework must be electro-welded or utilise manipulative compression joints requiring a tool to assemble.

Drain off cocks shall be fitted at low level on all systems and tanks to aid draining down.

Push fit jointing will not be permitted on any pipe material under any circumstances.

9 Workmanship Standards

Arrange all exposed pipework to run in a neat and presentable appearance, parallel with other pipe or service runs and building structure, subject to gradients for draining or venting. Ensure all vertical pipes are plumb or follow building line.

Water services shall be protected at all times from freezing and condensation.

All water services pipework shall be identified by coloured bands to distinguish Potable Water, Cold Water, Raw Water (where rainwater is used for toilet flushing), Hot Water Flow and Hot Water Return.

10 Testing & Commissioning

Carry out Hydraulic Pressure Testing as described in HVCA TR/6 Guide to Good Practice for Site Pressure Testing of Pipework.

Any pipework covered up without a pressure test witnessed by the Infrastructure Manager will be entirely at the contractor’s risk. Advise the Infrastructure Manager at least 5 days in advance of the time that pressure tests may be witnessed.

Carry out commissioning of installations in accordance with the procedures, checks and tolerances given in the BSRIA Application Guides for water systems to achieve the standards set in the CIBSE Commissioning Codes.

After final flushing, carry out sterilization to potable water systems in accordance with BS 6700.

All control components shall be set up and commissioned in accordance with the manufacturer’s recommendations.

Keep a systematic record of all tests and commissioning procedures. Provide copies to the TfL Infrastructure Manager on request.

11 Handover

Reference should be made to the Manual to the Standards for general requirements for

handover and submissions required for the Operation and Maintenance Manual.

Procedures for preventative measures against the effects of aerobic bacteria and Pseudomonas shall form part of the hand over documentation.

Axonometric or full 3D drawings shall be provided for all plant rooms and congested areas of distribution, clearly identifying the equipment and interconnecting services.

12 Maintenance

The contractor shall provide full maintenance during the defects liability period in accordance with the TfL maintenance model. Any departure from this requirement will require the grant of dispensation from the Infrastructure Manager.

When new equipment is added or alterations are made to existing installations there shall be no detrimental impact on the ease of maintenance of existing facilities, unless through dispensation from the Infrastructure Manager.

The contractor shall create and maintain a maintenance log recording all reported defects, problems and maintenance issues and their resolution. Upon completion of the rectification of defects the log shall be issued to the Infrastructure Manager prior to the release of any retention monies.

13 Further Information

13.1 Legislation

- Building Regulations Part L2 Conservation of Fuel & Power.
- Building Regulations Part G Sanitation, hot water safety and water efficiency.
- Water Supply (Water Fittings) Regulations 1999.
- The Pressure Equipment Regulations 1999.
- ECA Scheme Water Energy Technology Criteria List - www.eca.gov.uk.
- Non-Domestic Heating, Cooling and Ventilation Compliance Guide - Dept. for Communities and Local Government. (Tier 2 document to Part L2,).

13.2 Codes of Practice

- HSE's Approved Code of Practice and Guidance L8 - Legionnaire's Disease.

13.3 Design Guidance

- WRAS Water Regulations Guide.
- CIBSE Guide F Energy Efficiency in Buildings.
- CIBSE Guide G Public Health Engineering.
- CIBSE Application Manual AM14 Non-domestic hot water heating systems.
- BSRIA Application Guide 2/2006 Design checks for public health engineering. A quality control framework for public health engineers.
- CIBSE TM13 Minimising the risk of Legionnaire's disease.
- CIBSE Commissioning Code W Water Distribution Systems.
- BSRIA Application Guide Commissioning water systems application principles.
- HVCA TR/6 Guide to Good Practice for Site Pressure Testing of Pipework.

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1	June 2010	Part supersedes standard LUF-M004-ST Water and Gas Services.

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Relevant British / European Standards

BS 8207	Code of practice for energy efficiency in buildings
BS 6700	Design, installation, testing and maintenance of services supplying water for domestic use within buildings and their curtilages.
BS EN 806	Specifications for installations inside buildings conveying water for human consumption
BS 1710:	Specification for identification of pipelines and services.

03

Acoustic Design Criteria

Issue 1 — December 2010



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03

Acoustic Design Criteria

1 Scope

This Standard sets out acoustic, noise and vibration criteria applicable to non-operational premises intended for use as offices by Transport for London (TfL).

2 References

This Standard should be read in conjunction with the accompanying Manual to the Standards and TfL standards RED 02, 03, 04, 08, GRN 01, 02, YEL 01, 02, 03, BLU 01, 02, 03, 04, 05, 06, 07, 08, 09, 10, 16.

It shall be the responsibility of the designer/installer to reference and comply with all the above and any other TfL Standards where necessary.

3 Definitions / Abbreviations

For a list of general abbreviations and definitions used within the standards please see the accompanying Manual to the Standards.

Definitions specific to this standard are;

- Hertz, Hz:
The number of wave cycles per second – 1 kHz or 1000 Hz is equal to 1000 cycles per second. An increase in frequencies equals an increase in pitch, like playing the keys of a piano from the base tones on the left to the treble tones on the right. A child is able to detect sounds between 20 Hz and 20,000 Hz, but as we age, we typically lose our ability to hear the highest pitch sounds. Speech typically lies between 100 and up to 10000 Hz. Regular landline telephony only transmits frequencies between 300 and 3400 Hz, where most of the

frequencies required for our understanding of speech lie (the so-called intelligibility).

- Decibel, dB
The decibel is the unit used for sound level measurement. Variations of the dB are used for different types of noise measurement. The most commonly used variation is the dB(A).
- A-Weighted Decibel, dB(A):
The human ear is not equally sensitive to all frequencies of sound, we interpret a low frequency sound as quieter than a high frequency sound of the same level. The A weighting approximates the sensitivity of the human ear by filtering these frequencies. A dB(A) measurement is considered representative of average human hearing.

Abbreviations specific to this standard are;

- L_{eq}
Energy averaged noise level over the measurement period. This measure is used for comparison with relevant standards for ambient noise.
- L_{max}
The maximum noise level of the measurement period.
- $L_{max (fast)}$
The maximum A-weighted sound pressure level measured over a specified time period with the sound level meter set to a 'Fast' ISO defined time averaging time period (of 0.125 seconds).

- L_{90}
Noise level exceeded 90% of the measurement period. This represents the background noise level. Where background noise levels are referenced in the noise fact sheets the L_{90} level is inferred.
- R_w
 R_w is the Weighted Sound Reduction Index which is a measure of the sound insulation performance of a single building element (such as walls, windows etc.), measured in controlled laboratory conditions. The higher the R_w rating, the better the sound insulation.
- $D_{nT,w}$
 $D_{nT,w}$ is the Weighted Standardised Field Level Difference which is single number rating describing the noise isolation performance achieved between two spaces across a building element. It is characterised by the difference in noise level on each side of a wall or floor. Measured in the field, $D_{nT,w}$ is subject to the inherent inaccuracies involved in such a measurement. It is a field measurement that relates to the R_w laboratory measurement. The higher the $D_{nT,w}$ rating, the better the insulation performance.
- NR (Noise Rating)
A set of defined curves used to provide a single figure rating to a broadband noise.

4 Design Standards

4.1 Acoustics, Noise and Vibration Design Criteria

4.1.1 External Noise Intrusion

External noise intrusion (whether from road, rail or aircraft sources) should, after attenuation by the composite building

envelope, not exceed the following criteria contained in Table 1 when measured under either Cat A standards (for speculative office space under consideration for lease) or final fitted-out office conditions:

Table 1. External noise intrusion

Area	Noise Rating
Bespoke open plan offices	NR40 (L_{eq})
Bespoke cellular offices	NR35 (L_{eq})
Speculative offices (under consideration for lease) –	NR38 (L_{eq})

In addition, $L_{Amax(fast)}$ noise intrusion levels should not normally exceed 55dB in open plan/speculative offices or 50dB in bespoke cellular offices.

In the case of mixed mode or fully naturally ventilated buildings, it may be acceptable to accept higher external noise intrusion levels than set out above - e.g. +5dB(A) relaxation in maximum ventilation mode provided occupants have the ability to close windows or reduce noise levels by other means, if required.

4.1.2 Finished Floor Vibration

Vibration transfer from continuous sources (e.g. plant items) to internal areas should not exceed $0.01m/s^2$ peak acceleration, based on W_b weighting as defined in BS 6472-1:2008. Vibration transfer from intermittent sources (e.g. underground trains) to internal areas should not lead to re-radiated $L_{Amax(fast)}$ noise levels in occupied cellular offices and meeting rooms in excess of 45 dB or in the case of open plan offices, in excess of 50 dB.

4.1.3 Building Services Noise

Internal building services noise should be controlled to meet the following noise ratings, (ref BS 8233:1999 Annexe B) when measured under either Cat A standards (for speculative office space under consideration for lease) or final fitted-out office conditions, in accordance with the Association of Noise Consultants guideline ANC 9701:1997-Part 1: Noise from building services. (See Table 2)

These noise limits apply at 1.5m from any grille, diffuser, riser shaft or other significant noise radiating surface, with plant operating at normal duties following full system balancing and commissioning.

Table 2. Building services noise	
Area	Noise Rating
Speculative offices (under consideration for lease)	NR38
Bespoke open plan offices	NR40
Bespoke cellular offices	NR35
Small meeting rooms	NR35
Large meeting / conference rooms (20+ people)	NR30
Entrance lobbies	NR40
Circulation spaces	NR40
Prayer/Faith Rooms	NR35
Reprographics	NR45
IT/Server Room (normally unoccupied)	NR50
Toilets	NR45
Plantrooms	70dBA
Loading bays	NR55
Underground car parks	NR55

4.1.4 Building Services Noise - External building services plant noise emission levels must comply with local planning / environmental authority requirements and statutory noise nuisance legislation as a minimum. In the event that such criteria are absent - e.g. planning permissions for the development do not condition plant noise emissions - services plant shall be at least 5dBA lower (10dBA if tonal) than the otherwise prevailing typically background $L_{A90, 5min}$ noise levels, when measured at the nearby noise sensitive windows.

Local planning officers may allow noise level relaxations for atmospheric noise emissions from emergency or standby plant. These should be checked locally, but are often 5dB less stringent than normally operating plant.

4.1.5 Lift Noise and Vibration

Vibration measurements must be made in the centre of the car floor, in three mutually perpendicular axes corresponding to vertical, front-to-back and side-to-side. Measurements must be made of acceleration levels in each direction over two complete cycles, one from the bottom of the building to the top, and one from the top of the building to the bottom.

The measurement method is critical to the repeatability of the results. It is therefore preferable to use an automatic recorder covering all frequency bands, as opposed to taking individual frequency band measurements over repeated lift runs. A cycle is defined as the period from just before the doors start to close at one level, to just after the doors open at the final level.

Acceleration levels should be measured as peak values over the frequency range 2 Hz to 80 Hz inclusive over each complete lift cycle.

The limits set out in Table 3 will apply on the floor of the car:

Table 3. Lift Noise and Vibration	
	Max. Acceleration
Horizontal Vibration	
2 Hz to 20 Hz inclusive	0.15 m/s ²
>20 Hz to 80 Hz inclusive	0.10 m/s ²
The above limits apply at any time during a complete cycle.	
Vertical Vibration	
At maximum speed	0.10 m/s ² in the frequency range 2 - 80 Hz
During acceleration/ deceleration and start/stop periods	0.50 m/s ² in the frequency range 2 - 80 Hz
The above limits apply to lifts with speeds up to 4 m/s. Lifts having speeds above this will be subject to increased vibration limits. For lift speeds in the range 4 - 7 m/s, a multiplier of 1.5 may be used for all acceleration level limits.	

4.1.6 Acceleration/Deceleration of Lift Car
Acceleration/deceleration rates of the whole car should not exceed 1.5 m/s² at any time during a complete cycle, and should preferably be below 1.2 m/s².

4.1.7 In Car Noise Levels

Door noise, when measured at 1.5 m from the floor and 1 m from the door face, should not exceed 60 dB_{L_{Amax}} when measured with a precision grade sound level meter set to "Fast" meter response.

Noise levels in the car at the maximum car velocity in the cycle should not exceed the criteria shown in Table 4 when measured as above:

Table 4. Building services noise

Lift speed	L _{Amax} Level
0.5 - 2.0 m/s	55 dB(A)
2.0 - 7.0 m/s	60 dB(A)

4.1.8 Lobbies

Lift noise, when measured at 1.5 m from the floor and 1 m from the door face with a precision grade sound level meter set to 'Fast' response should generally not exceed 55 dB L_{Amax} at any time during the lift cycle.

4.1.9 Lift Motor Rooms

Noise level information shall be made available as follows:

- L_{Amax} and average LA50 level over a complete cycle of lift operation.
- L_{Amax} levels in each of the eight 63 Hz to 8 kHz centre frequency octave bands.

The measurements shall be made with a precision grade sound level meter set to "Fast" response. The positions at which measurements are made should be noted on a drawing showing the principal noise producing elements of the lift machinery. No measurements should be closer than 1 m from any wall or floor surface.

4.1.10 Sound Absorptive Ceilings

For general open plan offices, floor to ceiling heights should not exceed 3 metres. Suspended ceilings, where they are installed, or acoustic rafts beneath thermal mass slabs should be selected to ensure an average composite soffit (including absorptive and non-absorptive areas) sound absorption coefficient, α , greater or equal to 0.9 over the octave band range 500Hz to 2kHz.

4.2 Sound Insulation Standards

4.2.1 Floor to Floor

For properties under consideration for lease, sound level difference vertically between individual office floors (between client offices

or between client offices and another demise) shall be at least $D_{nT,w}$ 45dB at shell and core stage when tested in accordance with BS EN ISO 140-4:1998 and rated in accordance with BS EN 717-1:1997. Following final fit out, or under Cat A standards, floor to floor sound insulation levels shall be at least $D_{nT,w}$ 48dB.

4.2.2 Room to Room

The sound insulation performance of internal building elements should be assessed on the functions of the space in question and the background noise levels desired in that space. This results in a guide to the privacy requirement in that space.

Table 5. Room to Room privacy factors

Privacy Factors (PF) Applicable across walls without doors	Bespoke open plan offices	Bespoke cellular offices	Small meeting rooms	Large meeting / conference	Entrance lobbies	Circulation spaces	Prayer/Faith Rooms	Reprographics	IT/Server Room	Toilets
Bespoke open plan offices	-									
Bespoke cellular offices	70	70								
Small meeting rooms	70	75	75							
Large meeting / conference rooms	75	75	75	75						
Entrance lobbies	-	70	70	80	-					
Circulation spaces	-	70	70	75	-	-				
Prayer/Faith Rooms	75	75	75	75	75	75	75			
Reprographics	75	75	75	80	70	-	75	-		
IT/Server Room	75	75	75	80	70	70	75	-	-	
Toilets	75	75	75	80	75	75	75	70	70	-

Relevant 'Privacy Factors' between typical spaces are given in the Table 5. The Privacy Factor (PF) refers to the audibility of normal voice level speech between one area and another.

PF	Subjective condition
<70	= Clearly audible and intelligible
70-75	= Audible but not intrusive
76-80	= Audible but not intelligible
>80	= Inaudible

The Privacy Factor is defined as:

$$PF = D_{nT,w} + NR$$

Where NR is the Noise Rating in the listener's space and $D_{nT,w}$ is the 'weighted standardised level difference' across the composite wall system between listener and speaker areas.

Note that the $D_{nT,w}$ is the sound insulation performance level resulting from all the elements forming a particular room boundary. For example, when a partition is installed the total noise transmitted between two spaces is a combination of the direct path through the partition, plus any flanking via adjoining walls, ceilings, window elements as well as the influence of doors, ductwork and services penetrations, perimeter seals, window mullions etc. This must be accounted for at the fit-out design stage when considering drawing details and when proposing particular building elements.

Individual building elements should still be specified in terms of R_w (as defined in BE EN ISO 717-1:1997). In this regard, it is good practice to 'over specify' the R_w rating of an individual element by 7 to 10 dB to cater for the loss of performance experienced when such element are installed in non-perfect site conditions.

5 Testing and Commissioning

The following section provides guidance on acoustic testing requirements to verify a particular development's compliance with agreed acoustics, noise and vibration standards. Consideration must be given to the extent to which the following is applied on a building by building basis.

5.1 Sound insulation

Test procedures should be in accordance with BS EN ISO 140-4 and BS EN ISO 140-7.

Tests should be carried out by a body accredited by the United Kingdom Accreditation Service (UKAS) or the Association of Noise Consultants (ANC) for doing such tests.

Performance should be rated in accordance with BS EN ISO 717-1 and BS EN ISO 717-2.

- Airborne sound insulation testing of a random selection of partition and floor types to include meeting rooms, conference rooms and executive offices as a minimum. These tests should be done at the earliest opportunity (preferably in a complete mock-up on site) to identify potential weaknesses before these are replicated in numerous areas.
- Impact sound insulation testing of a random selection of floor types. Include typical office floors as a minimum, plus other sensitive areas identified during the design as needing additional impact sound insulation.
- A typical test regime would be airborne tests on eight partitions of each construction type plus airborne and impact tests on four floors of each construction

type. Include a selection of flanking arrangements (for example internal walls, external cladding, masonry walls).

5.2 Noise levels generated by mechanical and electrical services

Services should be operating at their maximum normal design duty before the following checks take place:

- Noise levels should be measured in randomly selected areas, particularly those close to plant rooms. This should include measurements of noise levels during start-up where this is a noisy operation.
- Where possible, testing should include measurements in at least five rooms served by each ventilation system.
- The rooms selected should have the lowest NR criterion for that system and/or be closest to the branch off the main duct.
- Tests should be undertaken before fit-out equipment (photocopiers, desktop computers etc) is installed or operational, unless there has been agreement that this equipment should also meet the criterion.
- Tests should be carried out when the rooms are furnished but unoccupied. If it is not possible to test when rooms are furnished, an allowance may be made for the expected difference in reverberation time when the room becomes furnished.
- Reductions in the number of tests may be acceptable if, for example, there is repetition of design.
- The measurements in each room should be spatially averaged, with each measurement position representing the use of the room (minimum of three measurements per room).

- The measurement time period selected should represent the use of the room and/or the operation of the plant/equipment.
- Other test requirements should be taken from the ANC's guidelines – Noise measurement in buildings.

5.3 Intrusive noise

The following measurements should be taken from a sample of rooms during daytime and night-time:

- A typical requirement would be for spatially averaged measurements in representative rooms on each façade (and at a number of floor levels if the external noise level varies with height on the façade).
- Where appropriate, during measurements, windows and trickle ventilators should be open as required to achieve the required amount of ventilation.
- Measurements should be made for a period of time that represents the use of the room and the external noise sources.
- The measurements in each room should be spatially averaged, with each measurement position representing the use of the room (a minimum of three measurements per room).
- If the external noise sources are sufficiently constant, measurement time periods of less than one hour are acceptable.
- Tests should be done when the rooms are furnished but unoccupied.
- If it is not possible to test when rooms are furnished, an allowance may be made for the expected difference in reverberation time when the room becomes furnished.

- Other test requirements should be taken from the ANC's guidelines – Noise Measurement in Buildings.
- Due to the practical problems for measuring rain noise on a completed building, it will normally be acceptable to prove the performance by calculations based on the laboratory-measured rain-noise data for the roof system used.

5.4 Environmental noise

All plant should be operating at its maximum normal design duty. The following should also be taken into account:

- Suitable measurements should be made to check compliance with planning conditions etc. as appropriate.
- Appropriate locations and times should be selected, noting that measurements will probably be needed at night.
- Where agreement has been made for relaxing noise criteria for emergency plant, it should be tested separately.

5.5 General comments

Noise and vibration measurements should be made using suitable instrumentation in accordance with BS EN 61672 Parts 1 and 2, following the British and International Standards as identified above or other appropriate standards where relevant. The equipment used should have calibration certification traceable to national standards.

Personnel chosen to carry out the commissioning tests should be suitably trained in the test procedures and relevant Standards.

Commissioning measurements are not normally undertaken when offices are occupied by staff, unless the Acoustician undertaking the measurements is confident that the occupants are not contributing to overall noise level measurements in any way. This is usually best avoided with commissioning being undertaken in an unoccupied floor condition at or around the agreed project handover date.

5.6 Failure to meet criteria

In the event of a failure to meet the project's acoustic criteria:

- Elements that do not meet the agreed performances set out in the acoustic strategy document should be remedied.
- Test failures that indicate poor workmanship or design should normally result in testing of other areas, to show whether they meet the standards.
- The responsibility for failures may be due to more than one party, depending on individual circumstances.
- An acoustic specialist representing interested parties may decide to allow small individual failures, and this will depend on individual circumstances. Generally, 1 dB or 2 dB is considered negligible in acoustic terms, as this difference is undetectable to normal human hearing. However, this does not justify planned under-design of the building.

5.7 Commissioning results

The following measurement results should be presented:

- Airborne-sound-insulation ratings (in terms of $D_{nT,w}$).
- Impact sound insulation (in terms of $L_{nT,w}$).
- Noise levels generated by mechanical services (in terms of NR).
- Intrusive noise levels (in terms of $L_{Aeq, 1hr}$ and L_{Amax} as appropriate).
- Environmental noise levels (in terms of the appropriate parameter).
- Comparison of all commissioning results with design criteria, statement of acceptability, details of remedial measures and subsequent changes in results.

6.0 Further Information

Other critical Standards and Guidelines to be referenced are:

- British Council for Offices Guide to Specification 2009.
- Chartered Institute of Building Services Engineers Guide A: Environmental Design.
- Association of Noise Consultants Guidelines ANC-9701:1998 Part 1 Noise from building services.
- Association of Noise Consultants Guidelines ANC-9801:1998 Part 2 Noise from external sources (e.g. traffic noise) within buildings.

Revision History:

Issue	Date	Description
1	December 2010	New Standard created for TfL Head Office Standards

Relevant British / European Standards

British Standard 6472	Part 1 'Guide to evaluation of human exposure to vibration in buildings
British Standard 717-1	Acoustics - ratings of sound insulation in buildings and of building elements. Airborne sound insulation
British Standard 8233	Sound insulation and noise reduction for buildings – Code of Practice

02

Design Criteria

Issue 2 - April 2011



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02 Design Criteria

1 Scope

This Standard sets out the design criteria required in non-operational premises intended for use as offices by Transport for London (TfL)

This Standard should be read in conjunction with all Transport for London (TfL) Standards.

- Acoustic design criteria are included in a separate document GRN 03.

2 References

This standard should be read in conjunction with the accompanying Manual to the Standards and all TfL standards.

It shall be the responsibility of the designer/installer to reference and comply with all the above and any other TfL Standards where necessary.

Relevant British Standards referred to in the text are listed on the rear cover. Unless otherwise stated, references are to the latest editions and revisions.

3 Definitions / Abbreviations

For a list of general abbreviations and definitions used within the standards please see the accompanying Manual to the Standards.

4 Construction Design and Management Regulations (CDM)

Reference should be made to the Manual to the Standards for requirements under the CDM regulations.

5 Design Criteria

5.1 External weather conditions

Plant and equipment shall be designed to achieve the specified performance under the following external conditions:

	Inner London	Greater London
Summer	32°C	30°C
Winter	-1°C	-3°C

5.2 Insulation

Target insulation levels for thermal elements in new build and refurbishment (i.e. where insulation is being applied to existing structures)

Table 2. Area weighted U-Value

Element	New Build	Refurbishment
Wall	0.15 W/m ² K	0.30 W/m ² K
Floor	0.15 W/m ² K	0.20 W/m ² K
Roof	0.10 W/m ² K	0.20 W/m ² K
Windows (System U-Value)	1.6 W/m ² K	1.6 W/m ² K
Windows (Centre pane U-Value)	1.1 W/m ² K	1.1 W/m ² K
Doors	1.6 W/m ² K	1.6 W/m ² K
Rooflights	1.90 W/m ² K	2.00 W/m ² K

All new installations must be shown to be better than the incumbent system.

5.3 Heating & Cooling

Heating systems and cooling systems (where essential) shall be designed to achieve the following internal temperatures:

Table 3. Heating and Cooling

Area	Heating	Cooling
Offices	21°C	24°C
Meeting Rooms	21°C	26°C
Reception	21°C	26°C
Reprographics	19°C	26°C
IT / Server Room	N/A	26°C
Toilets	19°C	N/A
Circulation	18°C	N/A
Store Rooms	15°C	N/A
Plant Rooms	12°C	N/A

Areas not listed here are to be designed in accordance with relevant CIBSE Guidance.

5.4 Ventilation

Design Occupancy	1 person per 7.5m ²
Fresh Air Allowance	Natural Ventilation or 12 litres/second/person
Air Movement:	Natural Ventilation or 0.25m/s max
Relative Humidity	Uncontrolled
The CO ₂ set-point	800ppm.

5.5 Daylight

Working areas should be designed to achieve 4% average daylight factor on the working plane to at least 80% of the seated workspaces. All workspaces should be within 7m radius of a window where possible.

Daylight factor calculations shall be carried out in accordance with Estimating Daylight in Buildings Parts 1 and 2, BRE Digests 399 and 310 and based on a CIE overcast sky.

5.6 Electric Lighting

Table 4. Electric Lighting

Area	Illuminance
Offices (Non task)	300 lux
Offices, meeting rooms (task)	500 lux
Meeting Rooms	300 lux
Reception	300 lux
Reprographics	500 lux
IT / server Room	200 lux
Toilets	200 lux
Circulation	100 lux
Stairs, escalators & Lifts ¹	150lux
Plant Rooms	300 lux

Notes

¹ Lift car lights should be extinguished when idle.

5.7 Office Electrical Loads

Table 5. Office Electrical Loads

Area	
Lighting	12W/m ²
Small Power	15W/m ²
Risers and corridors	5W/m ²
Mechanical plant, lifts and fixed loads	Actual loads

Dispensation from the Infrastructure Manager must be sought to exceed these values.

5.8 Energy Efficiency

The mechanical and electrical systems shall be designed and installed with regard to the following requirements:

- All electric motors shall be Class I high efficiency motors.
- Air and water distribution systems shall use variable flow control.
- Electric motor drives shall be direct drives.
- Ventilation systems shall achieve specific fan power of not more than 1.5W per l/s.
- Lighting installations shall be designed to achieve efficiencies better than 65 lm/circuit W.
- Light output ratios of fittings shall be 80% or better.
- Lighting power density shall be less than 3W/m² per 100lux.
- Space conditioning system shall be provided with optimum start/stop controls.
- Space heating capacity shall not exceed 90W/m² GIA.
- Cooling capacity shall not exceed 140W/m² GIA.

- Boiler seasonal efficiency shall be greater than 85%.
- Refrigeration equipment shall have a coefficient of performance (COP) that is at least as good as that required by the Energy Technology Criteria List at the specified UK rating points.
- Modulating controls are to be incorporated in all boiler plant.
- Space heating and cooling systems should be configured to eliminate the risk of simultaneous operation, such as using deadbands and interlocks.

5.9 Carbon Benchmarks

New buildings and major refurbishments shall have predicted carbon dioxide emissions calculated in accordance with the National Calculation Method used by Part L of the Building Regulations, whether or not a Part L submission or EPC is required. The works shall be designed to achieve carbon dioxide emissions at least 25% lower than the Target Emissions Rate from the calculation.

Revision History:

Issue	Date	Description
1	December 2010	New Standard created for TfL Head Office Standards
2	April 2011	Lighting levels amended in line with latest CIBSE figures



01

Environmental Guidelines

Issue 2 — December 2010



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01 Environmental Guidelines

1 Scope

This Standard sets out environmental guidelines for all Transport for London (TfL) Standards. The document provides guidance for designers and contractors on management, design and materials. Minimum design criteria are included in GRN 02.

Although these guidelines form a stand-alone document they are referenced in all Standards and are provided as such to emphasize the key role played. In addition this document shall allow regular updating and amendments in order that TfL buildings demonstrate and implement exemplary environmental practices. The user is therefore responsible for ensuring that the current revision is used at all times.

2 References

This Standard should be read in conjunction with the accompanying Manual to the Standards and all TfL standards.

It shall be the responsibility of the designer/installer to reference and comply with all the above and any other TfL Standards where necessary.

Relevant British Standards referred to in the text are listed on the rear cover. Unless otherwise stated, references are to the latest editions and revisions.

3 Definitions / Abbreviations

For a list of general abbreviations and definitions used within the Standards please see the accompanying Manual to the Standards. Definitions specific to this standard are:

- Enhanced Recycling Opportunities (EROs)
As defined in WRAP publication, Setting a requirement for recycled content in building projects, as 'Quick Wins'.
- Quick Win
A Quick Win is a construction specification, product category or type of material that offers the opportunity to increase recycled content beyond current average practice and is cost-competitive to procure and install within a construction scheme. In addition it satisfies the conditions of being technically acceptable, meeting the required level of performance, and having reliable supply and availability. Ideally it should also demonstrate strong environmental credentials – or at least not introduce significant environmental penalties relative to conventional alternatives. Excerpt from 'WRAP publication, Setting a requirement for recycled content in building projects.

4 General Guidance

Sustainability and environmental concerns underpin TfL's approach to all aspects of the design fit out, construction, occupation and even disposal stages of all projects whilst providing exemplar sustainable workspace at the best value to the taxpayer.

Sustainability is not about being an additional bolt on, upgrade or uplift to any specification. Sustainability is the application of ingenuity, design, procurement and construction skill that achieves the project objectives with the most lean design, the fewest components and those whose procurement, construction delivery, usage, and disposal require the least resources in the broadest terms.

Whilst it is clearly not feasible to improve the performance levels of the entire property portfolio at the same time, in order to achieve these aspirations an approach that seeks to make improvements to buildings for all levels of refurbishment shall be adopted based on the principles of consequential improvement established by Part L2 of the Building Regulations. Within this approved document there is a requirement for consequential improvement to the building energy performance in the event of any alteration that changes the heating or cooling requirement of the building.

Within the Manual to the Standards a number of minimum criteria have been set for three levels of refurbishment that attempt to ensure that, over time and through the implementation of the revised TfL standards, environmental performance of the property portfolio shall be dramatically improved in all

areas, (see Manual to the Standards for levels of refurbishment and minimum criteria).

At the level of minor refurbishment this improvement will include improving draught proofing and control of the heating and lighting, which together address the most commonly encountered problems in old buildings. Major refurbishments and new build projects requiring building regulations approval will have to comply with the full set of TfL Head Office Standards in addition to the Building Regulations.

Reference is made within the text to criteria set out in the British Research Establishment Environmental Assessment Method (BREEAM) offices scheme. Major Refurbishment Projects and New Build Projects will be required to achieve BREEAM excellent (see Manual to the Standards) in addition to the criteria set out in this document. For all projects the BREEAM Assessors Manual provides a useful checklist of criteria that should be considered.

4.1 Carbon emissions

Perhaps the greatest improvement to existing buildings which can readily be achieved, is the reduction of carbon emissions.

UK energy policy is presently being developed with the goal of reducing carbon emissions by 80% by 2050. Commercial buildings in the UK account for around 20% of carbon emissions and more than 80% of the buildings we will inhabit by 2050 have already been built. To meet the UK's target dramatic improvements to the performance of the UK's existing building stock are required.

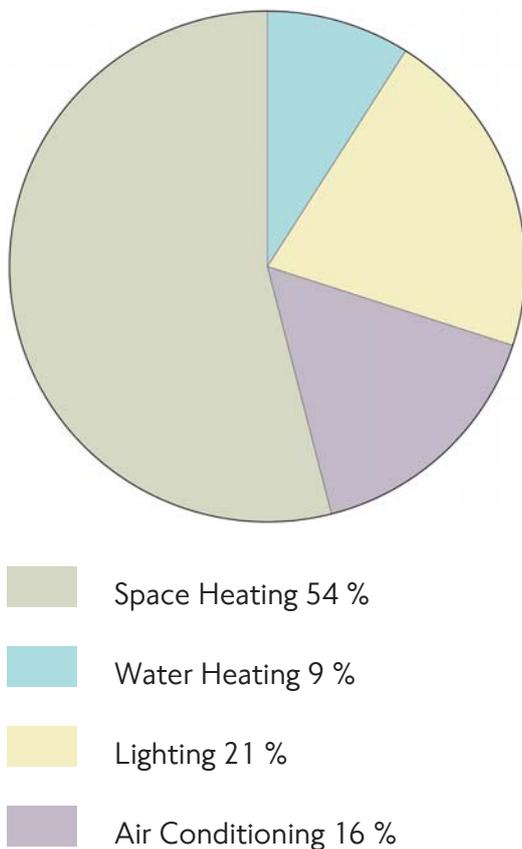


Fig. 1

Fig. 1 indicates the balance of carbon dioxide emissions from the fixed building services installations in what would be a typical head office building now due for refurbishment. Emissions from the fixed building services are currently regulated under the Building Regulations, and measured for BREEAM and other assessments. The emissions from building services typically only represent 75% of the total building emissions with the remaining 25% arising primarily from use of power for IT and office equipment, which are not covered by the regulations.

The order of priority on each refurbishment project to maximise carbon savings for the investment should therefore be:

- 1 Space heating
- 2 Daylight and natural ventilation
- 3 IT and office equipment
- 4 Other energy uses.

Space heating represents more than half of the overall emissions in typical buildings prior to the 2006 Building Regulations. Head office refurbishments should prioritise the installation of heating system controls and elimination of draughts as the primary means of reducing carbon emissions (see Manual to the Standards Minor Refurbishment Level).

For larger refurbishments the priority is to improve the thermal performance of the building envelope by replacing the glazing and increasing insulation levels whilst renewing the heating system plant and equipment (see Manual to the Standards Intermediate Refurbishment Level).

Artificial lighting and air conditioning typically represent around 35-40% of emissions. However, these will represent a much greater proportion once the heating emissions have been reduced. Refurbishment projects should therefore also include measures to maximise the benefit of daylight in office spaces and to reduce the heat gains through organisation of the space and provision of natural ventilation where appropriate (see Manual to the Standards Minor Refurbishment Level).

5 Construction Design and Management Regulations (CDM)

Reference should be made to the Manual to the Standards for requirements under the CDM regulations.

6 Management

All designers and contractors shall have management system accreditation for quality (ISO 9001) and for the environment (ISO 14001).

Contractors shall source 50% by mass of materials from a factory / plant, quarry, wharf, railhead or recycling centre within a 35 mile radius of the site (in accordance with the London Development Agency, 'Sustainable Development Guide').

All contractors shall provide a site waste management plan (SWMP) in line with the DTI Code of Practice and associated good practice guidance. The SWMP must include the entire development process from the pre design stage and will need to set targets in line with Mayoral Waste strategies over and above minimum legal requirements.

For all projects the TfL Waste Proforma shall be completed. This is available from and shall be returned to the Sustainable Buildings Team.

All contractors will be required to sign up to the Considerate Constructors Scheme, or in the City of London to the Considerate Contractor Scheme, and shall be signed up to the Mayor's Green Procurement Code achieving a minimum level of Bronze.

All contractors shall implement the London best practice guidance on the control of dust and emissions during construction and demolition.

All contractors shall complete a pre-demolition audit to maximize the material recovered from the demolition of existing

buildings in line with ICE Demolition Protocol. Contractors shall use recovered construction and demolition material on site wherever possible.

Contractors shall use a consolidation centre to manage the supply of materials and recyclable materials where possible and shall use prefabricated and standardized modulation components to minimize waste both on and off site.

Designers / installers must complete the TfL sustainability check list and return to the Sustainable Buildings Team for sign off prior to any work commencing.

80% of all waste generated by the project shall be reused or recycled unless agreed through dispensation from the Infrastructure Manager .

7 Design Standards

7.1 Space planning

The perimeter of each floor plate up to about 6-8 m depth can be lit with daylight using simple windows and, circumstances permitting, be naturally ventilated by the same means. This is known as the passive zone as indicated on Fig 2. The interior of the building is known as the active zone as this will typically require artificial lighting and mechanical ventilation to deliver comfort and function.

Interior space planning for refurbishments should take into account the passive and active zones. Many support functions, such as storage / copy rooms and circulation, do not require high levels of lighting, are infrequently occupied and can thus be located in the active

zone without resorting to full air conditioning. Other areas such as toilets and kitchenettes, which would require active systems in any case, can be migrated into the active zone, leaving more of the passive zone for general office occupancy.

7.2 Exposed soffit

Within new buildings and for refurbishments of Intermediate and Major level (see Manual to the Standards for details) the opportunities shall be taken to expose the interior soffit, therefore maximizing use of the thermal mass of the building, as well as providing 'open plan' and flexible working environments, thus maximizing natural daylight and ventilation for the greatest number of staff. While this may be difficult, or even impossible, to achieve in some projects the designer should work with this general philosophy in mind throughout the design process (see also TfL Standard RED 04).

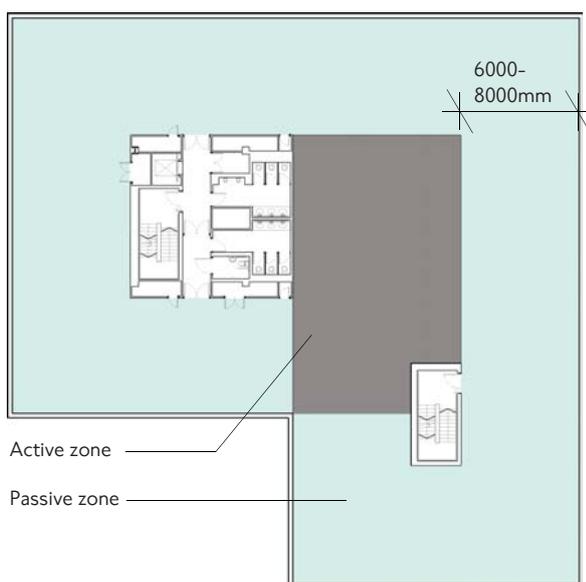


Fig. 2

Note:

Thermal Mass refers to the ability of the building structure to store heat. If lightweight finishes, such as suspended ceilings, are removed to expose a heavyweight interior soffit then the heat gains from occupancy can be partly absorbed into the structure, mediating the internal temperature. This storage ability can significantly reduce the energy required to heat and cool the building throughout the year. In winter the absorbed heat is released overnight so that the building does not get as cold and needs less heating the following morning. In the summer night time ventilation cools down the building so the temperature does not rise so far the following day.

7.3 Ecology

There shall be no negative change in the site's existing ecological value as a result of work undertaken at any refurbishment level.

Projects of major refurbishment level and new build projects shall enhance the ecological value of the site in accordance with BREEAM credit LE5 - Enhancing Site Ecology unless through dispensation from the Infrastructure Manager. Application for dispensation must include a dispensation form supported by a report from a suitably qualified ecologist.

Examples of ways in which ecological biodiversity could be enhanced include green roofs and bat boxes.

Designers shall also investigate opportunities for internal planting where possible.

7.4 Sustainable Urban Drainage Systems (SUDS)

Drainage and surface flow systems shall be designed to minimise the impact of the development on the urban sewage and storm water networks and to mitigate the risk of surcharge or flooding to the property or neighbours generally in accordance with CIRIA Guide 635, Designing for Exceedance in Urban Drainage – Good Practice.

Consideration should be given to rainwater retention on roofs or purpose built structures and to sustainable urban drainage systems (SUDS) as appropriate. SUDS should be designed in accordance with CIRIA Guide 697 The SUDS Manual

8 Design / Contractor Submittal Requirements

Reference should be made to the Manual to the Standards for general requirements for drawing and sample submittals.

The design team will be expected to apply a rigorous common sense approach to delivering, within a tight budget, a design that meets TfL general sustainability objectives and the performance criteria outlined within this document. To aid this process designers /

installers must complete the TfL sustainability check list and return to the Sustainable Buildings Team for sign off prior to any work commencing.

Designers and contractors will be required to demonstrate at key stages the objective and audit methods of selection and comparison that have been used to arrive at design / installation decisions.

To provide independent auditing and verification of the design decisions and outcomes the following tools should be used:

- Part L of the Building Regulations. The design shall need to exceed all targets and minimum levels set out in supporting tier 2 documentation (major refurbishment level only).
- Use of the RIBA's climate change toolkit and through the use of CIBE endorsed Design Quality Indicator (DQI) scheme.
- CIBSE guidelines, including CIBSE Guide F, Energy Efficiency in Buildings and CIBSE Guide L, Sustainability.
- Use of BRE guide to specification and also the National Green Specification to assist in material selection.
- Compliance with Central Government's Sustainable Development in Government SDIG guidelines.
- Use of WRAP calculator tools to demonstrate recycled content of construction materials.
- Completion of TfL waste proformer.

9 Materials Standards

In terms of the materials used the following principles shall apply:

- Minimize embodied energy, through the use of local, reclaimed and recycled materials.
- Apply the Mayor's Green Procurement Code.
- Apply TfL's Responsible Procurement Policy.
- 80% of materials shall be responsibly sourced with the additional requirement that 100% of timber products shall be from Forest Stewardship Council (FSC) sources (or other recognized certified timber with chain of custody).
- Materials shall be selected on the basis of low environmental impact over the full life cycle of the building.
- Where possible building elements shall be reused.
- All new building elements / materials shall achieve A / A+ rating according to the Green Guide to Specification Elemental Ratings.
- External hard landscaping and boundary protection shall also achieve A / A+ rating as defined in the Green Guide to Specification.
- Insulation materials containing substances known to contribute to stratospheric ozone depletion, or with the potential to contribute to global warming, must not be used. Natural materials shall be used where possible.
- No construction or specification of material with high embodied energy shall be used (as defined by the Green Guide to Specification) unless a compelling whole life energy or technical case is made through the use of the dispensation form.

- Materials shall be assessed using whole life costing and benchmarking.
- Wherever practical i.e. where maintenance and cost requirements allow, the use of low emission finishes, (paints, varnishes etc.), construction materials, carpets and furnishings should be used.
- All paints and varnishes shall be water based and have low VOC levels (0.3% to 7.99%).
- Interior finishes shall be water based and have minimal VOC levels* (0% to 0.29%).

* Where maintenance and durability considerations prohibit this, dispensation must be sought.

All building elements / products identified including those for inclusion in the product selector, shall provide an environmental product declaration which should include (but not be restricted to) a life cycle analysis taking into account:

- Materials
- Production
- Transport
- Use
- Disposal

9.1 Re-use

Developments shall be designed for deconstruction, as defined by CIRIA (2004) to maximize reuse and recycling opportunities.

9.2 Recycled content

As one of its objectives on sustainable development, TfL is seeking to maximise the cost-effective use of materials recovered from the waste stream – thereby diverting waste from landfill and reducing demand for finite natural resources.

This can be achieved by using materials that have above average recycled content, employing both off-the-shelf mainstream products such as certain brands of bricks, blocks, chipboard and plasterboard, and materials that have been recycled from site-won materials, such as crushed brick used for hardcore.

To deliver measurable performance, TfL seek to exceed a threshold outcome defined as follows:

Note:

The value of materials deriving from recycled content on a project may be calculated using the following summation across all the products and materials used: ΣA (quantity of product A) x (cost of product A) x (% recycled content by mass of product A)

Recycled content is the proportion, by mass, of recycled material in a product, excluding waste material (such as process scrap) re-utilized within the same process that generated it. See ISO14021 for a formal definition. Where a product or material is reused (e.g. is removed and replaced or is moved to another location), then it is credited at 100% recycled content by value. The cost of a product is the unit delivered price for the materials, excluding installation costs.

At least 20% (in accordance with the London Development Agency, 'Sustainable Development Guide') of the total value of materials used in the construction project must be derived from recycled and re-used content in the products and materials selected.

In addition products and materials implementing 'Good Practice' standards of recycled content shall be implemented where technically and commercially viable. See WRAP publication, 'Choosing Construction Products' and WRAP online tools for guidance. For all major new build projects and refurbishments of Intermediate and Major Level TfL also seeks to identify and implement the most effective cost-neutral Enhanced Recycling Opportunities (EROs) to increase the value of materials deriving from recycled and re-used content, and quantify the improvement in the total recycled content above baseline or standard practice. For all major new build projects and refurbishments of Intermediate and Major Level designers shall be responsible for identifying and agreeing with TfL the potential opportunities to increase the recycled content of the project, such as the top 10 EROs or equivalent opportunities. This assessment may be made using one of the WRAP calculator tools available from (www.wrap.org.uk/construction).

In any tender the contractor should detail how they will meet the minimum level of recycled content for the project, and for all major new build projects and refurbishments of Intermediate and Major Levels which of the opportunities for higher recycled content (EROs) they will implement, identifying the

minimum level of recycled content to be achieved in each.

Contractors may propose with justification any modifications to the requirements.

Where relevant, the Contractor should employ a systematic approach to good practice in the recycling and re-use of locally available construction, demolition and excavation waste materials (on-site and from nearby sites) – e.g. applying the methodology outlined in the Demolition Protocol (published by ICE, London Remade and Envirocentre).

The contractor shall:

- Assess (with suppliers and trade contractors where appropriate) whether products and materials containing levels of recycled content at least equal to 20% of the total value of materials and /or those levels defined in the list of EROs can be obtained at competitive prices.
- Supply information on the options identified in the EROs List, detailing which the contractor considers inappropriate or cannot be obtained at a reasonable price or do not meet the required performance criteria.
- Identify any other product areas offering higher recycled content that the contractor proposes to use as an alternative to those defined in the EROs List, which can be obtained at a reasonable price, meet the required performance criteria and enable the works to meet the overall project requirement for recycled content.
- Be prepared to negotiate a final EROs List of (cost neutral) materials to be included in the Contract documents (if awarded) for implementation in the project.

The contractor is responsible for:

- Sourcing products and materials with levels of recycled content equivalent to or greater than those included in the List of selected ERO materials, selecting options which also meet all other relevant TfL Standards – including where the Contractor has used materials which were not candidate EROs identified by the design team.
- Upon completion of the project, demonstrating compliance by providing evidence of the actual materials used to match those proposed at the design stage, the quantity of the materials used and their levels of recycled content.

10 Handover

Reference should be made to the Manual to the Standards for general requirements for handover and submissions for inclusion in the Operation and Maintenance Manual.

In addition to those items already identified above the following information shall be provided on completion of the project for inclusion in the buildings Operation and Maintenance records:

- BREEAM certification where required.
- Post occupancy evaluation to ensure systems work as designed when the building is in use through the BSRIA Softlandings scheme.
- Compliance with CIBSE TM39 (Metering) and CIBSE TM31 (logbooks).

11 Further information

- CIBSE Guides
- Handbook of Sustainable Building (Anink et al)
- Green Building Handbook (Wooley)
- Green Guide to Specification (BRE)
- Environmental Code of Practice for Buildings and Their Services (BSRIA)
- Environmental Rules of Thumb (BSRIA)
- Environmental Design Guide for naturally ventilated and daylit offices (BRE)
- CIRIA Guide 635, Designing for Exceedance in Urban Drainage – Good Practice.
- CIRIA Guide 697 The SUDS Manual
- BRE Environmental & Sustainability Standard – BREEAM offices 2008 Assessor Manual

Revision History:

Issue	Date	Description
1	18th September 2000	Reformatted - LU Facilities
2	December 2010	Reformatted and revised as TfL Head Office Standards

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05

Bird Repellant Measures

Issue 2 — December 2010



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05 Bird Repellent Measures

1 Scope

This Standard sets out general requirements for bird repellent measures for non-operational premises intended for use as offices by Transport for London.

2 References

This Standard should be read in conjunction with the accompanying Manual to the Standards.

It shall be the responsibility of the designer/installer to reference and comply with all the above and any other Standards where necessary.

Relevant British Standards referred to in the text are listed on the rear cover. Unless otherwise stated, references are to the latest editions and revisions.

3 Definitions / Abbreviations

For a list of general definitions and abbreviations used within the Standards please see the accompanying Manual to the Standards.

Definitions specific to this standard are:

Historic Buildings:

Historic buildings are defined as:

- Listed buildings.
- Existing buildings situated in conservation areas (where the building itself has conservation status and contributes to the status of the conservation area).
- Existing buildings which are of architectural and historical interest and which are referred to as a material consideration in a local authority's development plan.

- Existing buildings of architectural and historic interest within national parks, areas of outstanding natural beauty and world heritage sites.

4 General Guidance

The prolonged presence of birds on buildings can have a damaging effect upon the building's fabric, as well as being unsightly and a possible health hazard. Older buildings with ornate facades are particularly susceptible to bird presence.

The proposed installation and methods of fixing must be approved by the Infrastructure Manager prior to commencement of the work.

Where the building is in a conservation area, or listed as being of architectural or historical interest, the system adopted must be approved by the local authority.

Deterrents should comply with RSPB, RSPCA, DEFRA guidelines and the Wildlife and Countryside Act 1981.

5 Construction Design and Management Regulations (CDM)

Reference should be made to the Manual to the Standards for requirements under the CDM regulations.

6 Design Standards

An assessment of the existing building fabric and the types of birds that are to be deterred must be carried out and specific design and cost proposals submitted as part of the design. Generally roost inhibitors such as stainless steel pre-tensioned wires shall be used on horizontal ledges. Nets and guards for service openings and louvres. For buildings of historical interest the use of passive deterrents such as the use of hawks / falcons may be considered.

Any penetrations for fixings shall not be detrimental to the fabric penetrated, for instance by creating water ingress.

6.1 Stainless Steel Pre-tensioned Wires
Stainless steel pre-tensioned wire systems shall be of proprietary manufacture unless agreed otherwise with the Infrastructure Manager and shall be used only where they will not impair the free opening of windows.

Wires shall be spring loaded and made of 1mm diameter stainless steel

Support pins shall be 120mm x 4mm diameter marine grade 316 stainless steel. Pins shall be flattened and drilled at one end to accommodate a 1mm diameter wire or tensioning spring.

A 10mm collar shall be provided at each pin fixing point.

Where ledges are greater than 200mm wide multiple rows of wires shall be considered.

6.2 Anti-bird Netting

Netting shall be retained on all edges by galvanized steel perimeter cables attached to the building structure using proprietary wall fixings or chemical anchors.

Allowance shall be made for access panels, with heavy duty zippers for instance, made for cleaning, maintenance, security or safety purposes where required.

Anti-bird netting shall have a design life of 10 years.

6.3 Bird Repellent Gel

Bird repellent gel shall only be used where:

- Drilling of the structure is impractical or undesirable.
- The surface to be protected is too small or narrow to allow the installation of wires.
- Other methods would impair the use of windows.

Bird repellent gels shall be non-toxic and shall not cause any staining or damage to the surface of the structure.

6.4 Anti-bird / Anti-climb Matting

Matting shall consist of polyurethane and shall be fixed in accordance with the manufacturer's recommendations.

7 Design / Contractor Submittal Requirements

Reference should be made to the Manual to the Standards for general requirements for drawing and sample submittal requirements.

8 Materials Standards

Netting shall be of fine gauge polyethylene cord forming a 50mm x 50mm mesh.

All materials must be specified / sourced and installed in accordance with the parameters set out in TfL Standards GRN 01.

9 Installation

The entire system shall be installed in accordance with the manufacturer's recommendations.

Wires should be installed to ensure maintenance and window cleaning activities can still be safely and conveniently achieved.

Any detritus removed for access or installation shall be the responsibility of the contractor, and the detritus shall be double bagged and removed from site and disposed of in an approved manner. Recycling opportunities shall be explored.

Note.

Pigeons are potential transmitters of disease. Suitable personal protective equipment should be used when handling bedding and droppings.

10 Handover

Reference should be made to the Manual to the Standards for general requirements for handover and submissions required for the Operation and Maintenance Manual.

The following information shall be provided specifically for bird repellent measures in good time for inclusion in the buildings Operation and Maintenance records;

- Complete and verified set of marked up as built drawings indicating the location and type of bird repellent measure installed.
- Full details of all training requirements, maintenance regimes and materials required to maintain the works undertaken. This is to include any tasks that will in any event be carried out by the works contractor or principal contractor as part of the defects liability period responsibilities / works.
- Full details of any replacement / relocation works that may reasonably be foreseen during the design life of the works.
- Details of locations of all source materials and components required to carry out the above maintenance and replacement works.
- Contact details of the works package contractor and all other associated companies or operatives.
- Full details of how the works are to be dismantled, removed and disposed of at the end of their design life - maximizing the opportunity for recycling.
- All method statements required to cover those works identified above including the identification of any access platforms or other plant etc. required to facilitate the works.

11 Maintenance

When new equipment is added or alterations are made to existing installations, there shall be no detrimental impact on the ease of maintenance of existing facilities unless through dispensation from the Infrastructure Manager.

Regular inspections will be required to ensure that the device used remains free from debris such as falling leaves which may result in it becoming less effective.

Visual inspection to window ledges shall be carried out in conjunction with window cleaning. All other inspection should fall within regular building inspections.

12 Further information

- D.E.F.R.A
- R.S.P.C.A
- Association of Wildlife Trust
Consultancy
- BRE Digest 415

Revision History:

Issue	Date	Description
1	18th September 2000	Reformatted - LU Facilities
2	December 2010	Reformatted and revised as TfL Head Office Standards



02

Doors

Issue 4 — December 2010



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02 Doors

1 Scope

This Standard sets out requirements for new doors and door furniture in non-operational premises intended for use as offices by TfL.

2 References

This Standard should be read in conjunction with the accompanying Manual to the Standards and with TfL Standards RED 01, 03.

It shall be the responsibility of the designer/installer to reference and comply with all the above and any other TfL Standards where necessary.

Relevant British Standards referred to in the text are listed on the rear cover. Unless otherwise stated, references are to the latest editions and revisions.

3 Definitions / Abbreviations

For a list of general abbreviations and definitions used within the Standards please see the accompanying Manual to the Standards.

Abbreviations specific to this standard are;

- Light Reflectance Value (LRV) is the total quantity of visible light reflected by a surface at all wavelengths and directions when illuminated by a light source.

4 General guidance

General guidance for doors and ironmongery, found in *Designing for Accessibility, 2004* and *Specifier's Handbook for Inclusive Design* -

Architectural ironmongery, should be adhered to at all times.

The surface finish of the door should contrast visually with the wall with a LRV difference of 30 points between door and wall.

All opening and critical dimensions should be checked and verified by the contractor prior to manufacture.

When specifying external doors, consideration should be given by the specifier as to any planning restrictions such as applied to listed buildings / buildings within conservation areas.

5 Construction Design and Management Regulations (CDM)

Reference should be made to the Manual to the Standards for requirements under the CDM regulations.

6 Design Standards

6.1 External Doors

External doors shall meet the minimum U-Values as set out in TfL Standard GRN 02 or those contained in the approved document Part L - whichever has the greatest performance.

Draught lobbies should be used in preference to air curtains where possible.

Where practicable external doors shall be 'Secured by Design'.

6.2 Doors

Doors shall comply with the requirements of BS 4787.

All new door leaves shall be of ½hour minimum fire resistant construction as defined in The Building Regulations 2000- Approved Document B.

All new doors shall have a clear opening not less than 825mm wide x 2000mm high. (See Fig. 1)

Generally, doors shall be hung to swing into rooms or in the case of fire escape routes, in the direction of egress from the building. An unobstructed space of at least 300mm should be provided between the leading edge of a door (when it opens towards you) and a return wall, unless the door is opened by automatic control.

Any door across a corridor or passageway, or providing access to an office or meeting room, and any door hung to swing in two directions, shall be provided with a clear glazed vision panel giving a continuous zone of visibility from 500 to 1500mm from finished floor level (See Fig. 2).

Door frames and linings should be blocked off walls, wherever possible, to allow for full architraves (See Fig. 3).

For refurbishment work, or work carried out in existing buildings, doors and door frames should match the existing where possible.

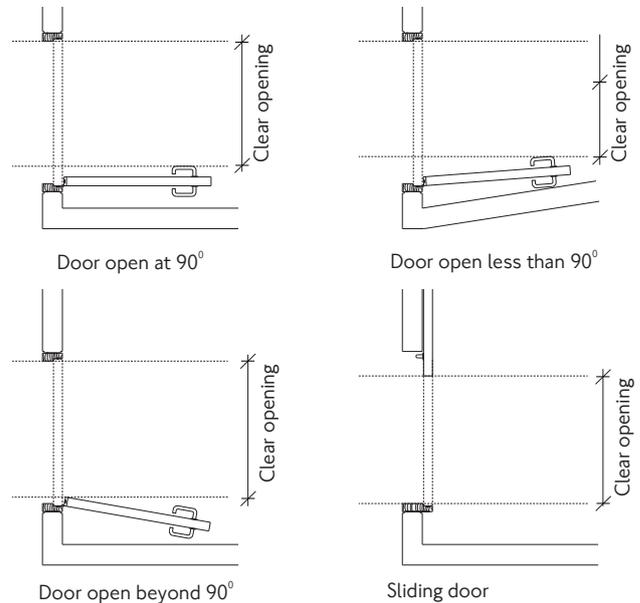


Fig. 1 Clear openings through doors.

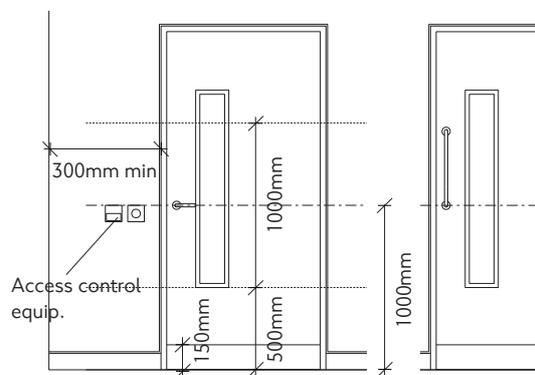


Fig. 2 Door Elevations.

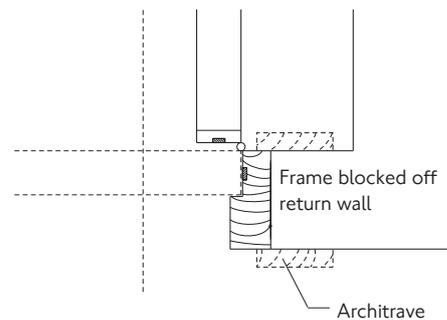


Fig. 3

Steel door sets shall be used where application dictates e.g. doors with fire rating greater than 1 hr.

Doors shall be full height i.e with no over panels (See Fig. 4).

6.3 Door furniture

Door furniture shall comply with BS EN 1906 and BS 8300. All handles / locks etc should contrast visually with the surface of the door.

Door furniture shall be of stainless steel G.316 and of a Grade 3 category of use.

Door furniture should comply with the recommendations of the Door and Hardware Federation, Code of Practice for Hardware for Fire and Escape Doors, July 2009.

Generally door handles shall be of lever type. positioned 1000mm above finished floor level. Pull handles should be located with the low end 1000mm above finished floor level. The position and style of door furniture should be consistent throughout the building (See Fig. 2).

The cylinder type should be of euro cylinder type unless agreed otherwise with the Infrastructure Manager.

Doors where no latch is provided (e.g. doors within corridors) should be provided with push plates and pull handles. Double doors hung to swing in two directions shall be provided with a push plate on the left hand leaf and a pull handle on the right hand leaf when approached from either direction.

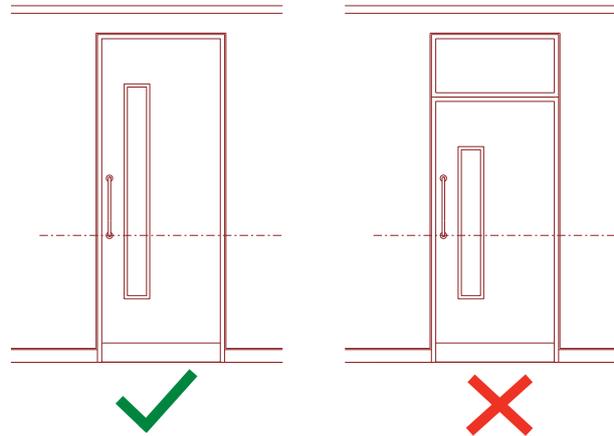


Fig. 4 Door Elevations.

All self closing door devices should have 'controlled' action and conform to BS EN 1154.

150mm high metal kicker plates shall be provided on both sides of all doors to corridors and sanitary accommodation.

Doors subject to regular use by wheeled traffic, i.e. mail rooms, store rooms, etc. shall be provided with half door height metal kicker plates.

Handles on self locking doors, for example to cold rooms, shall be provided with emergency lever overrides.

Door furniture (including closers and retainers) shall be in accordance with the requirements of the Building Regulations - Approved Document B and the Fire Precautions Act 1971.

Access control / break glass boxes shall be located in accordance with BS 8300 and be positioned on a door handle datum line (See Fig. 2).

7 Design / Contractor Submittal Requirements

Reference should be made to the Manual to the Standards for general requirements for drawing and sample submittal requirements. Requirements specific to this Standard and requiring approval from the Infrastructure Manager are:

- A door schedule detailing the proposed type, finish, required fire rating of all new and modified doors must be included in the design.
- A fully coordinated ironmongery schedule must be included in the design.
- A fully coordinated lock suiting schedule providing for a minimum of three levels of suiting must be included in the design.

8 Materials Standards

All materials must be specified / sourced and installed in accordance with the parameters set out in TfL standards GRN 01 which includes requirements for sustainable timber.

Reference should also be made to the TfL Product Selector for examples of materials and colours of wall finishes acceptable to TfL.

All colours shall be approved by the Infrastructure Manager prior to commencement of works.

The surface finish of doors should be chosen in accordance with the use of the surrounding areas and the required fire performance. Painted doors must receive factory priming / sealing. Doors to receive a veneer finish must be factory finished in hardwood veneer and clear varnish requiring no additional decoration.

9 Installation

Door furniture must be securely fixed with bolt through fixings. Low friction hinges should be used to improve door swing and minimize opening and closing forces

The type, number and position of hinges should be determined by the door size and weight. A minimum of three hinges should be provided for each door.

10 Handover

A minimum of three keys for each cylinder to differ should be provided. Exact numbers to be agreed with Infrastructure Manager.

Note:
Door furniture should be re-checked at the end of rectification period as adjustments may be required to door handles / closers etc.

All doors should be checked for defects prior to handover. The surface finish should be such that defects would not be apparent with a matt paint finish.

Certification: independently certified evidence must be provided to show that all incorporated components comply with performance requirements and requirements for fire resistance if tested to BS 476-22, BS EN 1634-1 or BS EN 1634-3.

Reference should be made to the Manual to the Standards for general requirements for handover and submissions required for the Operation and Maintenance Manual.

The following information shall be provided specifically for doors in good time for inclusion in the building's Operation and Maintenance records:

- Complete set of as built drawings to include items set out in Section 7.

11 Maintenance

Where new doors are added or alterations are made to existing installations there shall be no detrimental impact on the ease of maintenance of existing facilities unless through dispensation from the Infrastructure Manager.

Regular maintenance is essential to ensure continued performance of doors and door furniture and maximise product life span. Maintenance should be carried out strictly in accordance with manufacturer's instructions and details included in the Operation and Maintenance manuals.

12 Further information

Further information on compliance with the requirements of BS 1906 can be found in ABMH (Association of Building Hardware Manufacturers) Best Practice Guide – Lever Handles and Knob Furniture to BS EN 1906. Additional information can be sourced from the following.

- British Wood Preserving and Damp Proofing Association
- Door and Shutter Manufacturer's Association.
- Intumescent Fire Seal Association
- Timber Research and Development Association (TRADA)

Revision History:

Issue	Date	Description
1		Preliminary Issue
2	20th November 1999	Minor Revisions
3	18th September 2000	Reformatted - LU Facilities
4	December 2010	Reformatted and revised as TfL Head Office Standards

Relevant British / European Standards

BS 8300	Design of buildings and their approaches to meet the needs of disabled people – Code of practice
BS 4787	Internal and external wood doorsets, door leaves and frames.
BS 8214	Code of practice for fire door assemblies with non-metallic leaves
BS 8424	Building hardware - Pull handles - Requirements and test methods
BS EN 179	Building hardware -Emergency exit devices operated by a lever handle or push pad - Requirements and test methods
BS EN 1125	Building hardware - Panic exit devices operated by horizontal bar - Requirements and test methods
BS EN 1154	Building hardware - Controlled door closing devices -Requirements and test method
BS EN 1155	Building hardware - Electrically powered hold-open devices for swing doors - Requirements and test methods
BS EN 1906	Building hardware – Lever handles and knob furniture – Requirements and test methods
BS EN 1935	Building hardware - Single-axis hinges - Requirements and test methods
BS EN 12209	Building hardware - Locks and latches - Mechanically operated locks, latches and locking plates - Requirements and test methods.

03

Fire Stopping and Fire Barriers

Issue 1 — December 2010



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03 Fire Stopping and Fire Barriers

1 Scope

This Standard sets out general requirements for fire stopping to walls, soffits, service ducts and any other fire barriers in non-operational premises intended for use as offices by Transport for London (TfL).

This Standard supersedes LUF-F003-ST Fire stopping to walls, soffits and service ducts.

This Standard applies to every contractor or installer working for TfL or within the TfL environment.

2 References

This Standard must be read in conjunction with the Manual to the Standards and TfL Head Office Standards RED 03, 04, GRN 01.

It shall be the responsibility of the designer/installer to reference and comply with all the above and any other TfL Standards where necessary.

The information on fire stopping section in Section B3 of Approved Document B, should be read in conjunction with any Standard relevant to the works being completed including those above, together with British Standards referred to in the text and listed on the rear cover. Unless otherwise stated, references are to the latest editions and revisions.

3 Definitions / Abbreviations

For a list of general abbreviations and definitions used within the Standards please see the accompanying Manual to the Standards.

4 General Guidance

This Standard applies to every contractor or installer working for or within the TfL environment. It shall be the responsibility of the contractor to allow for, and enable the remedying of, any breach or disturbance made in a fire barrier, compartmentation or existing fire stopping.

An understanding of the design function of various elements of the building fabric (walls etc.) prior to commencing works is key to ensuring that their integrity is maintained during and following any works that may involve penetrating such a barrier.

The designer and/or contractor shall consult with the Infrastructure Manager prior to commencing works. In particular, advice will be sought before breaching any barrier to confirm the fire safety status of the barrier (by consulting fire safety records and plans). If necessary a fire risk assessment will be carried out before commencing work that will consider:

- The necessity for the breach
- The size of the breach
- The time needed for works
- The fire protection needed for any penetrations
- Any special precautions needed during the works (especially where and when the unprotected breach is open)
- The suitability of any temporary and final method of fire stopping

Fire protection in buildings subject to the provisions of Section 20 of The London Building Acts (Amendment) Act 1939 (Section 20 Buildings) which apply in inner London boroughs, may need to be to a higher standard and therefore additional design advice may be required.

Advice from manufacture’s and suppliers should be sought before the specification is provided.

Fire stopping and fire barriers shall comply with the requirements of the Building Regulations 2000.

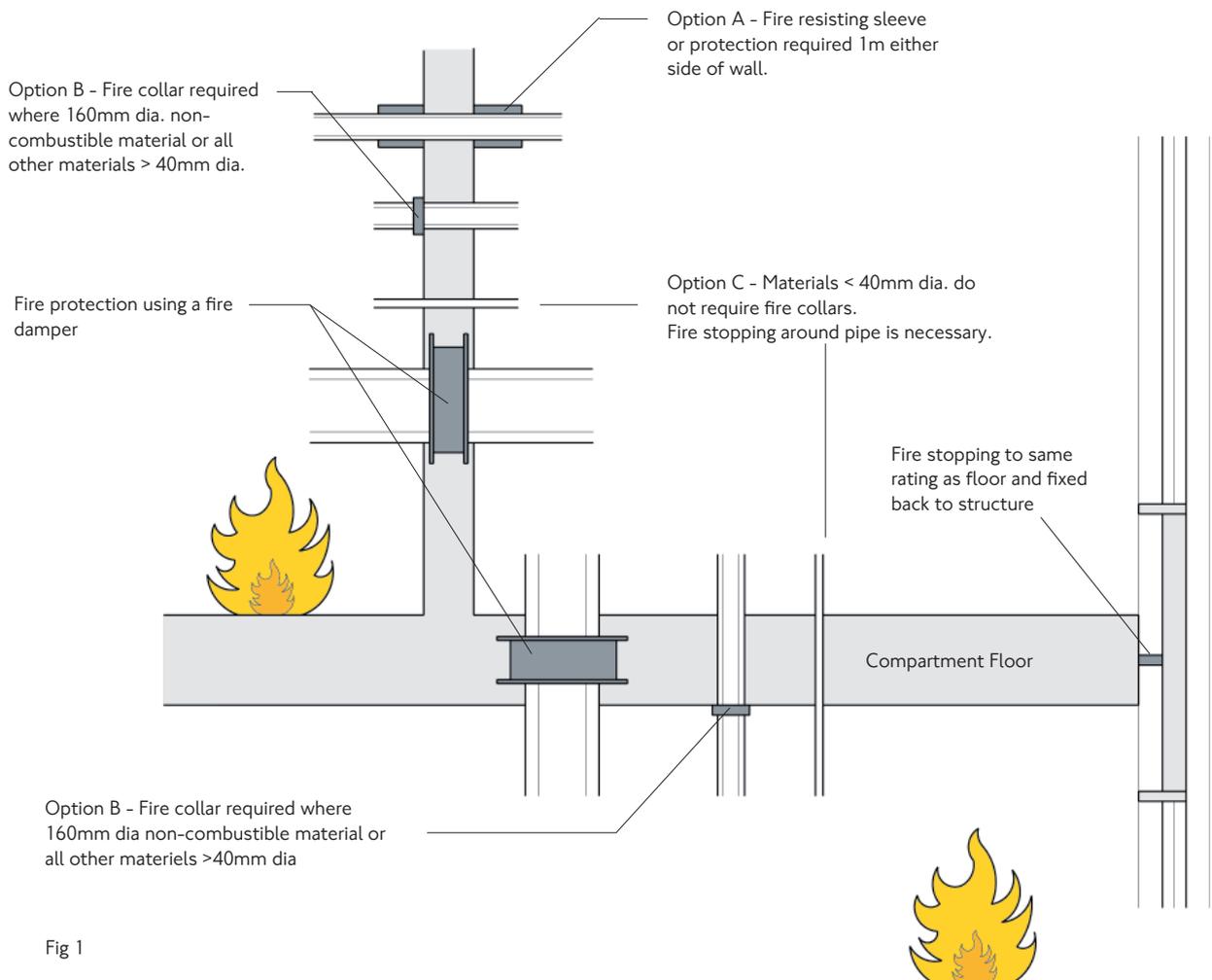


Fig 1

Any exhaust points should be sited so as not to further jeopardize the building in the event of a fire and should be located away from final exits, combustible building cladding or roofing material and openings to the building.

5 Construction Design and Management Regulations (CDM)

Reference should be made to the Manual to the Standards for requirements under the CDM regulations.

6 Design Standards

Fire barriers and/or and associated Standard details shall have been tested and comply with the tests in the BS 476, Fire tests on building materials and structures.

The recommendations in BS5588-9:1999; Fire precautions in the design, construction and use of buildings, Part 9, Code of Practice for Ventilation and Air Conditioning Ductwork: should be followed where relevant. It may also be possible to use the content of BS9999:2008, Code of Practice for Fire Safety in the Design, Management and Use of Buildings: where it has been previously agreed with the Infrastructure Manager.

A health and safety document should be provided for the works.

Where possible, any works should not be sited so that they affect the integrity of building structure. Where this is not possible, additional works will ensure there is adequate support to all walls, floors and structures affected by the works.

7 Design / Contractor Submittal Requirements.

Reference should be made to the Manual to the Standards for general requirements for drawing and sample submittal requirements.

8 Equipment Standards

Smoke detectors and automatic release mechanisms used to actuate fire/smoke dampers should conform to BS5445-7:1984 (or BSEN 54-7: 2001) and BS5839-3:1998 respectively.

9 Material Standards

Fire dampers and their frames shall have been of type shown to satisfy the test in BS476-20: 1987.

Fire rated ductwork should be of type shown to satisfy the test in BS476-24: 1987.

Where pipework passes through a fire barrier or fire rated wall, one of the following approaches is acceptable:

- Provide a proprietary seal system which has been shown by test to maintain the fire resistance of the fire barrier, wall or floor.
- Pipes with a maximum diameter of 160mm that are of non-combustible material but could soften under temperature loading e.g. lead, aluminium, aluminium alloy, may be used with a sleeving of a non-combustible pipe. The sleeve should extend at least 1000mm either side of the opening.

- Pipes with a maximum diameter of 160mm that are of non-combustible material (which will not soften at temperatures of 800°C): e.g. cast iron, copper or steel)
- Contain the pipework within a protected shaft, where the fire rating of the shaft should be at least that of the construction through which it passes.

Services passing through a fire separating element should be fire stopped (i.e. pipes, ducts, conduits or cables). A proprietary fire-stopping and sealing system which have been shown by test to fire stop elements include:

- Cement mortar.
- Gypsum-based plaster.
- Cement-based or gypsum-based vermiculite / perlite mixes.
- Glass fibre, crushed rock, blast furnace slag or ceramic-based products (with or without resin binders).
- Intumescent mastics / foams.

The environmental impact of the chosen material should be taken into consideration and TfL Standard GRN 01 Environmental Guidelines for general guidance on materials should be consulted.

10 Installation/ Workmanship Standards

Where any fire barrier is breached or existing fire stopping disturbed it will be the responsibility of the contractor/installer to allow for and follow a suitable and sufficient scheme of work that includes preparation, carrying out the works together with any necessary follow up actions.

Where the fire barrier, fire rated wall or floor is penetrated by services, they should be;

- Kept as few in number and small as possible.
- Be suitably fire stopped.
- The fire stopping should allow for thermal movement in the case of ductwork and pipes.

Joints between fire separating elements (i.e. at the junction between walls and floors; walls and walls etc) should be fire stopped and designed to standard details.

Fire barriers shall be securely fixed to soffits using mild steel straps or angles and mild steel screws at not less than 300mm centres. Ventilation ductwork passing through fire rated walls or fire barriers shall be fitted with fire dampers of a type approved by the Infrastructure Manager, with a fire rating equivalent to that of the wall or fire barrier.

Fire dampers should be provided in the duct work that passes through compartment walls or the ductwork should be contained within a fire rated shaft. In either case the fire rating should be equivalent to the element through which it passes.

Where ductwork passes through and is open to escape routes; it should be provided with a fire and smoke damper to the fire rating of the compartment which it passes.

Class A duct doors shall be:

- Used where sealing between floors is impractical or uneconomical or where future services are to be provided for.

- Capable of providing one hour fire resistance and shall be constructed of 25mm thick Monolux or similar panelling within a steel frame. Finishes shall be Class O as defined in the Building Regulations.

Class B duct doors

May be used where joints around edges of services are adequately sealed and shall be capable of providing half hour fire resistance and shall be constructed of 12.5mm thick Monolux or similar panelling within a steel frame.

11 Testing and Commissioning

All fire dampers should be tested by competent persons on completion of the installation.

12 Handover

The handover of any fire stopping works is important as it impacts on future works, statutory risk assessments and maintenance.

Reference should be made to the Manual to the Standards for general requirements for handover and submissions required for the Operation and Maintenance Manual.

The following information shall be provided specifically for Fire Stopping in good time for inclusion in the building's Operation and Maintenance Manual:

- A complete set of 'As Built' drawings in .pdf and .dwg format. The drawings will clearly show the location of any works, the

materials used in the works and method used to achieve the fire stopping.

- Dimensions should be included to show the sizes of any service passing through compartmentation.
- Details of any structural re-enforcement or structural supports that were necessary as part of the works.
- Full manufacturer's details of any equipment.
- Full details of all maintenance regimes and materials to carry out the works.
- Details and locations of access hatches.
- Locations of any areas that require maintenance.
- Details of the life expectancy or replacement time of materials.
- Contact details of works package contractors and associated companies or operatives.
- If relevant, full details of how the works could be dismantled if required in the future.

13 Maintenance

When new equipment is added or alterations are made to existing installations there shall be no detrimental impact on the ease of maintenance of existing facilities, unless through dispensation from the Infrastructure Manager.

Using the information in Section 12 above all fire dampers should be tested by competent persons at regular intervals not exceeding two years. Access points for maintenance must be located on the 'As Built' drawings. Any information on the control of dampers will be provided to the Infrastructure Manager.

The ease of maintenance should be considered when installing equipment which will require maintenance.

14 Further Information

- The Building Regulations 2000
- The London Building Acts (Amendment) Act 1939

04

Insulation to Building Thermal Elements

Issue 1 — December 2010



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04 Insulation to Building Thermal Elements

1 Scope

This Standard sets out the minimum requirements for thermal insulation to the thermal elements of the building fabric. An improvement of 44% on performance levels set in Part L of the Approved Documents shall be achieved. This requirement shall include instances of consequential improvement required by Approved Document Part L or as set out in the Manual to the Standards.

This Standard supersedes LUF F004 ST Insulation of Roof Voids.

2 References

This Standard should be read in conjunction with the accompanying Manual to the Standards and TfL Standards RED 07, YEL 01, GRN 01, 02, 03 BLU 02, 04.

It shall be the responsibility of the designer/installer to reference and comply with all the above and any other TfL Standards where necessary.

Relevant British Standards referred to in the text are listed on the rear cover. Unless otherwise stated, references are to the latest editions and revisions.

3 Definitions / Abbreviations

For a list of general abbreviations and definitions used within the Standards please see the accompanying Manual to the Standards.

Definitions specific to this Standard are:

- Thermal element
Walls, floor or roof that separates a thermally conditioned part of the building

from an unconditioned or external environment (see Approved Documents Part L for full definition).

- Consequential improvements:
Energy efficiency improvements required to be made to existing buildings over 1000m² total useful floor area where the proposed building work consists of:
 - an extension;
 - the first installation of fixed building services; or
 - an increase in to the installed capacity of any fixed building services.

Reference should be made to the Approved Document Part L for guidance on circumstances where exemption from consequential improvements exists.

- Historic Buildings are defined as:
 - Listed buildings
 - Existing buildings situated in conservation areas (where the building itself has conservation status and contributes to the status of the conservation area).

- Existing buildings which are of architectural and historical interest and which are referred to as a material consideration in a Local Authority's development plan.
- Existing buildings of architectural and historic interest within national parks, areas of outstanding natural beauty and world heritage sites.
- Insulation Index: A measure of performance used in BREEAM assessments that seeks to assess the thermal properties of insulation products used in the building relevant to the embodied impact of that insulating material.

4 General Guidance

Reducing the amount of energy used from fossil fuels is one of the most important factors in promoting sustainability. Insulation has significant potential for reducing CO₂ emissions with the energy conserved through insulation use far outweighing the energy used in its manufacture.

Where work of intermediate refurbishment level and above are undertaken, opportunities to improve the thermal performance of the building fabric will be required.

For all refurbishment works reference must also be made to Part L2B of the approved documents in order to ascertain whether 'consequential improvements' will be required as a result of the work undertaken.

Where improvements are required to be made to thermal elements, U-values listed in TfL Standard GRN 02 should be met. Where this is not possible for economic, space planning

or other reasons dispensation must be granted from the Infrastructure Manager. Procedures outlined in the Approved Documents must be followed.

There is a high risk of condensation forming within the insulation therefore measures must be taken to avoid this. Ventilation of roof voids should be in accordance with BS 5250 - Code of Practice for the Control of Condensation in Buildings.

All thermal insulation shall be designed, specified and installed in accordance with BRE publication Thermal Insulation: Avoiding Risks.

Where improvements to the thermal elements of Historic Buildings are proposed / required a specialist study must be undertaken by a heritage conservation specialist, who is a full member of the Institute of Historic Building Conservation, to investigate the implications of improving the fabric performance whilst minimising detrimental effects to the character and condition of the existing building. The report should make recommendations for improvements in accordance with English Heritage's 'Balancing the Needs for Energy Conservation With Those of Building Conservation: an Interim Guidance Note on the Application of Part L.' and minimum requirements set out in BRE Environmental & Sustainability Standard – BES5055.

Any insulation installation shall not compromise fire compartmentation which must be taken into account at the design stage. E.g. there may be a danger that cavity wall insulation may bypass fire compartmentation.

5 Construction Design and Management Regulations (CDM)

Reference should be made to the Manual to the Standards for requirements under the CDM regulations.

6 Design Standards

All new thermal elements must achieve a building element rating of 'A' according to the Green Guide to Specification.

Where the design of new roof elements are undertaken, green roofs must be considered.

All insulation must comply with the latest relevant British and European Standards (see Appendix 1).

All insulation must be designed and specified in accordance with the specific nature of the work undertaken and / or the building use and existing fabric.

An initial assessment must be undertaken to determine the most appropriate position of the building thermal envelope.

Where insulation is retro fitted to an existing roof void, an assessment of the existing condition of the roof, (whether a cold or warm roof, ventilated or unventilated), shall be made before a correspondingly suitable insulation material can be chosen (See Figs. 1,2).

Where insulation is retro fitted to walls, an assessment of wall type (whether cavity or external / internal lining of insulation is more appropriate to the building application) must be made before a correspondingly suitable

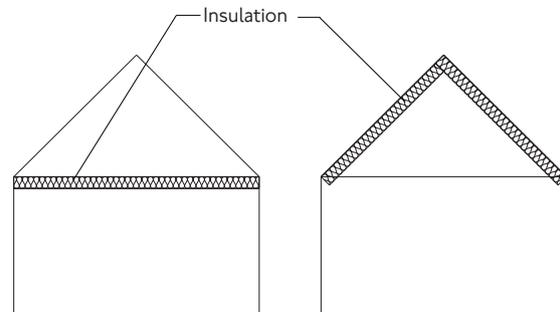


Fig. 1 Cold / Warm Roof

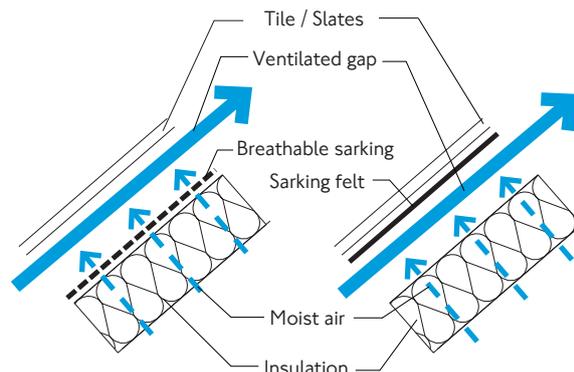


Fig. 2 Unventilated / Ventilated Roof

insulation material can be chosen. Where an external lining of insulation is considered, planning restrictions must be taken into account (See Fig. 3).

Roof insulation must be continuous with wall insulation to avoid thermal bridging.

Where improvements to thermal elements are proposed they must be accompanied with a cost analysis demonstrating a pay back of not more than 15 years unless an alternative period is agreed through dispensation from the Infrastructure Manager.

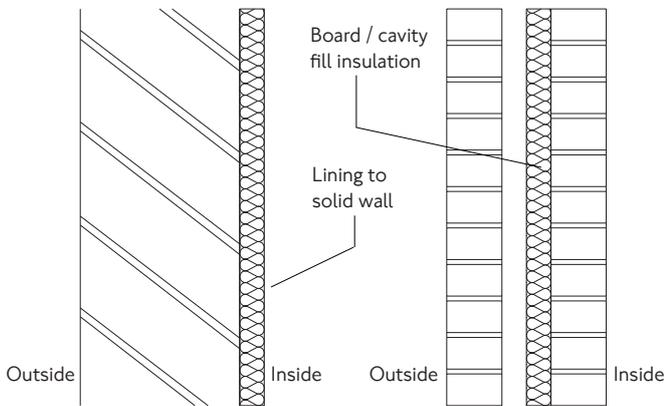


Fig. 3 Solid wall internal insulation / Cavity wall insulation

selected with the highest Green Guide to Specification rating possible. Subsequently choice should be made with the following selection hierarchy:

- 1 Insulation derived from organic sources (e.g. sheep's wool, cellulose batts).
- 2 Insulation derived from naturally occurring minerals (e.g. glass mineral wool, rockwool).
- 3 'Multi-foil' insulation (e.g. radiant barriers).
- 4 Insulation derived from fossilized vegetation. (e.g. expanded polystyrene beads).

7 Design / Contractor Submittal Requirements

Reference should be made to the Manual to the Standards for general requirements for drawing and sample submittal procedures and requirements.

8 Materials Standards

CFCs and HCFCs should not be present in the materials used or in their production. All insulation materials must achieve a Green Guide rating of 'A'.

Thermal properties of insulating materials must outweigh the relevant embodied environmental impact of that material. An Insulation Index greater or equal to 2 must be achieved as calculated in accordance with BRE Environmental & Sustainability Standard BES5055, BREEAM Offices 2008 Assessor Manual.

The choice of insulation will primarily depend on the desired performance and should be

Insulation shall be classified as Class O to BS 476.

All materials must be specified / sourced and installed in accordance with the parameters set out in TfL Standards GRN 01 – Environmental Guidelines.

9 Installation

Installation shall be strictly in accordance with the latest British Standards and with manufacturer's recommendations.

All joints between rigid boards shall be installed without gaps, tapped and sealed.

10 Handover

Reference should be made to the Manual to the Standards for general requirements for handover and submissions required for the Operation and Maintenance Manual.

The following information shall be provided specifically for insulation to building thermal elements:

- Complete and verified set of marked up as built drawings and specification confirming the location of insulating materials and the area (m²) and thickness (m) or volume of insulation specified as detailed in section 7.
- Manufacturer's technical details confirming the thickness and thermal conductivity of the insulation materials specified.
- Evidence of compliance with an approved certification scheme for responsibly sourced materials.
- Full details of how the works are to be dismantled, removed and disposed of at the end of their design life - maximising the opportunity for recycling.

11 Maintenance

When new equipment is added or alterations are made to existing installations, there shall be no detrimental impact on the ease of maintenance of existing facilities unless through dispensation from the Infrastructure Manager.

Maintenance should be minimal, however where cavity / void inspection is required means for inspection such as access panels should be provided and indicated on drawings included in the Operation and Maintenance manual.

12 Further information

- The Flat Roofing Alliance
- National Insulation Association
- British Urethane Foam Contractors Association
- BRE Loss Prevention Certification Board (LPCB)

Revision History:

Issue	Date	Description
1	December 2010	New standard created superseding F004 ST Insulation of roof Voids

Relevant British / European Standards

BS 476-3	Fire tests on building materials and structures. Classification and method of test for external fire exposure to roofs
BS 3958-5	Thermal insulating materials. Specification for bonded man-made mineral fibre slabs
BS 5250	Code of practice for control of condensation in buildings
BS 6229	Flat roofs with continuously supported coverings. Code of practice
BS EN 13162	Thermal insulation products for buildings. Factory made mineral wool (MW) products. Specification
BS EN 13163	Thermal insulation products for buildings. Factory made products of expanded polystyrene. Specification
BS EN 13164	Thermal insulation products for buildings. Factory made products of extruded polystyrene foam (XPS). Specification
BS EN 13165	Thermal insulation products for buildings. Factory made rigid polyurethane foam (PUR) products. Specification
BS EN 13166	Thermal insulation products for buildings. Factory made products of phenolic foam (PF). Specification
BS EN 13167	Thermal insulation products for buildings. Factory made cellular glass (CG) products. Specification
BS EN 13168	Thermal insulation products for buildings. Factory made wood wool (WW) products. Specification
BS EN 13169	Thermal insulation products for buildings. Factory made products of expanded perlite (EPB). Specification
BS EN 13170	Thermal insulation products for buildings. Factory made products of expanded cork (ICB). Specification
BS EN 13171	Thermal insulation products for buildings. Factory made wood fibre (WF) products. Specification

Revision History:		
Issue	Date	Description
1	December 2010	Supersedes LUF-F003-ST Fire stopping to walls, soffits and service ducts.

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Relevant British / European Standards

BS 476	Fire tests on building materials and structures
BS 5445-7	Components of automatic fire detection systems. Specification for point-type smoke detectors using scattered light, transmitted light or ionization
BS 5588-9	Fire precautions in the design, construction and use of buildings. Part 9 Code of practice for ventilation and air conditioning ductwork
BS 5839-3	Fire detection and alarm systems for buildings. Specification for automatic release mechanisms for certain fire protection equipment
BS 9999	Code of practice for fire safety in the design, management and use of buildings
BS EN 54-7	Fire detection and fire alarm systems. Smoke detectors. Point detectors using scattered light, transmitted light or ionization
BS EN 1366-3	Fire resistance tests for service installations. Penetration seals.

Revision History:		
Issue	Date	Description
1	December 2010	Supersedes LUF-F003-ST Fire stopping to walls, soffits and service ducts.

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Relevant British / European Standards

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BS 5588-9	Fire precautions in the design, construction and use of buildings. Part 9 Code of practice for ventilation and air conditioning ductwork
BS 5839-3	Fire detection and alarm systems for buildings. Specification for automatic release mechanisms for certain fire protection equipment
BS 9999	Code of practice for fire safety in the design, management and use of buildings
BS EN 54-7	Fire detection and fire alarm systems. Smoke detectors. Point detectors using scattered light, transmitted light or ionization
BS EN 1366-3	Fire resistance tests for service installations. Penetration seals.

01

Windows

Issue 2 — December 2010



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Rear Cover - Relevant British / European Standards

01 Windows

1 Scope

This Standard sets out general requirements for windows for non-operational premises intended for use as offices by Transport for London.

2 References

This standard should be read in conjunction with the accompanying Manual to the Standards and TfL standards RED 05, 07, GRN 01, 02, 03 BLU 01, 02, 03, 04, 13.

It shall be the responsibility of the designer/installer to reference and comply with all the above and any other TfL Standards where necessary.

Relevant British Standards referred to in the text are listed on the rear cover. Unless otherwise stated, references are to the latest editions and revisions.

3 Definitions / Abbreviations

For a list of general abbreviations and definitions used within the standards please see the accompanying Manual to the Standards.

Definitions specific to this standard are;

- Hard coat Low-E glazing
Basic Building Regulations 2000 standard coating.
- Soft coat Low-E glazing
High performance sputter coated glazing capable of significant further improvements in thermal insulation and solar control without significant light transmission reductions.

- Centre of Pane U-Value
U-value quoted by glazing manufacturer.
- Window System U-value
Whole glazing system U-value required to be calculated to prove building regulation compliance.

4 General Guidance

All windows shall comply with the requirements of:

- The Building Regulations 2000
- The Town and Country Planning Act 1990
- The Planning (Listed Buildings and Conservation Areas) Act 1990.

When considered from first principles, for example in new buildings, it is clear that the design of window openings will have far reaching implications: from aspects such as building form to issues relating to passive design and the internal environment of the end user. It is therefore important that a holistic approach is taken and that this document is read in conjunction with other corresponding Standards.

There is also a wealth of documentation ranging from publications such as CIBSE, Lighting Guide LG10: Daylighting and window design, which addresses first principles of window design, to more specific material

performance specifications of particular window systems. This Standard cannot therefore cover all areas but seeks to summarise key points and should be used for guidance only.

The proposed design of all windows must be agreed with the Infrastructure Manager before any work commences and take into account location and planning requirements. Where refurbishment is undertaken, an assessment must be made as to whether the degree of work undertaken will trigger consequential improvements under Part L of the Approved Documents. Criteria for levels of refurbishment as set out in the Manual to the Standards must also be followed.

New windows must take into account accessibility requirements as set out in BS 8300: 2009 – Design of buildings and their approaches to meet the needs of disabled people. Where the existing conditions and any restrictions allow the requirements should be followed wherever possible when windows are replaced.

Window manufacturers and installers shall have a quality management system in place assessed to ISO 9001.

5 Construction Design and Management Regulations (CDM)

Reference should be made to the Manual to the Standards for requirements under the CDM regulations.

Note:

Planning regulations may restrict the type and finish of replacement as well as all new windows.

Therefore, as is the case for all new windows where they are to be replaced / refurbished the local authority planning officer should be contacted in order to determine whether restrictions apply.

6 Design Standards

U-PVC windows shall not be used.

All windows shall achieve the highest BRE Green Guide and BFRC) ratings possible.

All windows shall be fitted with internal locking devices and shall be designed to deter intruders in accordance with BS 8220. The safe opening and closing of windows as well as access for cleaning should comply with Part N3 of the Approved Documents.

Where there is a danger of an operator or other person falling through a window above ground level opening restrictors shall be applied. For top hung or horizontal pivot windows, a restrictor stay in accordance with BS 8213 that prevents the opening of the window more than 100mm shall be provided.

Restrictor stays should be capable of being detached in an emergency or for window cleaning and maintenance.

Where restrictor stays are proposed consideration must be made to any passive ventilation strategy.

Where windows are replaced they should meet the minimum window system U-Values as set out in TfL Standard GRN 02 or those set out in the approved document Part L – whichever has the greater performance.

High performance soft coat Low E coatings should be incorporated to minimise centre of pane U-Values and consequential draughts in winter. These coatings must incorporate solar selective properties (where reduction in solar heat gain transmissions is significantly greater than reduction in light gain transmission- usually a ration of 2:1)

Where windows are to be replaced the opening style / window profile / sight lines of the incumbent system should be maintained where possible.

Reference should be made to relevant BRE and CIBSE guidance for the calculation of solar control calculations e.g. CIBSE publication TM37: 2006.

6.1 Aluminium Frames

Aluminium window frames, hardware and fixings shall comply with the requirements of BS 4873, Aluminium and Alloy Windows and Doorsets. Specification.

Where agreed with the Infrastructure Manager powder coating and painting to aluminium frames shall be avoided to aid future recycling options. Where required, frames shall be finished with a polyester matt coating complying with the requirements of BS 6496. The coating shall be a minimum of 60 microns thick. Coastal locations may required further cover.

6.2 Steel Frames

Steel framed windows shall only be used where required for compliance with fire regulations, or where there is a requirement to match existing steel frames.

Steel window frames, hardware and fixings shall comply with the requirements of BS 6510, Steel framed windows and glazed doors.

Where metal windows are used, a thermal break must be incorporated.

6.3 Timber Frames

Timber window frames, hardware and fixings shall comply with the requirements of BS 644, Timber Windows – Fully Finished Factory Assembled Windows of Various Types: Specification.

Frames shall be fabricated in accordance with the recommendations of BS 1186: Part 2, Timber for and Workmanship in Joinery: Specification for workmanship.

Weather tightness shall be defined in accordance with BS 6375 : Part 1, Performance of windows: Classification for Weather

Tightness (including guidance on selection and specification) taking into account the specific design wind loading.

A neoprene gasket shall be fitted to all opening vents and casements.
For adhesives see materials section.

Timber preservatives / paints shall be chosen in accordance with TfL Standard GRN 01. Where maintenance and durability considerations prohibit this, dispensation must be sought from the Infrastructure Manager.

Timber beads shall be fixed in place with pins or screw and cup fixings appropriate to the length of bead. The length of pins and screws shall be at least twice the thickness of the bead being fixed. Linseed based putty should not be used unless replacing individual panels within windows or where required to match adjoining existing glazing systems.

6.4 Window Furniture.

Window furniture shall be easy to find, reach and operate by people who have sight, movement and dexterity difficulties in accordance with BS 8300 – Design of buildings and their approaches to meet the needs of disabled people.

Lever handles shall be provided in preference to knob furniture and where not required to match existing or adjacent windows shall be brushed stainless steel.

All opening and fastening systems shall be designed to accommodate the reach and dexterity of all potential users without compromising security.

7 Design / Contractor Submittal Requirements.

Reference should be made to the Manual to the Standards for general requirements for drawing and sample submittal requirements. Requirements specific to this standard are;

- A window schedule and corresponding drawings must be completed and approved by the Infrastructure Manager as part of the design process.
- A written window cleaning strategy shall be provided as part of the design.

8 Materials Standards

All materials must be specified / sourced and installed in accordance with the parameters set out in TfL standard GRN 01, which includes details of requirements for sustainable timber.

8.1 Timber

In addition to the requirements of GRN 01, timber shall be of a species classified as suitable for its purpose in accordance with BS EN 942, Timber in Joinery General Requirements

All timber and wood based materials shall comply with the requirements of BS EN 942. CCA (Copper Chrome Arsenic) treated softwood shall not be used.

8.2 Glazing

Glazing shall comply with the requirements of BS 6262, Code of Practice for Glazing for Buildings.

Glazing and solar control measures shall be selected on a case by case basis to take into

account wind loads, in accordance with BS 6262, relevant data sheets issued by the Glass and Glazing Federation, and analysis to determine the trade off between solar control, lighting requirements, air conditioning and heating loads.

Generally with respect to site orientation, a project's north elevation should use clear insulating units incorporating Low-E, while the other elevations may require reduced solar heat gain coefficient glazing and Low-E.

All glazing below 800mm from the floor shall be safety glazing in accordance with BS 6262. The inner pane should have a clip-on bead or gasket around the edge of the unit.

All toughened glass shall be heat soak tested.

8.3 Adhesive

In addition to the requirements of GRN 01 the following guidance should be followed.

BS 644 states that adhesives used in the fabrication of timber windows must comply with the requirements of EN 204 or BS 1204:2002 (superseded by BS EN 12765) PVAC adhesives shall be used in preference to synthetic resin adhesives.

Any adhesive must be compatible with the proposed finish and with any preservative treatment used. Where the specification of a proprietary adhesive is preferred, the manufacturer should be consulted about its properties and suitability.

9 Installation

All windows shall be installed by specialist sub contractors in accordance with manufacturer's recommendations.

Reference should also be made to BRE press publication, Thermal Insulation: Avoiding risks where replacement windows are installed and the thermal properties of the building fabric upgraded.

Frames shall be sealed against the external fabric with a two-part polysulphide sealant.

10 Handover

Reference should be made to the Manual to the Standards for general requirements for handover and submissions required for the Operation and Maintenance Manual. All items set out in Section 7 shall be provided in good time for inclusion in the building's Operation and Maintenance records.

11 Maintenance

When new windows are added or alterations are made to existing installations there shall be no detrimental impact on the ease of maintenance of existing facilities unless through dispensation from the Infrastructure Manager.

Regular maintenance is essential to ensure continued performance of windows and maximise product life span.

Timber windows shall undergo maintenance requirements as outlined in the operation and maintenance manuals and as stipulated by manufacturer's recommendations.

Window controls shall be regularly checked, cleaned, repaired or replaced on a regular basis. Torque force characteristics shall be monitored and maintained in accordance with BS 8300 – Design of buildings and their approaches to meet the needs of disabled people.

Windows shall be cleaned as required depending on the specific building. Maintenance procedures should require window cleaners to report any faults found when cleaning to the Infrastructure Manager.

12 Further information

- CIBSE Daylighting and window design. Lighting Guide LG:10: 1999

Revision History:

Issue	Date	Description
1	18th September 2000	Reformatted - LU Facilities
2	December 2010	Reformatted and revised as TfL Head Office Standards

Relevant British / European Standards

BS 476	Fire tests on building materials and structures Part 22 - Methods for determination of the fire resistance of non loadbearing elements of construction
BS 644	Wood windows
BS 952	Glass for glazing
BS 1186	Timber for and workmanship in joinery
BS 1204	Specification for type MR phenolic and aminoplastic synthetic resin adhesives for wood
BS 4873	Aluminium and Alloy Windows and Doorsets. Specification.
BS 5368	Methods of testing windows
BS 5589	Code of practice for preservation of timber
BS 6206	Specification for impact performance requirements for flat safety glass and safety plastics for use in buildings
BS 6262	Code of practice for glazing for buildings
BS 6375	Performance of windows and doors. Classification for weathertightness and guidance on selection and specification
BS 6496	Specification for powder organic coatings for application and stoving to aluminium alloy extrusions, sheet and preformed sections for external architectural purposes, and for the finish on aluminium alloy extrusions, sheet and preformed sections coated with powder organic coatings
BS 8213-4	Windows, doors and rooflights. Code of practice for the survey and installation of windows and external doorsets
BS 8220-3:	Guide for security of buildings against crime. Storage, industrial and distribution premises
BS EN 13438	Paints and varnishes. Powder organic coatings for galvanized or sherardised steel products for construction purposes

05

Kitchenette Products

Issue 1 — December 2010



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05 Kitchenette Products

1 Scope

This chapter details products contained in and around the on floor kitchenettes. When selecting products the following general guidance should be followed in addition to observing Health and Safety regulations prior, and during installation:

- Read TfL Standards Manual
- Follow BLK 01 - User Guide
- Follow steps to success
- Choose all product colours from single Preset Design Scene
- Complete TfL Sustainability Checklist prior to order for all projects

2 General Guidance

Further information for products contained within this chapter can be found in BLK 08.

If due to project constraints a product is not available in time or a different colour option is required to those indicated in the pre set scenes reference can also be made to the index of products in BLK 07. Here the user can identify more colour options and a secondary product choice from an additional manufacturer. Secondary product choices should only be made through dispensation from the Infrastructure Manager. (see Manual to the Standards)

Reference should also be made to the Manual to the Standards for all levels of refurbishment / installations being undertaken to determine the requirement for or dispensation from consequential improvements.

2.1 Preset Scene

Fig 1 shows the preset design scene template for Kitchenette Products with a corresponding key used for all scenes. There are three colour options for this scene.

3 Construction Design and Management Regulations (CDM)

Reference should be made to the Manual to the Standards for requirements under the CDM regulations.

4 Design / Contractor Submittal Requirements / Handover.

Reference should be made to the Manual to the Standards for general requirements for drawing and sample submittals as well as procedures for handover and information required for inclusion in operation and maintenance manuals.

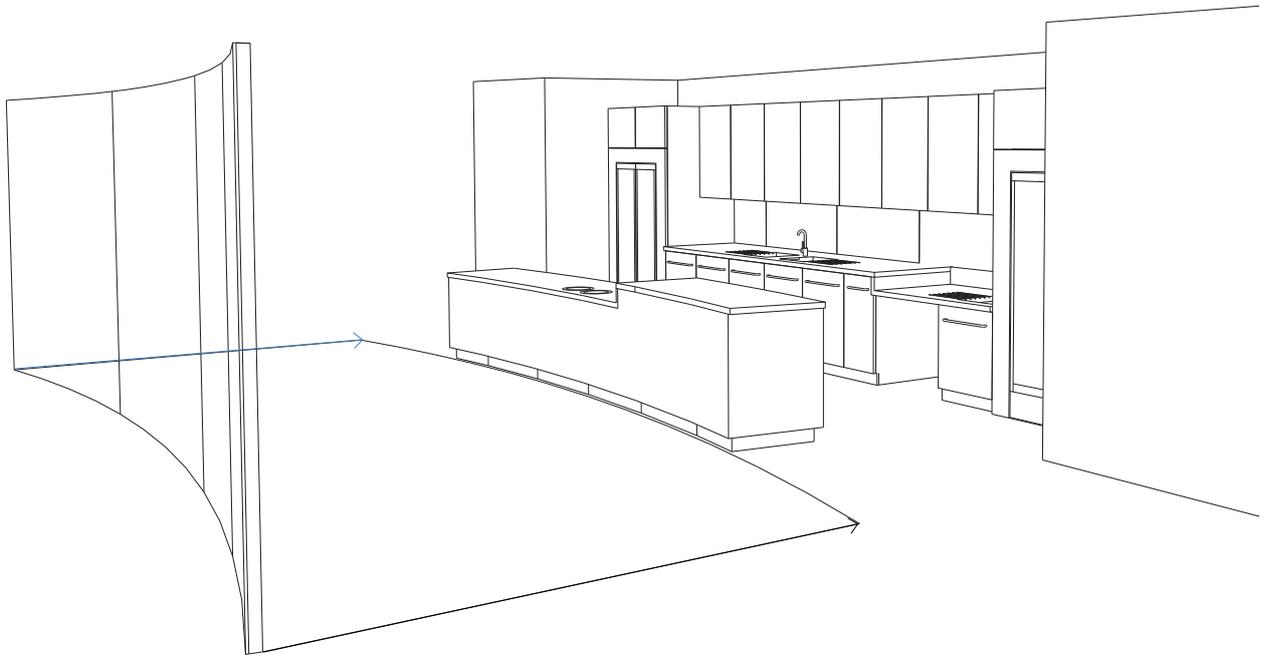
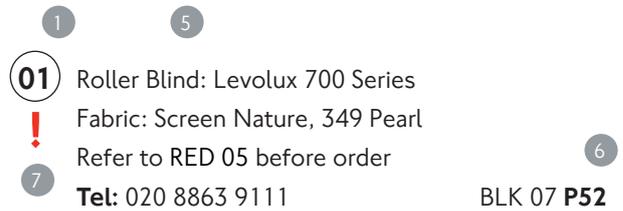


Fig. 1 Kitchenette products preset design scene template.

5 Key

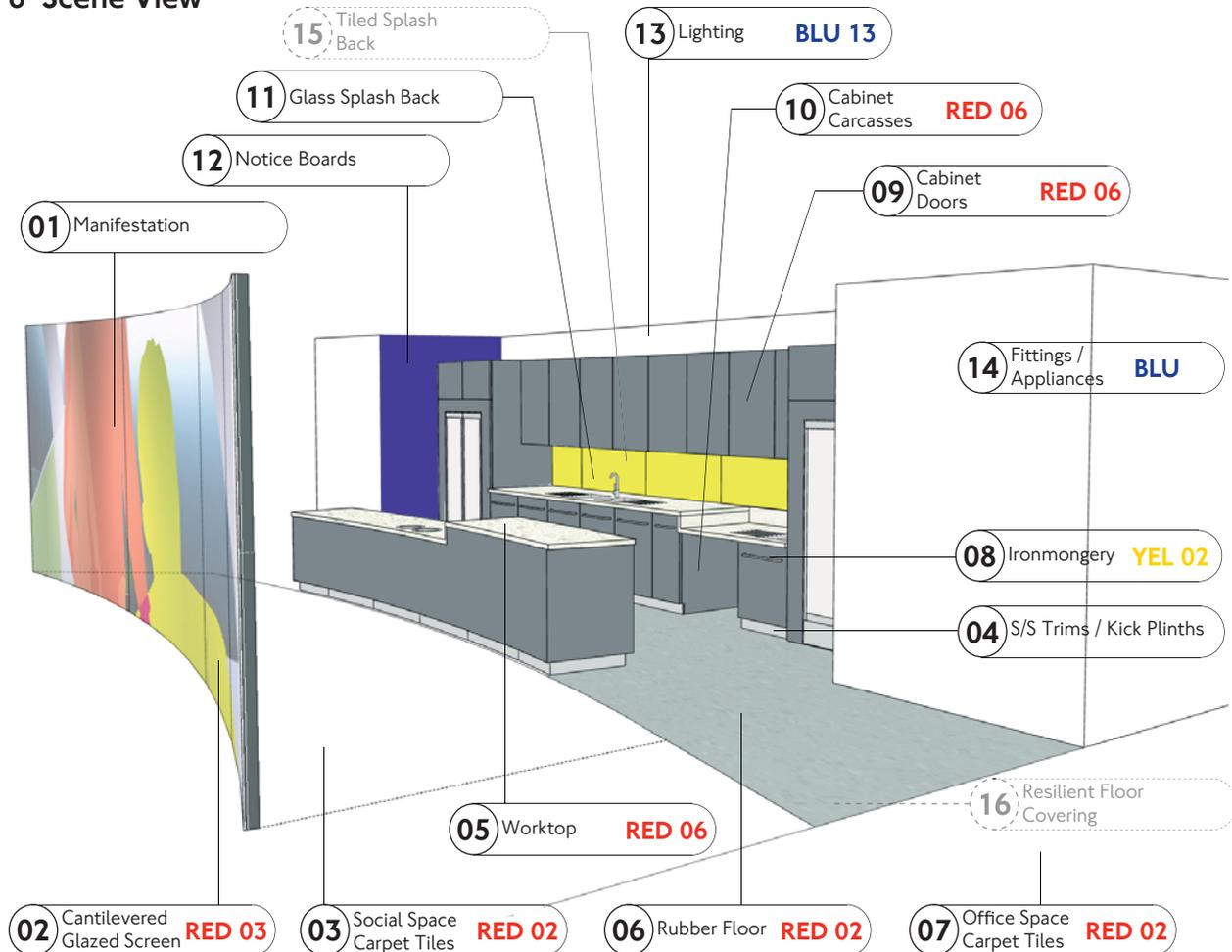


- 1 Product Number
- 2 Product Name
- 3 Reference to TfL Standard
- 4 Dotted line indicates alternative product. E.g. it may not be possible to expose the soffit and use acoustic rafts therefore a suspended ceiling could be used.

- 5 Basic product information
- 6 Reference to further product information.
 ! Symbol indicates where caution is required in the selection of the product. E.g. Blind fabric selection will depend on the orientation of the building so reference to the TfL Standards RED 05 will be required.

05a Kitchenette Products

6 Scene View



7 Quick Reference

- | | |
|--|---|
| <p>01 Manifestation: VGL Graphics
Art work to be agreed with Infrastructure Manager
Tel: 0118 922 1300</p> | <p>05 Worktop: GLASSeco Ltd, Classic Range
Colour W4/W
Tel: 01959 576897 BLK 07 P56</p> |
| <p>02 Cantilevered Glazed Screen: Bespoke Item
E.g. Brown and Carroll Ltd
Refer to RED 03 for design standards
Tel: 01268 763232</p> | <p>06 Rubber Floor: Nora Flooring Systems UK Ltd
Noraplan Logic, Colour 2381
Tel: 01788 513160 BLK 07 P14</p> |
| <p>03 Carpet Tiles: InterfaceFLOR, Heuga 530
Colour reference: Varies - see BLK 03
Tel: 020 7490 3960 BLK 07 P10</p> | <p>07 Carpet Tiles: InterfaceFLOR, Transformation
Colour reference: 345502 Steppe
Tel: 020 7490 3960 BLK 07 P08</p> |
| <p>04 S/S Trims and Kick plinths: Bespoke Item
E.g. Brown and Carroll Ltd
Tel: 01268 763232</p> | <p>08 Cabinet Ironmongery: Yannedis
Handles nom 420mm 10mm dia. D-Handles
Tel: 020 8550 8833 BLK 07 P46</p> |