

Condition 6: **Methodology For Mechanical and Electrical installation**

Introduction

Pall Mall Court was originally designed as the Manchester headquarters for London Insurance Group designed by architects Brett & Pollen and constructed between November 1966 and December 1968.

Pall Mall Court was constructed across several historic building plots that comprised a variety of buildings, uses and phases. This section will chronologically chart these phases, highlighting the historic context of Pall Mall Court and its surroundings.

General heritage management principles.

All significant interventions should be informed and preceded by thorough documentary research and detailed visual and if necessary, physical investigation.

Works will be based on the objective of minimum intervention and disturbance to the significant fabric of the Pall Mall building.

Proposed works will be evaluated and informed by their potential impact on the fabric of the building.

Intervention works has been carefully considered and justified in terms of its necessity as a repair, an adaptation which better reveals its significance, or an enhancement which extends its sustainable use.

Interventions in the fabric that protect, or better reveal Pall Mall significance will be encouraged.

Change that would cause unmitigated harm to the significance of the building will be avoided.

Every element of the works will be completed sympathetically by competent operatives. with a proven track record of working within the Grade 11 listed environment. The project culture of care, consideration and preservation of the buildings Heritage will always be maintained. This culture will be administered via Contractor selection. Induction, relevant Toolbox Talks relating to protecting of our heritage and site notice boards. A photographic record of all existing finishes will be maintained, before, during and after the works are complete.

Any damage to the Historic elements of the structure will be repaired in accordance. with a previously agreed and approved methodology.

If required the heritage consultant will be consulted as the works progress, to mitigate. any detrimental effect to the historic/ heritage components of the building fabric. Before any works commence the management, team will carry out a review and understanding of the building fabric, the building fabric adjacent to the works (including horizontally and vertically neighbouring areas that may be affected), and the surrounding area.

All trade contractors associated with the works will have proven competency, hold the relevant CSCS competency card and will attend a Site Induction including Task. Specific induction, regarding preservation of heritage items/Mosaic Tiles. Additional Task Specific and heritage preservation Toolbox Talks will be completed at regular intervals if required for prolonged works.

Drawing Reference. (Enclosed)

Small Power & Data Layouts

6911-CES-XX-B1-DR-E-6200 Basement Small Power & Data Layout

Revision: P03

911-CES-XX-LG-DR-E-6201 Lower Ground Floor Small Power & Data Layout

Revision: P02

6911-CES-XX-00-DR-E-6202 Ground Floor Small Power & Data Layout

Revision: P02

6911-CES-XX-01-DR-E-6203 First Floor Small Power & Data Layout

Revision: P02

6911-CES-XX-02-DR-E-6204 Second Floor Small Power & Data Layout

Revision: P02

6911-CES-XX-03-DR-E-6205 Third Floor Small Power & Data Layout

Revision: P02

6911-CES-XX-04-DR-E-6206 Fourth Floor Small Power & Data Layout

Revision: P02

6911-CES-XX-05-DR-E-6207 Fifth Floor Small Power & Data Layout

Revision: P02

6911-CES-XX-05-DR-E-6207 Fifth Floor Small Power & Data Layout

Revision: P02

6911-CES-XX-06-DR-E-6208 Sixth Floor Small Power & Data Layout

Revision: P02

6911-CES-XX-07-DR-E-6209 Seventh Floor Small Power & Data Layout

Revision: P02

6911-CES-XX-08-DR-E-6210 Eighth Floor Small Power & Data Layout

Revision: P02

6911-CES-XX-09-DR-E-6211 Ninth Floor Small Power & Data Layout

Revision: P02

6911-CES-XX-10-DR-E-6212 Tenth Floor Small Power & Data Layout

Revision: P02

6911-CES-XX-RF-DR-E-6213 Roof Level Small Power & Data Layout

Revision: P02

Lighting & Emergency Lighting Layouts

6911-CES-XX-B1-DR-E-6300 Basement Lighting & Emergency Lighting Layout

Revision: P04

6911-CES-XX-LG-DR-E-6301 Lower Ground Floor Lighting & Emergency Lighting Layout

Revision: P04

6911-CES-XX-00-DR-E-6302 Ground Floor Lighting & Emergency Lighting Layout

Revision: P03

6911-CES-XX-01-DR-E-6303 First Floor Lighting & Emergency Lighting Layout

Revision: P03

6911-CES-XX-02-DR-E-6304 Second Floor Lighting & Emergency Lighting Layout

Revision: P03

6911-CES-XX-03-DR-E-6305 Third Floor Lighting & Emergency Lighting Layout

Revision: P03

6911-CES-XX-04-DR-E-6306 Fourth Floor Lighting & Emergency Lighting Layout

Revision: P03

6911-CES-XX-05-DR-E-6307 Fifth Floor Lighting & Emergency Lighting Layout

Revision: P03

6911-CES-XX-06-DR-E-6308 Sixth Floor Lighting & Emergency Lighting Layout

Revision: P03

6911-CES-XX-07-DR-E-6309 Seventh Floor Lighting & Emergency Lighting Layout

Revision: P03

6911-CES-XX-08-DR-E-6310 Eighth Floor Lighting & Emergency Lighting Layout

Revision: P03

6911-CES-XX-09-DR-E-6311 Ninth Floor Lighting & Emergency Lighting Layout

Revision: P03

6911-CES-XX-10-DR-E-6312 Tenth Floor Lighting & Emergency Lighting Layout

Revision: P03

6911-CES-XX-RF-DR-E-6313 Roof Level Lighting & Emergency Lighting Layout

Revision: P02

High Level Containment Layout

6911-CES-XX-B1-DR-E-6600 Basement High Level Containment Layout

Revision: P04

6911-CES-XX-LG-DR-E-6601 Lower Ground Floor High Level Containment Layout

Revision: P04

6911-CES-XX-00-DR-E-6602 Ground Floor High Level Containment Layout

Revision P03

6911-CES-XX-01-DR-E-6603 First Floor High Level Containment Layout

Revision P03

6911-CES-XX-02-DR-E-6604 Second Floor High Level Containment Layout

Revision: P03

6911-CES-XX-03-DR-E-6605 Third Floor High Level Containment Layout

Revision: P03

6911-CES-XX-04-DR-E-6606 Fourth Floor High Level Containment Layout

Revision: P02

6911-CES-XX-05-DR-E-6607 Fifth Floor High Level Containment Layout

Revision: P02

6911-CES-XX-06-DR-E-6608 Sixth Floor High Level Containment Layout

Revision: P03

6911-CES-XX-07-DR-E-6609 Seventh Floor High Level Containment Layout

Revision: P02

6911-CES-XX-08-DR-E-6610 Eighth Floor High Level Containment Layout

Revision: P02

6911-CES-XX-09-DR-E-6611 Ninth Floor High Level Containment Layout

Revision: P02

6911-CES-XX-10-DR-E-6612 Tenth Floor High Level Containment Layout

Revision: P02

6911-CES-XX-RF-DR-E-6613 Roof Level High Level Containment Layout

Revision: P03

Low Level Containment Layout

6911-CES-XX-LG-DR-E-6614 Lower Ground Floor Low Level Containment Layout

Revision: P04

6911-CES-XX-00-DR-E-6615 Ground Floor Low Level Containment Layout

Revision: P02

6911-CES-XX-01-DR-E-6616 First Floor Low Level Containment Layout

Revision: P02

6911-CES-XX-02-DR-E-6617 Second Floor Low Level Containment Layout

Revision: P02

6911-CES-XX-03-DR-E-6618 Third Floor Low Level Containment Layout

Revision: P02

6911-CES-XX-04-DR-E-6619 Fourth Floor Low Level Containment Layout

Revision: P02

6911-CES-XX-05-DR-E-6620 Fifth Floor Low Level Containment Layout

Revision: P02

6911-CES-XX-06-DR-E-6621 Sixth Floor Low Level Containment Layout

Revision: P02

6911-CES-XX-07-DR-E-6622 Seventh Floor Low Level Containment Layout

Revision: P02

6911-CES-XX-08-DR-E-6623 Eighth Floor Low Level Containment Layout

Revision: P02

6911-CES-XX-09-DR-E-6624 Ninth Floor Low Level Containment Layout

Revision: P02

6911-CES-XX-10-DR-E-6625 Tenth Floor Low Level Containment Layout

Revision: P02

Fire Detection & Alarm Layout

6911-CES-XX-B1-DR-E-6700 Basement Fire Detection & Alarm Layout

Revision: P02

6911-CES-XX-LG-DR-E-6701 Lower Ground Floor Fire Detection & Alarm Layout

Revision: P02

6911-CES-XX-00-DR-E-6702 Ground Floor Fire Detection & Alarm Layout

Revision: P02

6911-CES-XX-01-DR-E-6703 First Floor Fire Detection & Alarm Layout

Revision: P02

6911-CES-XX-02-DR-E-6704 Second Floor Fire Detection & Alarm Layout

Revision: P03

6911-CES-XX-03-DR-E-6705 Third Floor Fire Detection & Alarm Layout

Revision: P02

6911-CES-XX-04-DR-E-6706 Fourth Floor Fire Detection & Alarm Layout

Revision: P02

6911-CES-XX-05-DR-E-6707 Fifth Floor Fire Detection & Alarm Layout

Revision: P03

6911-CES-XX-06-DR-E-6708 Sixth Floor Fire Detection & Alarm Layout

Revision: P02

6911-CES-XX-07-DR-E-6709 Seventh Floor Fire Detection & Alarm Layout

Revision: P03

6911-CES-XX-08-DR-E-6710 Eighth Floor Fire Detection & Alarm Layout

Revision: P02

6911-CES-XX-09-DR-E-6711 Ninth Floor Fire Detection & Alarm Layout

Revision: P02

6911-CES-XX-10-DR-E-6712 Tenth Floor Fire Detection & Alarm Layout

Revision: P02

6911-CES-XX-RF-DR-E-6713 Roof Level Fire Detection & Alarm Layout

Revision: P02

Mechanical Installation and Plumbing

52 Series – Above Ground Drainage

C3781-HEC-ZZ-BL-DR-M-5200 - ABOVE GROUND DRAINAGE LAYOUT BASEMENT LEVEL

Revision: P05

C3781-HEC-ZZ-LG-DR-M-5200 - ABOVE GROUND DRAINAGE LAYOUT LOWER GROUND FLOOR

Revision: P05

C3781-HEC-ZZ-GF-DR-M-5200 - ABOVE GROUND DRAINAGE LAYOUT GROUND FLOOR

Revision: P04

C3781-HEC-ZZ-01-DR-M-5200 - ABOVE GROUND DRAINAGE LAYOUT FIRST FLOOR

Revision: P04

C3781-HEC-ZZ-02-DR-M-5200 - ABOVE GROUND DRAINAGE LAYOUT SECOND FLOOR

Revision: P04

C3781-HEC-ZZ-03-DR-M-5200 - ABOVE GROUND DRAINAGE LAYOUT THIRD FLOOR

Revision: P04

C3781-HEC-ZZ-04-DR-M-5200 - ABOVE GROUND DRAINAGE LAYOUT FOURTH FLOOR

Revision: P04

C3781-HEC-ZZ-05-DR-M-5200 - ABOVE GROUND DRAINAGE LAYOUT FIFTH FLOOR

Revision: P04

C3781-HEC-ZZ-06-DR-M-5200 - ABOVE GROUND DRAINAGE LAYOUT SIXTH FLOOR

Revision: P04

C3781-HEC-ZZ-07-DR-M-5200 - ABOVE GROUND DRAINAGE LAYOUT SEVENTH FLOOR

Revision: P03

C3781-HEC-ZZ-08-DR-M-5200 - ABOVE GROUND DRAINAGE LAYOUT EIGHTH FLOOR

Revision: P03

C3781-HEC-ZZ-09-DR-M-5200 - ABOVE GROUND DRAINAGE LAYOUT NINTH FLOOR

Revision: P03

C3781-HEC-ZZ-10-DR-M-5200 - ABOVE GROUND DRAINAGE LAYOUT TENTH FLOOR

Revision: P03

C3781-HEC-ZZ-RL-DR-M-5200 - ABOVE GROUND DRAINAGE LAYOUT ROOF LEVEL

Revision: P03

53 Series – Domestic Water Services

C3781-HEC-ZZ-BL-DR-M-5300_DOMESTIC WATER SERVICES BASEMENT

Revision: P01

C3781-HEC-ZZ-LG-DR-M-5300_DOMESTIC WATER SERVICES LOWER GROUND

Revision: P02

C3781-HEC-ZZ-GF-DR-M-5300_DOMESTIC WATER SERVICES GROUND

Revision: P02

C3781-HEC-ZZ-01-DR-M-5300_DOMESTIC WATER SERVICES 1ST FLOOR

Revision: P01

C3781-HEC-ZZ-02-DR-M-5300_DOMESTIC WATER SERVICES 2ND FLOOR

Revision: P01

C3781-HEC-ZZ-03-DR-M-5300_DOMESTIC WATER SERVICES 3RD FLOOR

Revision: P01

C3781-HEC-ZZ-04-DR-M-5300_DOMESTIC WATER SERVICES 4TH FLOOR

Revision: P01

C3781-HEC-ZZ-05-DR-M-5300_DOMESTIC WATER SERVICES 5TH FLOOR

Revision: P01

C3781-HEC-ZZ-06-DR-M-5300_DOMESTIC WATER SERVICES 6TH FLOOR

Revision: P01

C3781-HEC-ZZ-07-DR-M-5300_DOMESTIC WATER SERVICES 7TH FLOOR

Revision: P01

C3781-HEC-ZZ-08-DR-M-5300_DOMESTIC WATER SERVICES 8TH FLOOR

Revision: P01

C3781-HEC-ZZ-09-DR-M-5300_DOMESTIC WATER SERVICES 9TH FLOOR

Revision: P01

C3781-HEC-ZZ-10-DR-M-5300_DOMESTIC WATER SERVICES 10TH FLOOR

Revision: P01

C3781-HEC-ZZ-RL-DR-M-5300_DOMESTIC WATER SERVICES ROOF

Revision: P01

55 Series – Air Conditioning

C3781-HEC-ZZ-BL-DR-M-5500 - AIR CONDITIONING SERVICES LAYOUT BL

Revision: P04

C3781-HEC-ZZ-LG-DR-M-5500 - AIR CONDITIONING SERVICES LAYOUT LGF

Revision: P05

C3781-HEC-ZZ-GF-DR-M-5500 - AIR CONDITIONING SERVICES LAYOUT GF

Revision: P04

C3781-HEC-ZZ-01-DR-M-5500 - AIR CONDITIONING SERVICES LAYOUT 1st FLOOR

Revision: P04

C3781-HEC-ZZ-02-DR-M-5500 - AIR CONDITIONING SERVICES LAYOUT 2nd FLOOR

Revision: P04

C3781-HEC-ZZ-03-DR-M-5500 - AIR CONDITIONING SERVICES LAYOUT 3rd FLOOR

Revision: P04

C3781-HEC-ZZ-04-DR-M-5500 - AIR CONDITIONING SERVICES LAYOUT 4th FLOOR

Revision: P04

C3781-HEC-ZZ-05-DR-M-5500 - AIR CONDITIONING SERVICES LAYOUT 5th FLOOR

Revision: P04

C3781-HEC-ZZ-06-DR-M-5500 - AIR CONDITIONING SERVICES LAYOUT 6th FLOOR

Revision: P05

C3781-HEC-ZZ-ZZ-DR-M-5500 - AIR CONDITIONING SERVICES LAYOUT 7th&8th FLOOR

Revision: P04

C3781-HEC-ZZ-ZZ-DR-M-5501 - AIR CONDITIONING SERVICES LAYOUT 9th-11th FLOOR

Revision: P04

56 Series - Heating

C3781-HEC-ZZ-BL-DR-M-5600 - LPHW SERVICES LAYOUT BASEMENT LEVEL

Revision: P05

C3781-HEC-ZZ-LG-DR-M-5600 - LPHW SERVICES LAYOUT LOWER GROUND FLOOR

Revision: P05

C3781-HEC-ZZ-GF-DR-M-5600 - LPHW SERVICES LAYOUT GROUND FLOOR

Revision: P04

C3781-HEC-ZZ-01-DR-M-5600 - LPHW SERVICES LAYOUT FIRST FLOOR

Revision: P04

C3781-HEC-ZZ-02-DR-M-5600 - LPHW SERVICES LAYOUT SECOND FLOOR

Revision: P04

C3781-HEC-ZZ-03-DR-M-5600 - LPHW SERVICES LAYOUT THIRD FLOOR

Revision: P04

C3781-HEC-ZZ-04-DR-M-5600 - LPHW SERVICES LAYOUT FOURTH FLOOR

Revision: P04

C3781-HEC-ZZ-05-DR-M-5600 - LPHW SERVICES LAYOUT FIFTH FLOOR

Revision: P04

C3781-HEC-ZZ-06-DR-M-5600 - LPHW SERVICES LAYOUT SIXTH FLOOR

Revision: P04

C3781-HEC-ZZ-07-DR-M-5600 - LPHW SERVICES LAYOUT SEVENTH FLOOR

Revision: P04

C3781-HEC-ZZ-08-DR-M-5600 - LPHW SERVICES LAYOUT EIGHTH FLOOR

Revision: P04

C3781-HEC-ZZ-09-DR-M-5600 - LPHW SERVICES LAYOUT NINTH FLOOR

Revision: P04

C3781-HEC-ZZ-10-DR-M-5600 - LPHW SERVICES LAYOUT TENTH FLOOR

Revision: P04

57 Series - VENT

C3781-HEC-ZZ-BL-DR-M-5700 - VENTILATION LAYOUT BASEMENT LEVEL

Revision: P06

C3781-HEC-ZZ-LG-DR-M-5700 - VENTILATION LAYOUT LOWER GROUND FLOOR

Revision: P06

C3781-HEC-ZZ-GF-DR-M-5700 - VENTILATION LAYOUT GROUND FLOOR

Revision: P07

C3781-HEC-ZZ-01-DR-M-5700 - VENTILATION LAYOUT FIRST FLOOR

Revision: P07

C3781-HEC-ZZ-02-DR-M-5700 - VENTILATION LAYOUT SECOND FLOOR

Revision: P07

C3781-HEC-ZZ-03-DR-M-5700 - VENTILATION LAYOUT THIRD FLOOR

Revision: P07

C3781-HEC-ZZ-04-DR-M-5700 - VENTILATION LAYOUT FOURTH FLOOR

Revision: P07

C3781-HEC-ZZ-05-DR-M-5700 - VENTILATION SERVICES 5TH FLOOR

Revision: P04

C3781-HEC-ZZ-06-DR-M-5700 - VENTILATION LAYOUT SIXTH FLOOR

Revision: P07

C3781-HEC-ZZ-07-DR-M-5700 - VENTILATION LAYOUT SEVENTH FLOOR

Revision: P07

C3781-HEC-ZZ-08-DR-M-5700 - VENTILATION LAYOUT EIGHTH FLOOR

Revision: P07

C3781-HEC-ZZ-09-DR-M-5700 - VENTILATION LAYOUT NINTH FLOOR

Revision: P07

C3781-HEC-ZZ-10-DR-M-5700 - VENTILATION LAYOUT TENTH FLOOR

Revision: P07

59 Series - SMOKE

C3781-HEC-ZZ-ZZ-DR-M-5950 - CARPARK SMOKE EXTRACT LAYOUT BASEMENT & GROUND LEVEL
Revision: P01

Risers

C3781-HEC-ZZ-ZZ-DR-M-5072 - Riser Layouts

Revision: P01

Other Reference (enclosed)

Ramboll Electrical Specification

Ramboll Mechanical Specification

Fixing Types

Artien Luminaire Schedule 201879 -SCH-1001/ A

Platform Lift Specification. Access Lifts

CCTV Drawings PDF

Camera Specification Axis M3115.

Fixing Pull Test

Design Principles

The listed status of the building has been considered during the design phase and a sympathetic approach to the design has been adopted.

This includes.

- A Sample area of the installation offered up for review before contract works can progress.
- the reuse of existing risers mitigating the requirement the intrusive builder's work. Where builder work is required, this will be cored using diamond drilling techniques.
- Wall chasing of the existing RC Frame is not permitted.

- Wall fixings through internal mosaic finishes will be avoided wherever possible, and reuse of existing containment will be promoted.
- The external building fabric will remain unchanged and installation penetrations through the building façade will not be permitted. Where possible existing grills/ louvre will be used.
- New roof mounted plant will be designed to mitigate noise and visual pollution. Screens will be provided for all roof Mounted Plant to mitigate the visual impact. at Ground Level and from adjacent buildings.

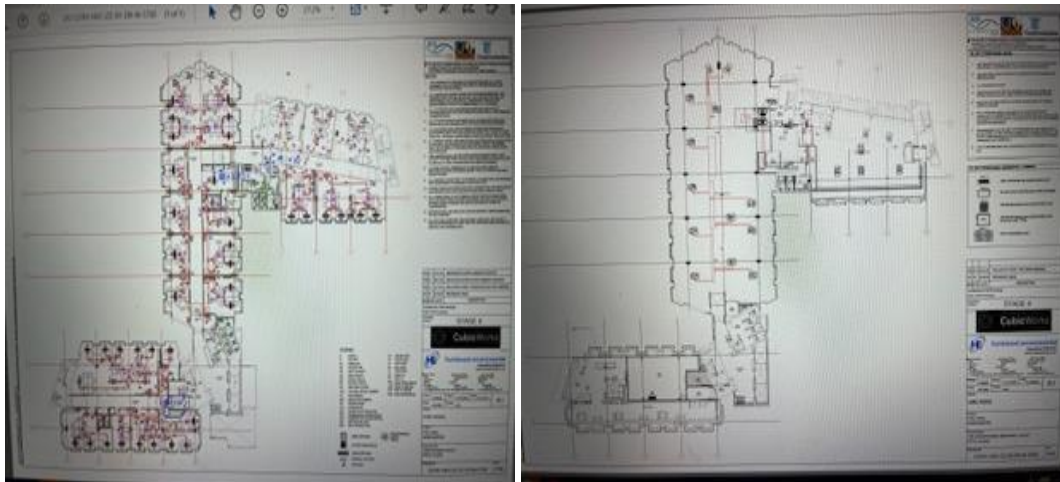
Wherever possible existing foul and surface water drainage pipework will be maintained and reused.

Existing Risers will be reused. Drawings are available within the appendice.

Acoustic testing will be implemented on completion of the works and the acoustic report will be made available for review.

Typica Floor, Vent

Typical Floor, AC



11 Floor Roof Plan,



Fixing Methodology for the Mechanical Installation on Coffered Ceiling

Fan coil unit

- All fixings are to be drilled a minimum of 100mm up from the bottom of the structural beam.
- A 35mm deep 6 mm hole will then be drilled.
- Angle bracket will then be installed and fixed to the side off the structural beam using a 35mm HUSS concrete screw.
- M10 rod will then be secured through the angle bracket to allow Unistrut to be fixed to the underside of the coffer.
- The fan coil is then to be hung from the Unistrut supported via the angle bracket.

HVRF pipework containment

- All fixings are to be drilled a minimum of 100mm up from the bottom of the structural concrete beam.
- A 35mm deep 6 mm hole will then be drilled.
- Angle bracket will then be installed and fixed to the side off the structural beam using a 35mm HUSS concrete screw.
- M8 rod will then be secured through the angle bracket to allow Unistrut to be fixed to the underside of the coffer.
- All containment will then be hung from the Unistrut supported via the angle bracket.

Duct work

- All fixings are to be drilled a minimum of 100mm up from the bottom of the structural concrete beam.
- A 35mm deep 6 mm hole will then be drilled.
- An 6mm knock in anchor will then be installed utilising an 6mm washer.
- All duct work will then be installed using a gripple wire.

LTHW pipework

- All fixings are to be drilled a minimum of 100mm up from the bottom of the structural concrete beam.
- A 35mm deep 6 mm hole will then be drilled.
- Angle bracket will then be installed and fixed to the side off the structural beam using a 35mm HUSS concrete screw.
- M10 rod will then be secured through the angle bracket to allow Unistrut to be fixed to the underside of the coffer.
- All containment will then be hung from the Unistrut supported via the angle bracket.

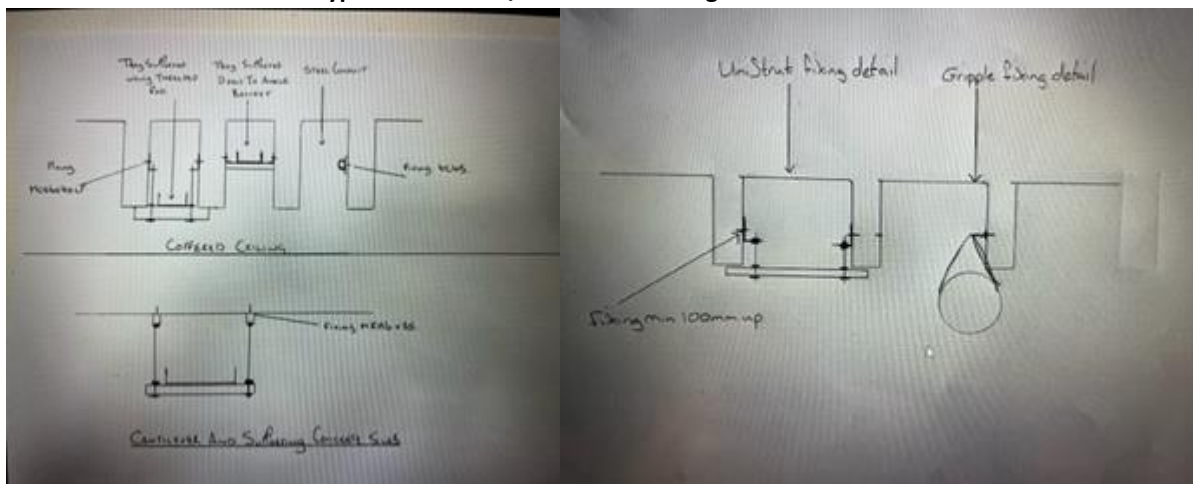
Plumbing pipework

- All fixings are to be drilled a minimum of 100mm up from the bottom of the structural concrete beam.
- A 35mm deep 6 mm hole will then be drilled.
- Angle bracket will then be installed and fixed to the side off the structural beam using a 35mm HUSS concrete screw.
- M10 rod will then be secured through the angle bracket to allow Unistrut to be fixed to the underside of the coffer.
- All containment will then be hung from the Unistrut supported via the angle bracket.

Drainage pipework

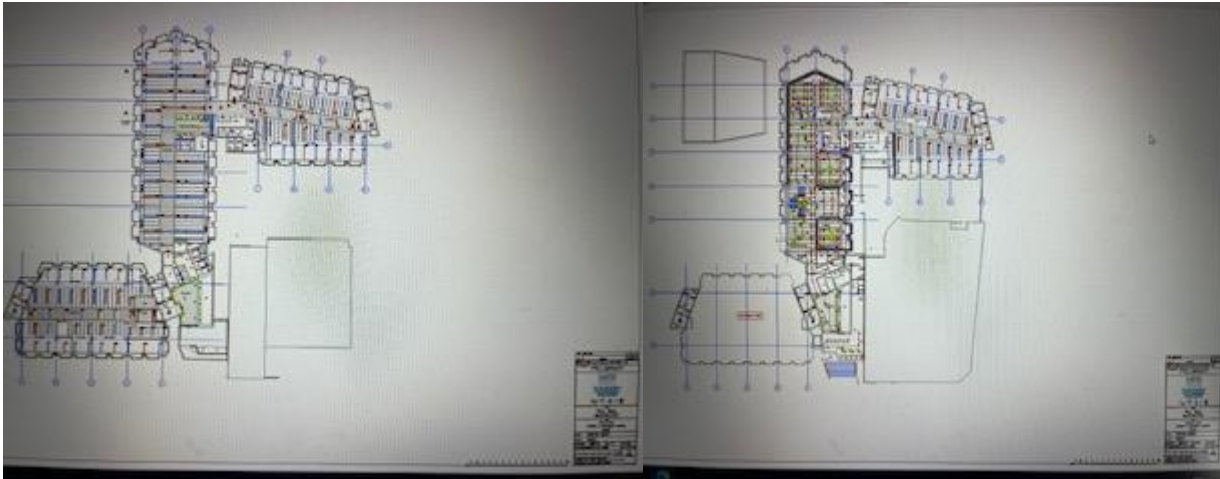
- All fixings are to be drilled a minimum of 100mm up from the bottom of the structural concrete beam.
- A 35mm deep 6 mm hole will then be drilled.
- Angle bracket will then be installed and fixed to the side off the structural beam using a 35mm HUSS concrete screw.
- M8 rod will then be secured through the angle bracket to allow Unistrut to be fixed to the underside of the coffer.
- All containment will then be hung from the Unistrut supported via the angle bracket.

Typical Electrical /Mechanical Fixing Detail



Typical Floor Lighting

Ground Floor Lighting



Fixing Methodology for the Electrical Installation on Coffered Ceiling

Containment including cable tray & basket suspended on a trapeze Unistrut bracket.

- Distance between Trapeze brackets will no greater than 1200mm.
- All fixings are to be drilled a minimum of 100mm up from the bottom of the structural beam.
- A 40mm deep 6 mm hole will then be drilled.
- Angle bracket will then be installed and fixed to the side off the structural beam using a 40mm MCS6x40LP concrete screw.
- M8 rod will then be secured through the angle bracket to allow Unistrut to be fixed to the underside of the coffer.
- All containment will then be hung from the Unistrut supported via the angle bracket.

Steel Conduit containment

- All fixings are to be drilled a minimum of 100mm up from the bottom of the structural concrete beam.

- A 50mm deep 5 mm hole will then be drilled.
- A distance saddle will then be fixed using a 6C45 countersunk concrete screw.
- The distance between saddles will comply with the BS7671 regulations.

Cables fixed directly to the structure.

- All fixings are to be drilled a minimum of 100mm up from the bottom of the structural concrete beam.
- Where cables leave the cable containment to terminate into an accessory i.e., a smoke detector the cables will be fixed directly to the building structure using a metal cable clip.
- A 40mm deep 5mm hole will be drilled.
- A metal cable clip will then be fixed using a WS6X30 Pan head concrete screw.
- The distance between clips will comply with the current body of regulations.

Please see Arten Lighting Specification enclosed within appendice for feature lighting images and fixing arrangement

CCTV will installed as detailed on the drawings enclosed with the the Appendice.

The dome cameras Axis M3115 will be installed internally (specification enclosed within appendices). A sympathetic approach for fixing into the historic fabric will be maintained. With cameras being fixed into ceiling tiles within the lobbies. This fully mitigates the requirement for fixing through mosaic tiles.

Fixing Methodology for the Electrical installation on the Cantilever and Supporting concrete slab

Containment including cable tray & basket suspended on a trapeze Unistrut bracket.

- Distance between Trapeze brackets will no greater than 1200mm.
- 2 x 40mm deep 6 mm holes will be drilled to the bracket length.

- 2 x MRH6x35 will then be screwed into the holes using an impact driver with a quarter inch socket.
- M8 rod will then be secured into the MRH6x 35 internal thread and locked off with a M8 nut,
- A cut length of Unistrut will be attached and secured to the bottom of the M8 rod using square washers and
- M8 nuts.

Typical Trapezoidal Hanger



Sample of Mechanical And Electrical First Fix Installation





Fixings Included in Appendix



02937 Midfix MRH
Rod Hangers Data Sh



02939 MIDFIX
MCS-LP ETA Concrete



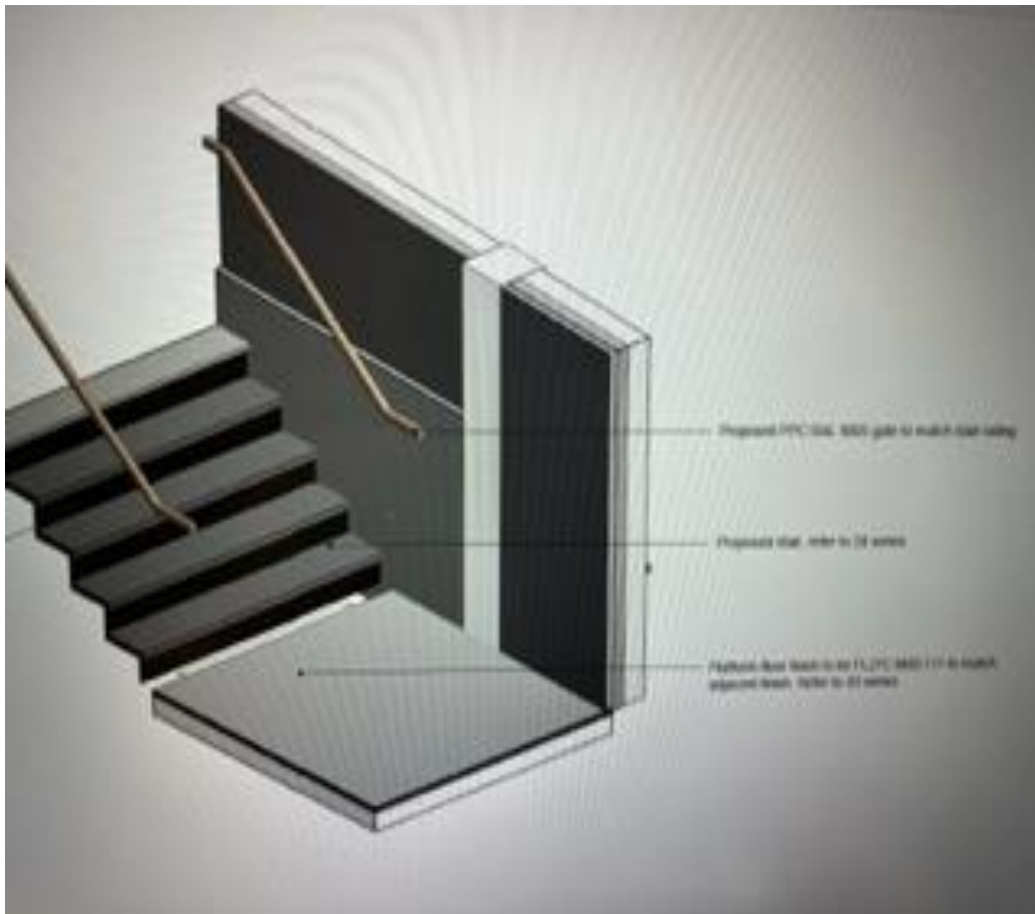
Technical-data-sheet-Technical-data-sheet-
for-the-HKD-push-in-for-HUS-H-10-screw-



Platform Lift

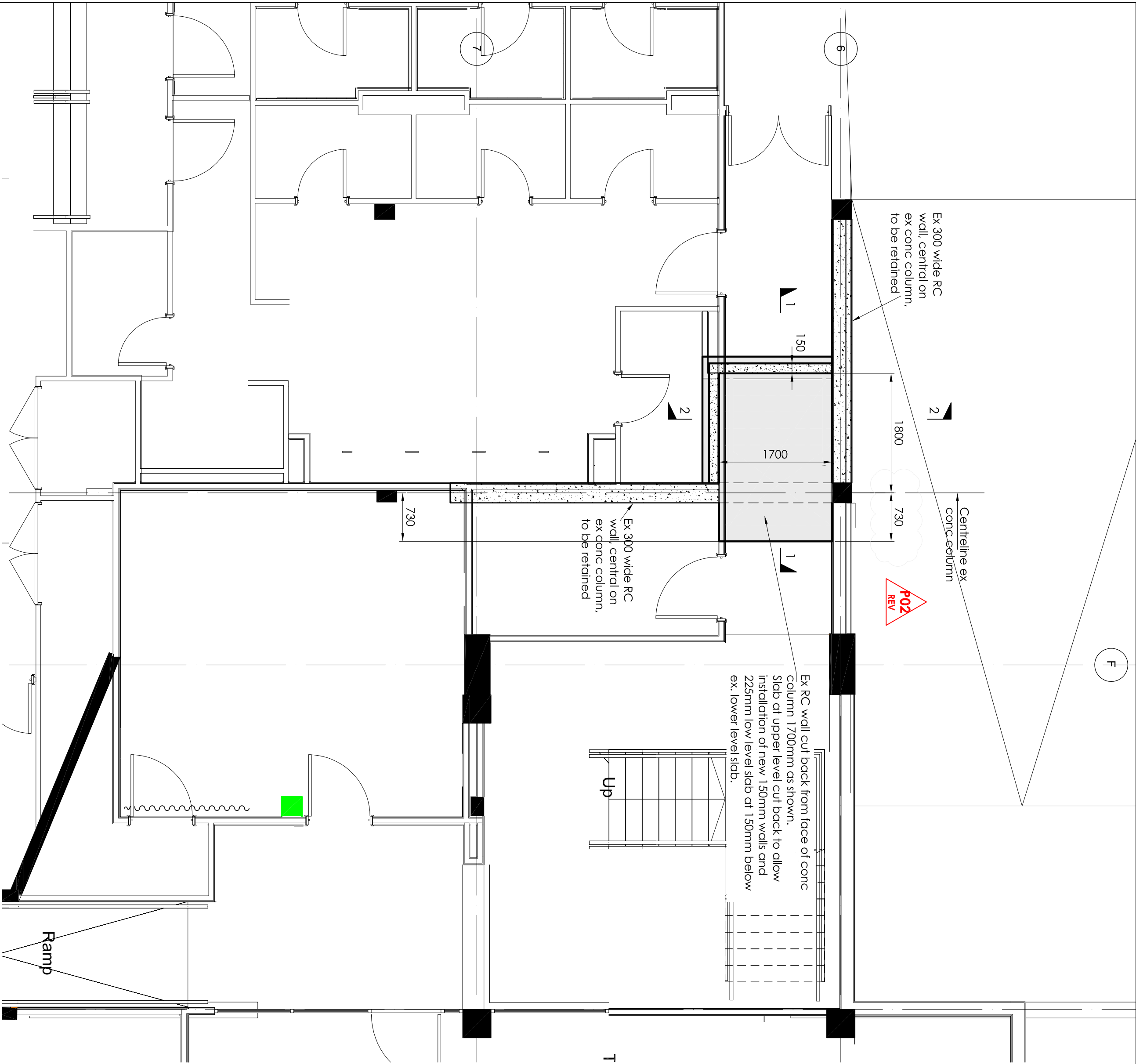
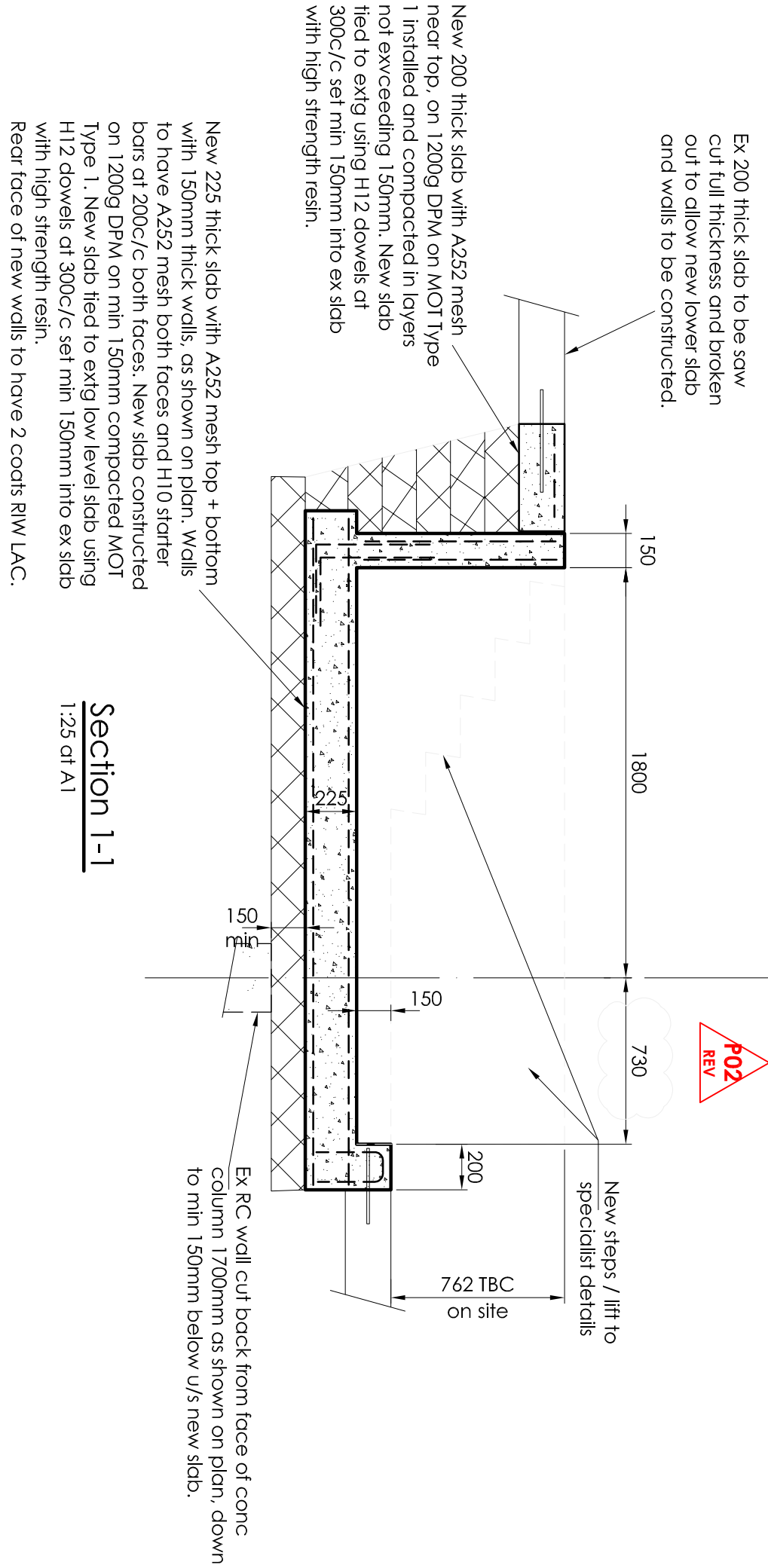
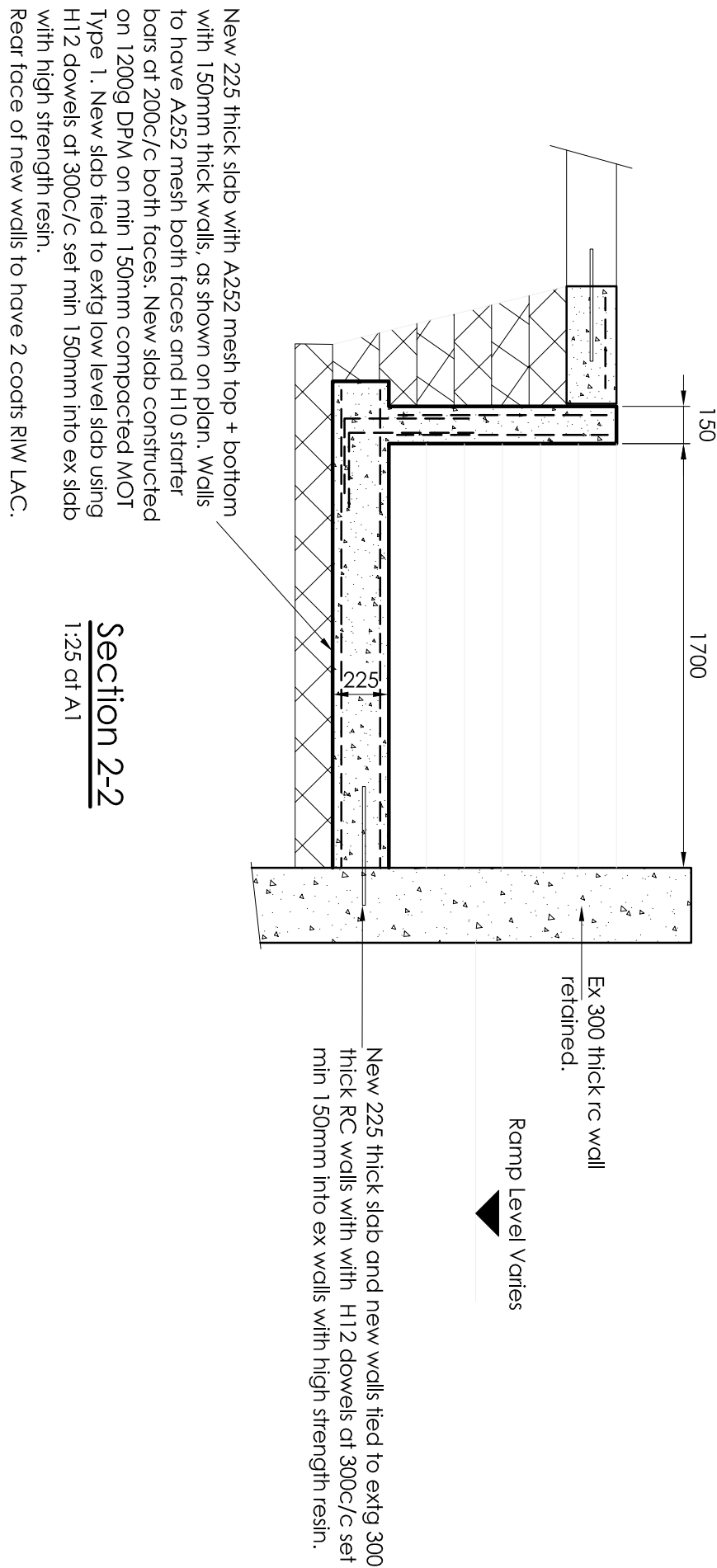
The proposed Platform Lifts will be at Basement and LGF level. Lift Pits designed by our Structural Engineers using Reinforced Concrete Structure.

3 D image Of Platform form Lift (Specification included within appendices)



Buiderswork Requirement for Platform Lift.

Drawing Reference Structural Works, Basement Level. Platform Lift, Slab and Wall Details
PM-DWC-81, DR-S 010- P02, (Included in appendice) .



GENERAL NOTES

- Do not scale this drawing.
Contractor to check all dimensions and report all errors and omissions to the Engineer.
- All external setting out to be confirmed on Architects drawings.
 - Existing levels to be confirmed prior to commencing works.
 - 150mm pit shown for platform lift. TBC by supplier.
 - All new concrete to be Grade C28/35.

P02 SETTING OUT AMENDED		IS	CJC	01.11.22
P01 PRELIMINARY ISSUE		RM	CJC	01.07.22
Rev	Detail	By	Auth	Date
Revisions				



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Client

bruntwood works

Project

Pall Mall
Manchester
Refurbishment Works

Drawing Title

Structural Works
Basement Level Platform Lift
Slab and Wall Details

Drawing Status

preliminary

Project No.	Discipline	Drawing No.
PM-DWC-B1	DR-S	010
Scale	Sheet No.	Revision
1:50 1:25	A1	P02
Date	Drawn	Checked
July 22	RM	CJC

PRODUCT DATA SHEET

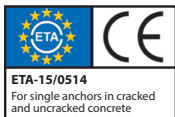
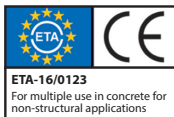
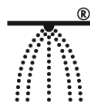
MRH - MIDFIX ETA ROD HANGERS

Features

- Thread cutting anchors with dual M8/M10 internal thread
- For hanging building services from solid and hollow concrete ceilings
- High load capacity in cracked and uncracked concrete
- Two lengths – standard and short for reduced embedment
- Advantages – small drill diameter, non-expanding, fast installation

Testing & approvals

- European Technical Assessments ETA-15/0514 & ETA-16/0123
- Approved for use as a multiple fixing in cracked and uncracked concrete
- Approved for use as a multiple fixing in pre-stressed concrete floor slabs
- Approved for use as a single fixing in uncracked concrete
- Fire resistance tested in concrete



MRH Rod Hangers

CODE	MF CODE	ANCHOR LENGTH	DRILL Ø X DEPTH	BOX QTY
MRH6x35	0293735	35	6 x 40	100
MRH6x55	0293755	55	6 x 60	100



Installation Tool

- Magnetic drive socket with 1/4" shank
- Suits cordless drills and impact drivers

CODE	MF CODE	SIZE	DRIVE	PACK QTY
MOP13	2394213	13	1/4" Hex	1



PRODUCT DATA SHEET

MRH - MIDFIX ETA ROD HANGERS

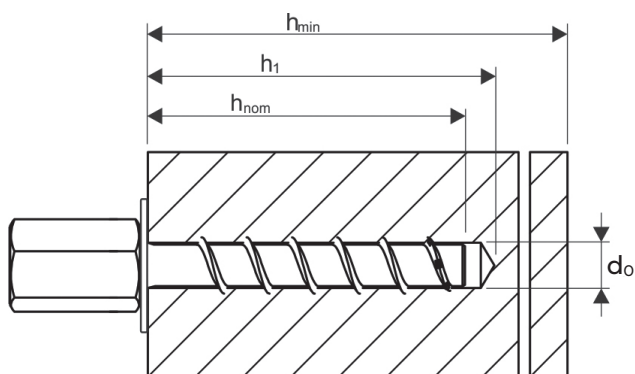
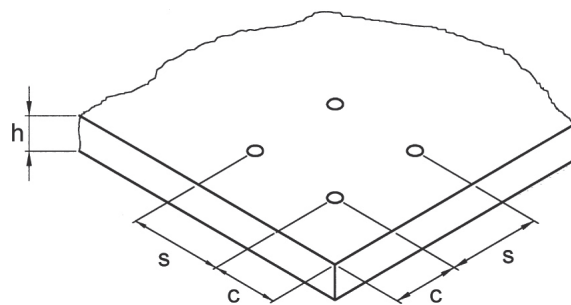
TECHNICAL DATA

For cracked and non-cracked concrete

Extract from Permissible Service Conditions of European Technical Assessment ETA-16/0123

For anchors used in multiple for non-structural applications. Typical of building services installations where the load of the installation is shared between multiple fixings. Total safety factor as per ETAG 001 included. For full design information and loads under fire exposure consult ETA-16/0123.

LOADS AND PERFORMANCE DATA			6×35	6×55
Cracked and non-cracked concrete				
Permissible tension load (C20/25 to C50/60)		[kN]	1.2	3.6
Spacing and edge distance				
Nominal embedment depth	h_{nom}	[mm]	35	55
Characteristic spacing	S	[mm]	35	40
Characteristic edge distance	C	[mm]	35	40
Minimum thickness of concrete	h_{min}	[mm]	80	100
Installation parameters				
Drill hole diameter	d_o	[mm]	6	6
Depth of drill hole	h_1	[mm]	40	60
Installation torque		[Nm]	10	10
Maximum torque (with impact screwdriver)		[Nm]	160	160



PRODUCT DATA SHEET

MRH - MIDFIX ETA ROD HANGERS

TECHNICAL DATA

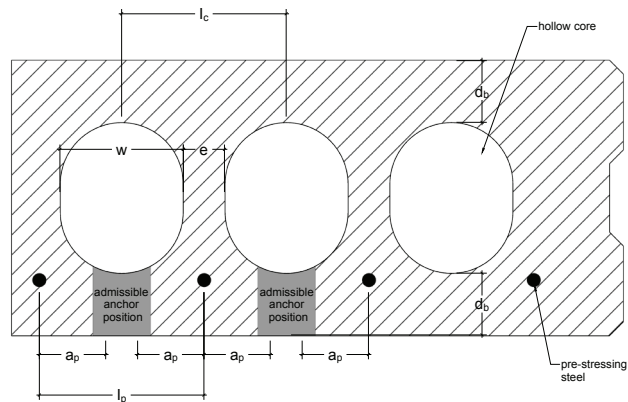
For precast pre-stressed hollow core slabs

Extract from Permissible Service Conditions of European Technical Assessment ETA-16/0123

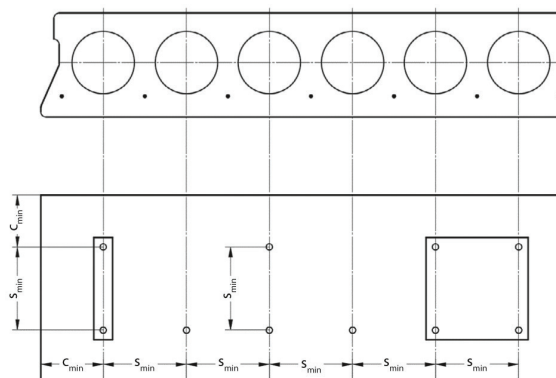
For anchors used in multiple for non-structural applications. Typical of building services installations where the load of the installation is shared between multiple fixings. Total safety factor as per ETAG 001 included. For full design information consult ETA-16/0123.

LOADS AND PERFORMANCE DATA		6×35			
Flange thickness	d _b	[mm]	min 25	min 30	min 35
Permissible tension load		[kN]	0.4	0.8	1.2
Spacing and edge distance					
Minimum spacing	S	[mm]	100		
Minimum edge distance	C	[mm]	100		
Minimum hollow core centres	l _c	[mm]	100		
Minimum reinforcement distance	l _p	[mm]	100		
Minimum distance between anchor & reinforcement	a _p	[mm]	50		
Maximum Hollow core/bridge width ratio	w/e		2		
Installation parameters					
Drill hole diameter		[mm]	6		
Depth of drill hole		[mm]	30	35	40
Installation torque		[Nm]	10		
Maximum torque (with impact screwdriver)		[Nm]	160		

Admissible anchor positions



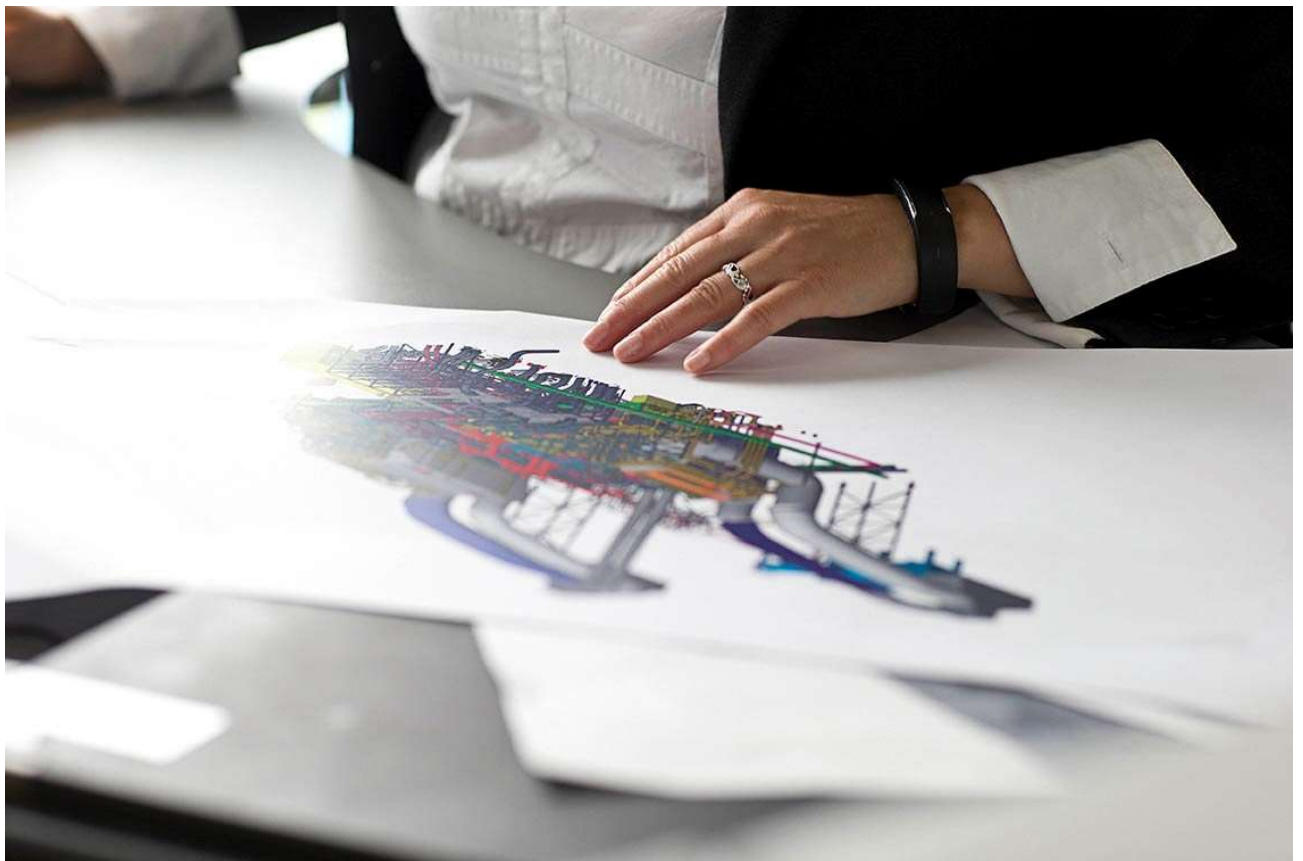
Minimum spacing and edge distance



Intended for
Bruntwood

Document type
Performance Specification
Date
May 2022

Pall Mall Court - Stage 3 MEP Mechanical Performance Specification



Pall Mall Court - Stage 3 MEP

Mechanical Performance Specification

Project Name	Pall Mall Court - Stage 3 Mechanical Performance Specification
Project No.	16200013339
Document No.	1620013339-RAM-XX-XX-RP-M-00005
Revision	P01
Date	04/05/2022
Prepared by	Stuart Moses
Checked by	Craig Wilson
Approved by	Craig Wilson

Revision	Date	Prepared by	Checked by	Approved by	Description
P01	04/05/2022	Stuart Moses Kyle Straccia	Craig Wilson	Craig Wilson	Stage 3

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Ss_50_30_04_97

Above-Ground Internal Stack Wastewater Drainage Systems

Systems

Ss_50_30_04_97 Above-ground internal stack wastewater drainage systems

Contractor's Responsibilities

The Contractor shall develop the tender design to completion, supply, install, co-ordinate with other contractors, test, commission and set to work the complete above ground foul and waste drainage system. This shall include all necessary tools, labour, materials and equipment required to provide a complete working installation that fully meets the functional and performance criteria specified within this specification. This shall include any requirements for upgrading existing above ground drainage systems.

The Contractor shall include for provision of maintenance to the system, seasonal commissioning activities and rectification as required by the Contract and the Mechanical & Electrical Specifications.

Function/Objectives

The above ground foul and waste drainage system will connect to all sanitary appliances, showers, basins, sinks, floor gullies, condensate drains and plant items. The drainage system shall be designed and installed to achieve the following:

- Collect, transport and dispose of all black and grey water outflow from the building to its connection to the utility sewers.
- Prevent the transmission of foul air from the drainage system into the building.
- Minimise the frequency of blockages and provide adequate pipe access to enable the effective clearance of any blockages should they occur.
- Minimise the risk of flooding to any part of a building, especially where the floor level is located below normal ground level.
- Pressure fluctuations in pipework do not vary by more than plus or minus 38mm water gauge and traps retain a water seal of not less than 25mm.
- All new drainage stacks shall connect to the new and existing pop-up locations within the basement.
- New connections to drain shall be fully coordinated and agreed with the Civil Engineer prior to commencement of works

For the specification of the below ground drainage system the Contractor shall refer to the Civil Engineering Specification.

Applicable Standards

In addition to this specification, the above ground foul and waste drainage installation shall comply with the following standards and guidelines current at the time of tender:

- Building Regulations
- British Standards
- The requirements of the local Building Control Authority
- Relevant HSE Guidance
- BSRIA Standards & Guidance Notes
- CIBSE Guides & Notes
- HVCA Standards and Guidance Notes.
- The Institute of Plumbing (C.I.P.H.E) Guide
- Client specific requirements

Any discrepancies identified by the contractor between the specification and the above documents shall be brought to the attention of the CA immediately.

Environmental Performance Assessment

The specification shall be read in conjunction with the latest version of the BREEAM Environmental pre assessment to ensure that any credits targeted applicable to the design of this system are achieved. The specification shall also be read in conjunction with the "Bruntwoods Guide to Net Zero Carbon in Operation"

guide and the "Stage 3 MEP report" to ensure all energy targets are met as part of the project

1. System Description

There are several existing drainage stacks located throughout the building, where practical, these shall be retained and the new services extended to suit the new layouts.

In the basement a full CCTV survey shall be carried out to ensure all existing drainage connections are available for use:

1. New connections to drain shall be provided as indicated on the above ground drainage layouts and architects GA's to serve all basement sanitary appliances. Final locations and requirements shall be coordinated with the Civil Engineer.

All sanitary appliances (unless shown otherwise) shall be drained via a gravity foul drainage system, using the minimum of pipework and fittings to meet the requirements of the applicable British Standards.

Stub Stacks will be limited to a maximum cumulative load of 5 l/s with a maximum height above the invert level of the drain for WC Branch connections of 1.5m and all other appliance connections of 1.5m.

Each appliance will be provided with a trapped waste outlet, providing a depth of seal as dictated by the Building Regulations Document H.

The above ground foul and waste drainage system has been based on a primary ventilated system (single stack principle) as identified in the applicable British standard. This will connect to the below ground foul drainage system, for details of the below ground drainage installation refer to the civil engineering specifications and drawings provided within the contract information.

Waste water branch pipelines shall be installed to comply with the limitations for bends, installed lengths and offset as defined by the applicable British standard. Where these limitations are exceeded, additional venting has been provided.

Stacks should be ventilated in accordance with the requirements of applicable British Standards. Ventilated stacks are preferred to AAV's wherever feasible.

At the top of each discharge stack the vent pipe diameter shall be equal to the stack diameter. The termination of each soil vent stack (SVP), shall be fitted with a durable and secure domical cage, which is resistant to bird nesting and entry by vermin.

Ventilation stacks shall not terminate less than 900mm above the top of any openable window or natural ventilation opening and within a horizontal distance of 3m and terminate 450mm above the roof level. Ventilation stacks will terminate outside the building positioned as indicated upon the Architectural drawings.

Stub Stacks shall only be used to connect discharge branches from ground floor appliances to a common point and connect to the below ground drainage system. All stub stacks shall be terminated with an access cap and connected to the below ground drainage system that is adequately ventilated.

Every sanitary appliance will be provided with a water trap, either as an integral part of the appliance, attached directly to the outlet, or attached in close proximity to the appliance. In order to provide ease of access, traps to showers may be positioned up to 750 mm from the outlet. All kitchen, washing machines and cleaner's sinks shall be provided with tubular traps only, all other appliances shall be fitted with either tubular or bottle traps.

Dishwashers shall be connected to the discharge stack via a float header pipe with 40mm up-stand discharge pipe arrangement, incorporating an air gap, and having a maximum installed length of 3m from the discharge stack. The waste pipe shall be installed at a gradient in accordance with the manufacturer's recommendations.

For the specification of all sanitaryware refer to Architectural specification, schedules and drawings.

Where condensate from fan coil units, air conditioning equipment (including branch controllers) or other plant items is present it will be drained to connection with the above ground drainage system. The Contractor shall provide a self-sealing, valve trap, waterless trap (such as HepVo) at the connection point to the stack.

Pipeline Materials & Distribution

Pipework runs shall be kept as short as possible, with the fewest number of bends, and installed with an adequate gradient to achieve self-cleansing velocity.

All above ground drainage stacks equal to or greater than 75mm shall be installed in Cast Iron to the applicable British Standards unless specifically outlined on the contract drawings. mechanical or push fit joints shall be utilised.

All branch soil and waste pipes and fittings shall be PVCu and MuPVC with solvent welded joints except where seal ring joints are required for thermal movement.

Where pipework or drainage traps are to run exposed to view the colour of the drainage pipework shall be confirmed with the Architect prior to order.

Appliances producing hot waste water shall be connected for the first 4m in copper pipework suitable for the likely temperatures experienced.

Offsets in main vertical discharge stacks will generally be avoided to limit the potential for blockage points within the system. Where unavoidable the offsets shall incorporate large radius or 2no. 45° bends to provide the change in direction.

Provide access doors to all pipes in accordance with Building Regulations and British Standards. This shall include:

- At each floor level, located at floor level plus 1200mm to centre (to be confirmed on site);
- Above and below any off-set; and
- All changes of direction.

Where installed, drainage pipework connections to appliances shall be undertaken in strict accordance with the limitations for unventilated branch discharge pipes as defined within the applicable British Standards. Where any proposed installation is unable to meet these limitations, it shall be brought to the attention of the design team via the Contractor, or his designer.

Discharge stacks connected to drains liable to surcharging or near an intercepting trap require ventilating pipes of not less than 50mm diameter connected to the base of the stack above the likely flood level.

All sanitary pipework receiving condensate should be made from materials resistant to a pH value of 6.5 and lower. The installation should be in accordance with British Standards.

Where practical pipework should be installed to avoid distribution above electrical equipment.

Pipework shall not be jointed within the thickness of walls or floors and shall not be embedded in the building structure.

The Contractor shall be responsible for designing any thermal expansion requirements in the pipework system and designing fixing systems that will not be damaged by the effects of such expansion.

Where PVCu drainage pipework passes through fire-rated structures and areas designated as fire compartments pipework shall be provided with intumescent pipe wrap installed in accordance with the ASFP Red Book: Fire Stopping and Penetration Seals for the Construction Industry – the 'Red Book'.

Workmanship

Good workmanship is essential. Workmanship should be in accordance with applicable British Standards.

Insulation

Where drainage pipework passes above noise sensitive areas it shall be insulated to provide acoustic treatment. Insulation shall be foil faced mineral wool sections.

Testing/Handover Procedures

Inspections should be made during the installation to ensure that the pipework is properly secured and has been kept clear of obstruction and debris. On completion, the discharge system should be inspected to ensure that no cement, rubble or other objects are left in or on the pipes and that no jointing material projects into the pipe bore. Preparation for testing includes:

- fully charging the water seals of all appliances,
- isolating any parts of the system not included in the test,
- providing safe access to all parts of the pipework so that any leaks may be detected.

Air tightness testing of the pipes and fittings shall be undertaken in accordance with Building Regulation guide H. The pipes, fittings and joints should be capable of withstanding an air test of positive pressure of at least 38mm water gauge for at least 3 minutes. Every trap should maintain a water seal of at least 25mm for the duration of the test.

All valve charts, valve labelling, plant schematics shall be completed at the time of commissioning and will form an integral part of the sign off process.

For full details of all Contractual requirements associated with handover and the O&M manuals the Contractor shall refer to the main contract preliminaries and the building services general conditions.

System performance

Ss_50_30_04/210 Design of above ground wastewater drainage systems

1. Design: Complete the design of the above-ground wastewater drainage system.
2. Standards: To BS EN 12056-1, BS EN 12056-2 and relevant parts of BS EN 12056-4 , BS EN 12056-5 and Building regulations approved document part H
3. System configuration
 - 3.1. Form: System III, single discharge stack system with full bore discharge branch pipes.
 - 3.2. Configuration: Primary ventilated stack system;
Unventilated discharge branches;
and Ventilated discharge branches.

Refer to contract drawings for arrangement.
4. Design discharges
 - 4.1. Design discharge types: Commercial kitchen wastewater and Domestic wastewater.
 - 4.2. Design discharge content:
 - 4.3. Recycling requirements: As applicable, Refer to requirements of the environmental performance assessment
 - 4.4. Commercial kitchen effluent treatment: Provide connection to above ground grease separation/treatment system provided by Kitchen fit out Contractor. Enzyme dosing shall not be permitted.
5. Requirements: Submit proposals including detailed design drawings, technical information, calculations and manufacturers' literature.

System completion

Ss_50_30_04/810 Testing above ground wastewater drainage systems

1. Dates for testing
 - 1.1. Notice: Required.
 - 1.2. Period of notice (minimum): 5 working days.
2. Preparation
 - 2.1. Pipework: Securely fixed and free from obstruction and debris.
 - 2.2. Traps: Fill with clean water.
3. Testing
 - 3.1. Water for testing: Supply clean water, assistance and apparatus.
 - 3.2. Smoke for testing: Do not use.
4. Records of tests: Submit.

Ss_50_30_04/820 Above ground wastewater drainage system pipework airtightness test

1. Preparation
 - 1.1. Open ends of pipework: Temporarily seal using plugs.

- 1.2. Test apparatus: Connect a 'U' tube water gauge and air pump to pipework via a plug or through trap of an appliance.
2. Testing: Pump air into pipework until gauge registers 38 mm.
3. Required performance: Maintain pressure of 38 mm without loss for at least 3 minutes.

Ss_50_30_04/830 Above ground wastewater drainage system siphonage and back pressure tests

1. Method
 - 1.1. WC pans: Test by flushing.
 - 1.2. Other appliances: Test by filling to overflow level, then removing the plug.
2. Number of tests: Test each appliance three times. Recharge traps before each test.
3. Self siphonage testing: Test each appliance individually.
4. Induced siphonage and back pressure testing
 - 4.1. Induced siphonage and back pressure testing: Test by discharging the following appliances simultaneously on each stack.
 - 4.2. WCs: The number of appliances to be discharged simultaneously shall be taken from the table in BS EN 12056-2 British Standards link, National Annex NG, clause NG.3
 - 4.3. Washbasins: The number of appliances to be discharged simultaneously shall be taken from the table in BS EN 12056-2 British Standards link, National Annex NG, clause NG.3
 - 4.4. Sinks: The number of appliances to be discharged simultaneously shall be taken from the table in BS EN 12056-2 British Standards link, National Annex NG, clause NG.3

Ss_50_30_04/840 Above ground wastewater drainage system pre-handover checks

1. Temporary caps: Remove.
2. Permanent blanking caps, access covers, rodding eyes, floor gratings and the like: Secure complete with fixings.

Ss_50_30_04/850 Above ground wastewater drainage system submittals

1. Content: Include manufacturers' drawings, technical information, calculations, literature, warranties and handling and maintenance instructions.
2. Timing: Hand over at completion.

Ss_50_30_04/860 Documentation

1. Operating and maintenance instructions
 - 1.1. Scope: Refer to general conditions section 00-80-70 Works Contract Completion
 - 1.2. Product information: Refer to general conditions section 00-80-70 Works Contract Completion
 - 1.3. Format: Refer to general conditions section 00-80-70 Works Contract Completion
 - 1.4. Number of copies: Refer to general conditions section 00-80-70 Works Contract Completion
2. Record drawings
 - 2.1. Content: Refer to general conditions section 00-80-70 Works Contract Completion
 - 2.2. Format: Full size paper print drawing and electronic drawing.
 - 2.3. Number of copies: Two
3. Submittal date: At handover.

Ω End of System

Ss_55_30_96_25 Dry riser systems

Systems

Ss_55_30_96_25 Dry riser systems

1. **Contractors Responsibilities**

The Contractor shall develop the tender design to completion, supply, install, co-ordinate with other contractors, test, commission and set to work the complete dry riser system. This shall include all necessary tools, labour, materials and equipment required to provide a complete working installation that fully meets the functional and performance criteria specified within this specification.

Function / Objectives

To provide a fixed pipework distribution system capable of delivering water to each floor level for fire suppression purposes.

Applicable Standards

In addition to this specification the dry riser installation shall comply with the latest editions of the following technical standards and guidelines:

- CIBSE Guide B
- Building Regulations Approved Document B
- LGA - Provision of water for fire fighting 3rd edition
- The Fire and Rescue Services Act 2004
- The Water Supply Regulations 1999
- British Standards
- BS 9990

Any discrepancies identified by the contractor between the specification and the above documents shall be brought to the attention of the CA immediately.

Environmental Performance Assessment

The specification shall be read in conjunction with the latest version of the BREEAM Environmental pre assessment to ensure that any credits targeted applicable to the design of this system are achieved. The specification shall also be read in conjunction with the "Bruntwoods Guide to Net Zero Carbon in Operation" guide and the "Stage 3 MEP report" to ensure all energy targets are met as part of the project

System Description

There are two existing dry riser systems used for fire suppression as follows:

- 1No. to the Tower lift lobby with dry riser inlet on King Street and outlets on each floor
- 1No. to the Tower lobby on the Marsden Street side with dry riser inlet on Marsden Street and outlets on each floor.

The Contractor shall test and commission dry riser systems for fire suppression purposes and where required upgrade any systems as necessary to provide a fully functional and working system.

The main components shall include:

- Inlet breaching located adjacent the main entrance (or as agreed with fire brigade) at ground level that provides the connection to the water supply. Breaching inlets used shall have 4 inlet connections complete with 2.5" male instantaneous inlets to BS336 fitted with non-return valves, 1" drain valve and caps and chains. The cabinets shall be located in the same location, on the external wall of the building accessible to the Fire Brigade from outside the building.
- A 100mm galvanised steel riser pipe (based on 1 outlet per floor) rising through the floors of building following the existing routes, complete with fire collars at each fire compartment line.
- Dry riser gate/landing valves provided at each floor as per the existing locations, providing outlets from the rising main. These valves shall be situated on each floor of the building and shall be housed in outlet cabinets or outlet architrave and door which are manufactured to BS 5041 part 4. Dry riser gate valves are either flanged PN16, female or male screwed, outlets to BS 336, complete with blank cap and chain, complying with BS 5041 part 2.

- The top of riser should be fitted with an air release valve which releases all air from the riser, as water is pumped in, but closes automatically under pressure of water.
- The dry riser must run at a continuous fall to facilitate draining ensuring all water is evacuated.

Pipelines and Material

All Dry Riser pipework shall be grooved, galvanised steel to the latest edition of BSEN1387 / EN10255.

Rising mains shall be jointed with mechanical grooved couplings with a long radius tee at each floor level that connects to the landing valve with a flanged joint.

Note that all components which are to be installed in any system which is to be connected to the service mains or any water company pipework comply with the Water Fittings Regulations and must be approved for its intended use by the Water Regulations Advisory Scheme (WRAS).

Completion and Handover

On completion of the work the contractor shall test the installation and provide a commissioning certificate for the installation that proves its functionality is fit for purpose.

Dry Risers shall be tested to the latest edition of BS9990: initial static pressure test of risers.

The system should be completely charged with water to a pressure equal to its design operating pressure measured at the inlet for a period of at least 1 hour. During this period, an inspection of the system should be made to check whether there is any leakage of water at any of the joints or landing valves. If any leaks are identified, appropriate remedial action should be taken and the system should be retested.

System performance

Ss_55_30_96/210 Design of riser systems

1. Standards: In accordance with CIBSE Guide E and BS 9990.
2. Design: Complete the design of the wet riser system.
3. Bore of main riser: 100 mm, Refer to Contract drawings
4. Requirement: Submit proposals including detailed design drawings, technical information, calculations and manufacturers' literature.

System completion

Ss_55_30_96/810 Flushing type A

1. Standard: In accordance with BS 9990.
2. Operation: Fill the system with water and discharge it via the topmost outlet. Flush out debris.

Ss_55_30_96/820 Testing

1. Standard: In accordance with BS 9990.
2. Notice before testing (minimum): Three days.
3. Static pressure test: Charge the system with water to a pressure of 1000 kPa. Maintain for 15 minutes. During this period, inspect the system to check that no water leaks at joints or landing valves. Submit test results
4. Flow test: After static pressure test, pass water through the system under pressure and record flow gauge readings. Submit test results.
Investigate and remedy any inability to sustain an effective firefighting jet from the topmost outlet, or any undue pressure loss. The system should be retested after any remedial work.

Ss_55_30_96/830 Setting to work

1. Standard: In accordance with BS 9990.
2. Operation: Check operation of hydrant valves. Check operation of non-return valves.
3. Make ready: Drain system and leave ready for use.

Ss_55_30_96/840 Inspection and test records

1. Reports: On completion of the works provide a report shall be provided and signed by the Contractor and his fire suppression specialist that identifies the testing undertaken on the dry riser system, provides signatures from those who witnessed the testing and states that the testing procedures of BS9990 have been strictly followed and met.

The report shall be inserted into the operation and maintenance manuals.

2. Record sheets
 - 2.1. Submission: On completion.
 - 2.2. Number of copies: Three.

Ss_55_30_96/850 Documentation

1. Operating and maintenance instructions
 - 1.1. Scope: Submit for the system giving optimum settings for controls.
 - 1.2. Product information: Include product description, date of purchase, performance characteristics, application (suitability for use), method of operation and control, and cleaning and maintenance requirements.
 - 1.3. Format: Paper and electronic copy.
 - 1.4. Number of copies: Two.
2. Record drawings
 - 2.1. Content: Location, size and route of Mechanical services; Location and identification of pipework regulating, isolation and control valves; and Location of outlets.
 - 2.2. Format: A1 paper print drawing and Electronic drawing.
 - 2.3. Number of copies: Two.
3. Submittal date: At handover.

Ss_55_30_96/860 Operating tools

1. Tools
 - 1.1. Type: Supply tools for operation, maintenance and cleaning purposes.
 - 1.2. Quantity: 2 set.
2. Keys
 - 2.1. Type: Supply keys for padlocks and air release valves.
 - 2.2. Quantity: 2 set.

Ss_55_30_96/870 Servicing and maintenance

1. Standard: In accordance with BS 9990.
2. Requirement: The Contractor shall allow within his price for the recommended maintenance testing of the system as identified in BS9990, which shall include:

All dry fire mains should be checked every six months to ensure that all valves are fully serviceable, and a wet pressure test should be carried out annually to ensure that there is no leakage.

Undertake for 12 months after completion.

Ω End of System

Ss_55_30_98_85 Sprinkler systems

Systems

Ss_55_30_98_85 Sprinkler systems

Description: **System Philosophy**

To provide life and (where required) property protection systems in accordance with the fire strategy for the building. The Sprinkler systems is to be designed by a sprinkler specialist and will form part of the contractor design portion of the project. The sprinkler systems are to be designed, supplied, installed, tested and commissioned by an LPS 1048 certified Contractor.

Performance Criteria

- BS750:1984
- CIBSE Guide B
- Building Regulations Approved document B
- LGA - Provision of water for firefighting 3rd edition 2007
- The Fire and Rescue Services Act 2004
- The Water Supply Regulations 1999

System Description

There is an existing Town Main fed sprinkler system serving the existing basement car park area. The system is fed from Marsden Street and enters via the basement wall next to the car park ramp. As part of the proposed development works, the car park area shall be reduced in size.

The Sprinkler Contractor shall make an allowance for a site survey of the existing system to determine the necessary modifications of the reduced protected area prior to commencement of design and installation.

The Contractor shall make the required upgrades to the existing sprinkler town main system to provide a fully functional and working system.

Sprinklers are required for the Car Park area and should be designed and installed fully in compliance with BS EN 12845:2015+A1:2019

The system shall be an Ordinary Hazard 2 (OH2) system as described within the fire strategy engineers report.

Trace heating will be required in areas where pipework is exposed to the elements and has risk of freezing.

The final design of the sprinkler system including sprinkler heads shall be confirmed by the specialist contractor.

All pipework is to be in Carbon Steel

Where fire extinguishing system pipework passes through a fire compartment barrier, A maintenance free, modular, automatic mechanical fire stopping device shall be installed.

Fire extinguishing system pipework anchoring and expansion to be provided via expansion bellows or loops. Final selection and positioning are a contractor design portion (CDP) The sprinkler system shall be monitored by the fire detection and alarm system for fire and fault.

Statutory Authorities

It will be the responsibility of the Contractor to liaise with the Statutory Authorities and provide any test notices required to ensure final connections are made in accordance with requirements of the testing and commissioning programme. Liaison with the Statutory Authorities during installation shall be carried out under this contract.

The Contractor shall provide all formalities in connection with test notices, agreement and application for supply forms etc.

All documents requiring the signature of the Employer are to be forwarded in time to meet the building programme in order for the necessary test and supply arrangements to be made.

System performance

Ss_55_30_98/210 Design of commercial and industrial sprinkler systems

1. System designer: Loss Prevention Standard 1048 registered. Loss Prevention Standard 1048 registered.

2. Design

- 2.1. Standard: Complete the design of the sprinkler system to [BS EN 12845](#) and [LPC Rules for automatic sprinkler installations](#).
- 2.2. Hazard class: OH2.
- 2.3. System type: Dry pipe.
- 2.4. Area of operation: Basement Car Park

[Ss_55_30_98/220](#) Extent of protection

1. Areas to be protected: Basement Car Park

[Ss_55_30_98/260](#) Integration of sprinkler system with fire alarm systems

1. Link from sprinkler system to fire alarm system
 - 1.1. Objectives: To initiate a fire alarm signal.
 - 1.2. Standard: To [BS EN 12845](#).
2. Link from fire alarm system to sprinkler system
 - 2.1. Objectives: Link fire alarm to sprinkler system
 - 2.2. Standard: In accordance with [BS 5839-1](#). In

System completion

[Ss_55_30_98/820](#) Testing and commissioning of water fire suppression systems

1. Standards
 - 1.1. Commercial and industrial sprinkler systems: BS EN 12845.

[Ss_55_30_98/850](#) Documentation for water fire suppression systems

1. Standard: To be confirmed by specialist contractor
2. Certificate of conformity:
3. Operating and maintenance instructions
 - 3.1. Scope: Submit for the system giving optimum settings for controls.
 - 3.2. Product information: Include product description, date of purchase, performance characteristics, application (suitability for use), method of operation and control, and cleaning and maintenance requirements.
 - 3.3. Format: Paper copy.
4. Record drawings
 - 4.1. Content: To BS EN 12845, section 4.
 - 4.2. Format: A1 paper print drawing. Electronic drawing.

[Ss_55_30_98/860](#) Servicing and maintenance

1. Standard: To be confirmed by specialist contractor

Ω End of System

[Ss_55_70_38_42](#)

Indirect hot water storage supply systems

Systems

[Ss_55_70_38_42](#) Indirect hot water storage supply systems

1. **System performance: Contractors Responsibilities**

The Contractor shall develop the stage 3 design to completion, supply, install, co-ordinate with other contractors, test, commission and set to work the complete Indirect hot water storage supply system. This shall include all necessary tools, labour, materials and equipment required to provide a complete working installation that fully meets the functional and performance criteria specified within this specification.

The Contractor shall include for provision of maintenance to the system, seasonal commissioning activities and rectification as required by the Contract and the Mechanical & Electrical Specification.

Function/Objectives

To supply hot water for use within the building at its end use appliances and as identified on the contract drawings.

Applicable Standards

In addition to this specification, the hot water installation shall comply with the following standards and guidelines current at the time of tender:

- Utility Suppliers Connection requirements & procedures
- Water Regulations and WRAS standards
- Building Regulations
- British Standards
- The requirements of the local Building Control Authority
- Relevant HSE Guidance
- BSRIA Standards & Guidance notes
- Client specific requirements
- CIBSE Guides & Notes
- HVCA Standards and Guidance Notes.
- IGEN Standards and guidance notes
- The Institute of Plumbing Guide
- HSE ACOP L8 - 'The Control of Legionella Bacteria in Water Systems'.

Any discrepancies identified by the contractor between the specification and the above documents shall be brought to the attention of the CA immediately.

Environmental Performance Assessment

The specification shall be read in conjunction with the latest version of the BREEAM Environmental pre assessment to ensure that any credits targeted applicable to the design of this system are achieved. The specification shall also be read in conjunction with the "Bruntwoods Guide to Net Zero Carbon in Operation" guide and the "Stage 3 MEP report" to ensure all energy targets are met as part of the project

Part L Building Regulation Compliance:

The Contractor shall ensure that prior to the final selection and order of any mechanical or electrical equipment they refer to the "Stage 3 MEP Report" and "Bruntwoods Guide to Net Zero Carbon in Operation" guide to ensure that the minimum equipment efficiencies as listed are achieved or bettered. As a bare minimum these will be as defined within the current edition of the Non-Domestic Compliance guide, but will typically exceed these values so must be checked.

Where variations or value engineering recognises equipment efficiency or control strategy changes that are potentially detrimental to the Part L compliance outcome, the Contractor must review and make the necessary enhancements to other areas of the proposed design in order to maintain a compliant project with respect to Part L at completion. Where applicable any equipment and strategy change must also be reviewed against any design stage BREEAM pre-assessment credits.

The Contractor shall be responsible for undertaking the EPC at completion of the project.

System Description.

The Contractor shall extend the cold water services and low temperature hot water service (as described in section Ss_60_40_37_48 of this specification), to serve packaged indirect hot water semi-storage heat exchangers as per the arrangement shown in the contract documentation.

Indirect hot water generators complete with semi-storage vessels are to be located within the mechanical plantroom at lower ground level to serve all hot water outlets within the serviced office floor plates and the WC cores within the building. The packaged storage cylinders and heat exchangers shall be piped and connected to give a balanced flow through each system, this is typically achieved by installing identical connection pipes and fittings to provide balanced pressure through each device.

An air to water heat pump shall be the primary source of domestic hot water production. This Air source heat pump shall supply water from the main tower roof down the dedicated riser (as shown on the contract drawings) to the lower ground plantroom at 65°C Flow and 60°C Return. This primary LTHW will circulate through at a constant flow rate, maintained via a constant flow differential pressure valve within the primary flow pipework. An orifice plate shall be provided on the primary return pipework to enable verification of flow.

The heating pipework shall be sized to enable an additional load for a future kitchen provision in the King Street block – as per the contract schematics.

The air source heat pump shall be provided as a packaged unit and be complete with control systems that can connect to the BMS via BACnet.

The air source heat pump will connect directly to the packaged indirect hot water cylinders, to maintain the hot water temperature as the required level, via a plate heat exchanger as part of the package domestic hot water cylinders, as shown on the contract drawings and the equipment schedules. This plate heat exchanger will separate the air source heat pump non-potable water from the potable domestic hot water within the indirect hot water cylinder. The flow from the air source heat pump to the plate heat exchanger shall be constant flow via a variable speed pump that shall be set to the correct flow rate during commissioning. An orifice plate shall be included within this circulation system to enable verification of flow. This secondary system shall also be provided with a quick fill loop, safety valve and expansion vessel to accommodate expansion from the system.

The cylinders shall also be provided with an electric immersion heater that shall provide a pasteurisation function to the domestic hot water system by raising the domestic hot water temperature to 70°C. Pasteurisation shall be controlled via the BMS and shall occur on a time schedule basis. Typically, the domestic hot water shall be pasteurised during periods of low usage (typically 3am in the morning) where the temperature is raised in the cylinders to 70°C for a period of time and circulated via a domestic hot water secondary return system. The thermostatic return valves within the secondary return pipework will register the increase in temperature and open up to enable flow and system pasteurisation as required.

The Immersion heater shall also act as a booster to provide the DHW cylinders if the demand for both the DHW and heating are above the capability of the ASHP in winter months.

A pumped circulation system shall be provided that will ensure water temperatures within the system are maintained above the targets values identified within HSE ACOP L8. Thermal circulation/ balancing valves shall be fitted on the return leg of branch circuits to aid circulation flow and circuit temperature maintenance. The valves will also have a disinfection setting allowing it to circulate high temperature water for sterilisation purposes for short durations.

The hot water system has been designed based on the following temperatures and parameters.

- Minimum Hot Water Storage Temperature - 60°C
- Minimum Hot Water Circulation Temperature - 55°C
- Circulation pipework and pump systems shall be sized to ensure that all hot water outlets have the ability to achieve 50°C water temperature within 30 seconds of continuous operation.
- Dead legs shall be kept to an absolute minimum; dead legs to basins with blending valves to be within 300 mm of the valve.

The hot water network shall be protected from the effects of expansion by suitable sized pressure vessels, alongside the mandatory safety valves (pressure/temperature relief valves).

To prevent scalding, the temperature of water at outlets, except where identified in the contract drawings, will be controlled with thermostatic mixing valves (TMV).

TMV mixing valves shall be utilised in public areas and where the users are classified as vulnerable or infirm. In these areas the following temperatures shall be used at outlets:

- 41°C For shower applications
- 43°C For washbasin applications

Please note that in accessible WC's, showers and changing areas and first aid rooms, the entire hot water installation shall be designed to be low surface temperature in accordance with approved document M.

DHW will be distributed at the unregulated circulation temperatures indicated above to serve kitchen sinks catering areas and cleaners sinks as required within the building. Each outlet shall be provided with a permanent label above the outlet reading ' warning very hot water'.

To reduce water consumption, outlets to basins, sinks and showers will be fitted with flow limiters or low flow rate fittings. Dead legs are to be kept to a minimum from mixing valves.

Temperature sensors mounted in the circulation loop shall be provided to monitor circulation temperatures throughout the system as per the recommendations of the HSE ACOP L8. Monitoring shall be via the Building management system, as shown on the contract drawings.

In accordance with the environmental performance criteria, automatic water shut off valves, activated by passive infra-red sensors shall be located in each main WC area to shut off the BCWS to the room in order to reduce the risk of minor leaks in toilet and washroom facilities.

Pipelines and materials

All internal pipework shall be installed using Copper tubing to BS EN 1057. Jointing shall be undertaken using;

- Press-Fit Joints and fittings (Viega Profipress system or equal and approved)
- WRAS approved capillary joints and fittings

Pipework shall be brazed in non-accessible areas. Where exposed to view in WC areas, Kitchens and bathrooms all pipework shall be chromium plated with matching chrome valves.

Generally pipework should be installed to avoid distribution above electrical equipment. Where avoidance of such equipment is not possible the installation of galvanised steel drip trays beneath the pipework section shall be provided, complete with a gravity drain connection routed to local foul waste downpipe.

Pipework shall not be jointed within the thickness of walls or floors and shall not be embedded in the building structure.

The Contractor shall be responsible for designing any thermal expansion requirements required in the pipework system. Where necessary thermal expansion of pipework shall be absorbed by expansion loops, sets or bellows units. Where no expansion devices are indicated, expansion movement shall be absorbed by changes in direction. Where necessary, bends shall be incorporated in connections to equipment and in branch connections in the mains. Cold draw shall be applied to all pipework where expansion occurs.

All exposed pipework shall be arranged to present a neat and tidy appearance and all vertical pipes are plumb or follow the building line. Pipes shall be parallel with other pipes, service runs and building structure subject to gradients for draining and venting. All pipework and fittings not "boxed in" or concealed but exposed to view shall be installed in chrome plated pipework, with chrome plated valves, fittings, pipework brackets, unions and supports.

All pipework shall be graded to allow system to be drained. Provide a means of draining at all low points.

All high points of the domestic hot water system shall include Automatic Air Vents (AAV's).

Supports, accessories for equipment, appliances or ancillary fittings in pipe runs shall be arranged so that no undue strain is imposed on the pipes.

Where pipes pass through fire barriers pack annular space between pipe and sleeve or insulation and sleeve with non-flammable and fire resistant material to form a fire/smoke stop of required rating. Apply 12mm deep cold mastic seal at both ends within sleeve. Where fire regulations and other considerations require the ends of sleeves to be sealed, such sealing should be of a permanently flexible form to allow movement of the pipe.

Make final connections to equipment in accordance with manufacturer's instructions, with isolation valves for future equipment isolation, and as indicated on the contract drawings.

Where pipes of dissimilar metals are used, appropriate means shall be taken to prevent galvanic action where dissimilar metals are connected together.

All non-ferrous components shall be thoroughly cleaned and de-greased.

Temperature and pressure gauges are to be installed at pertinent locations of the system, to ensure that the building operator can quickly determine satisfactory operation and to assist in fault finding where required.

All metallic pipework shall be electrically bonded in accordance with BS 7671.

All components of the water system are to be WRAS or KIWA UK approved.

Insulation

Insulation shall comply with BS 5422. Insulation to achieve an A or A+ rating according to the current version of the 'Building Research Establishment Green Guide to Specification'. All building services insulation shall meet the BREEAM criteria for responsible sourcing.

All pipework, except that which is exposed in occupied spaces, shall be insulated. The type and thickness of insulation is detailed elsewhere, and the finish is to be as detailed below:

- o Plantrooms up to 2m above floor level – Insulation to be over clad with Aluzinc cladding
- o Plantrooms above 2m above floor level – Foil finish
- o Plantroom Valves - Rigid PVC
- o External - 6 ply white , Venture cladding self adhesive jacketing.
- o External Valves - 6 ply white , Venture cladding self adhesive jacketing.
- o Internal Exposed - Rigid PVC
- o Internal Exposed Valve - No insulation
- o Roof Voids - Foil Finish
- o Ceiling voids - Foil finish
- o Internal Services Ducts - Foil Finish

- o Within Internal Boxing - Foil Finish
- o Valves in roof voids, internal ducts, boxings etc. - Foil finish

Load bearing insulated support inserts shall be provided at all bracket locations to ensure there is no break in the thermal properties, foil finish and protection. Supports shall be segmental supports suitable for the temperature range of the pipework. The insulation shall be fitted right up to the supports and the insulation shall be continued through the brackets with no thermal break.

Thermal insulating materials should conform to BS 5422 and should be installed in accordance with BS 5970.

Detailed guidance on the thermal insulation of pipework and ductwork is given in TIMSA guidance for achieving compliance with Part L of the Building Regulations.

Where routing externally, below ground pipework installed at depths less than 750mm below the finish floor level shall be insulated for frost protection.

Trace Heating

Where water service pipelines are installed externally or within a void where temperature could cause freezing, frost protection shall be provided using an electrically operated, self-regulating, heated cable system.

The trace heating tape shall be installed prior to the pipework insulation so that on completion the tape shall sit concealed within the insulation sleeve. The control module shall ensure that the fluid within the pipework is maintained at a set temperature along its length, the temperatures shall be set as follows:

- HWS Flow - 60°C min
- HWS Return - 55°C min

Where trace heating tapes are applied to pipework, warning labelling shall be fitted to insulation casing alerting facility/maintenance staff to the presence of electricity beneath. The Contractor shall ensure that these warning labels are fit for purpose with regard their durability to the local environmental conditions.

Labelling

All piped services shall be identified complete with flow direction indication, using adhesive tapes in accordance with this specification (except where pipework is exposed to view and decorated) and BS 1710.

The basic identification colour and code indications shall be placed at junctions, at both sides of valves, serviced appliances, bulkheads, wall penetrations and at any other place where identification is necessary to allow the safe onward use and maintenance of the system.

All valves located in plant rooms, service voids or where adjacent to plant shall be identified. The identification shall be in the form of either a brass or traffolyte disc, permanently chained to the valve with chromium plated brass chain, bearing a reference number corresponding with that on the framed and glazed valve chart provided in the buildings principal plant room.

The Contractor shall provide and install at all unblended hot water outlets, a small red traffolyte label with white lettering to read - WARNING VERY HOT WATER. Labels shall be fixed by means of chromium plated dome-head screws to the wall surface immediately behind and above the relevant tap.

Pipework Accessories & Valves

The Contractor shall ensure at the point of procurement that all valves selected are suitable for the system medium and test pressure. Valves shall be installed where indicated on the contract drawings or indicated in this specification. In addition, the Contractor shall include all valves necessary for the isolation, testing, flushing, regulation and commissioning of the system.

All valves must be anti-clockwise operation on closing. For valves mounted in chambers extended spindles must be installed on all valves which should end no lower than 200 mm below any valve chamber cover to facilitate operation.

All valves and cocks shall be installed in positions which permit easy access for operation and maintenance.

At the point of order, the contractor shall ensure that where valves are provided for the regulation of flowrates that could be defined as 'low flow' with respect to their duty, the valve selected is suitable for regulation within the flow range.

The contractor shall allow for the installation of any valve or devices imposed upon the work at the request of the utility provider.

Automatic air release valves shall be incorporated at all system high points and at the top of all risers.

Safety Relief Valves and Expansion vessels

All heat generating equipment and all vessels/pipework subjected to a pressure greater than atmospheric, shall be fitted with a Safety Relief Valve and suitably sized expansion vessel in accordance with current British Standards.

Typically on an indirect cylinder the following devices shall be installed to achieve a compliant installation:

- An expansion vessel, sized to account for the system expansion capacity
- An expansion relief valve shall be installed on the cold feed to the cylinder. A drain shall be taken from this valve to drain via a tundish.
- A temperature relief valve shall be installed on the cylinders. A drain shall be taken from this valve to drain via a tundish.
- A non-return valve shall be fitted to the cold feed to the cylinders, upstream of the expansion vessel.

All valves shall incorporate a padlock or lead seal to lock the set pressure and to obviate unauthorised tampering. Safety Relief Valves shall be mounted vertically and fitted directly to the equipment/system with the minimum possible length of pipe and no intervening valve or other restriction.

Discharges from relief valves fitted to systems operating at up to 90°C shall be routed to terminate 200mm above floor level with an anti-drip profile.

All pipework routing from safety relief valves shall be installed in Copper tubing for the first 2 m and taken to drain via a tundish and drainage system suitably rated for the discharge temperature.

The discharge to tundish shall be provided with a Type A air gap.

Water Consumption Metering

Sub metering shall be provided as identified and in accordance with any credits targeted within the environmental performance assessment and in compliance with building regulations.

Each meter shall have a pulsed output (Modbus RTU communications output) and shall be monitored by the BMS. It will be the Contractors responsibility to lay and connect communications wiring between the BMS outstations and any sub meter location. This will include any associated excavation, ducting or containment and integration/coordination with third party installations or equipment.

Isolation valves shall be fitted either side of any installed water meters to allow isolation and removal in the future. A drain valve shall also be fitted for this purpose. Bypass arrangements are not permitted. Care must be taken to install the meter at the correct orientation and with sufficient upstream and downstream length of pipework in line with manufacturers recommendations.

Labelling shall be provided adjacent to all meters identifying the meters function and any specific referencing identified in the contract schedules. This referencing shall be carried through to the BMS head end graphics for consistency.

Water meters shall be selected based upon the design flow rate anticipated for the site or circuit. Meters shall be WRAS approved for use with potable water. Meters shall have a minimum accuracy of $\pm 2\%$ for water temperatures $\leq 30^{\circ}\text{C}$ and $\pm 3\%$ for water temperatures $> 30^{\circ}\text{C}$, and all to be MID approved.

Legionella risk assessment

The contractor shall provide a legionella risk assessment on completion of the installation, in accordance with the guidelines of The HSE Approved Code of Practice: Legionnaires' disease: The control of Legionella bacteria in water systems (L8).

Testing/Handover Procedures

The contractor shall provide a commissioning programme and methodology making due allowances for interfaces with all other systems and equipment. All systems shall be pressure tested, flushed, chemically cleaned, chlorinated and set to work.

All TMV points within the building shall be tested on completion.

All water temperature monitoring devices shall be proved and logged on completion and a legionella monitoring programme identified within the Operation and Maintenance manuals.

The Contractor shall ensure that all pressure testing results, chlorination certificates and water sampling results are made available for review at commissioning stage and inserted into the O&M manuals.

Plant test certificates for all major plant items installed upon the cold water network shall be presented for review and inserted into the O&M manuals at completion.

All valve charts, valve labelling, plant schematics shall be completed at the time of commissioning and will form an integral part of the sign off process.

For full details of all Contractual requirements associated with handover and the O&M manuals the Contractor shall refer to section 00-80-70 : Work Contract Completion located within the MEP general clauses.

System performance

Ss_55_70_38/210 Design and detailing hot and cold water systems

1. Design: Complete the design and detailing of the hot and cold water supply.
2. Standard: To BS 8558 and in accordance with HSE publication L8: Legionnaires' disease. The control of Legionella bacteria in water systems. Approved Code of Practice and guidance on regulations.
3. Requirement: Submit proposals including detailed design drawings, technical information, calculations and manufacturer's literature.

Ss_55_70_38/240 Centralized hot water storage system

1. System design: Design the system to meet the following requirements.
2. Storage capacity
 - 2.1. Standard: In accordance with CIPHE Plumbing engineering services design guide.
 - 2.2. Type of building: Office. With canteen.
 - 2.3. Number of people: As per FF&E layouts
3. Primary heat source: Capable of raising temperature of water from 10°C to 60°C within one hour.
4. Water supply: Boosted.

Ss_55_70_38/250 Pipeline sizes for hot and cold water systems

1. Sizing: In accordance with To BS 8558 and CIPHE Plumbing engineering services design guide.
2. Proposals: Submit drawings with pipe sizes shown.
3. Performance
 - 3.1. Water velocity (maximum): 1.5m/s for hot water and cold water distribution outside of plant areas, 2.0m/s within plant areas.

System completion

Ss_55_70_38/810 Commissioning of hot and cold water supply systems type C

1. Pre-commissioning: In accordance with BSRIABG 2/2010 and CIBSECommissioning Code W.
2. Commissioning: In accordance with BS 8558, BSRIABG 2/2010 and CIBSECommissioning Code W.
3. Notice (minimum): 1 week
4. Equipment: Check and adjust operation of equipment, controls and safety devices.
5. Outlets: Check operation of outlets for satisfactory rate of flow and temperature.

Ss_55_70_38/820 Inspection and test records Type A

1. Construction phase reports: System commissionable.
2. Records for water systems: In accordance with BSRIABG 2/2010.
3. Record sheets
 - 3.1. Submission: On completion.
 - 3.2. Number of copies: two

Ss_55_70_38/830 Demonstrations Type A

1. Running of plant
 - 1.1. Operation: Run, maintain and supervise the installations under normal working conditions.
 - 1.2. Duration: One week.
2. Instruction: Instruct and demonstrate the purpose, function and operation of the installations. Provide completed commissioning sheets for all plant items and records of all successfully completed testing.

3. **Witnessing Requirements:** Handover material shall be provided in accordance with the recommendations of BSRIA BBG01/07 Handover, O&M manuals, and project feedback.
 A programme shall be agreed for pre-commissioning checks, setting to work, commissioning and performance testing of plant and installations, and allow for all costs incurred. Where required, formal method statements shall be provided supported by risk assessments detailing all commissioning procedures.
 Notice shall be given to all parties stating any requirements for attendance and co-operation of others, not less than fourteen working days in advance of the tests.
 The Employer's Agent will only witness test proceedings confirm recorded results and determine if the specified requirements have been satisfied. If following test or inspection any plant or part thereof is shown to be defective or not conforming to the specification the Employer's Agent will reject such defective parts by written notice, within reasonable time, indicating area of dispute.
 The Contractor shall appoint an approved commissioning specialist engineer, to supervise the whole of the testing, commissioning, performance testing and instruction of client's staff.
 The Contractor shall provide all specialised personnel (including manufacturer's representatives) and co-ordinate their activities.
 Equipment, material and systems shall be tested as detailed in Work Sections.
 If an inspection or test fails, repeat the procedure, until satisfactory results are obtained. All tests shall be completed before any paint; cladding or similar materials are applied or before services are concealed.
 Following satisfactory completion of testing and when the installations are in a safe and satisfactory condition, set to work, regulate and adjust the systems, as necessary, to meet the specified design requirements. All necessary instruments and recorders are to be provided to monitor systems during commissioning and performance testing. Test equipment shall be subject to a quality assurance procedure complying with BS 5781.
 Do not start performance testing, including system demonstration, system proving or environmental and capacity testing, until commissioning of the system is completed to the satisfaction of the Employer's Agent.
 Maintain on site full records of all commissioning and performance testing cross referenced to system components and on completion of the Works include a copy in each Operating and Maintenance Manual. All certification documents shall be provided for approval by the Employer's Agent before any system is offered for final acceptance. Gas, fuel oil, electricity and water for testing and commissioning will be provided by the Contractor.
 10-15% of all values should be checked by the mechanical designer.
 100% of all safety interlocks (and all fire dampers' operation) should be witnessed by the designer.
4. **Demonstration Requirements:** Once all systems have been commissioned and proved to be meeting the intent of the design with respect performance, control and operation the Contractor shall invite the client team to site and perform demonstrations of the operation of all key building services systems.
 The Contractor shall provide a minimum of 14 days notice of testing to allow staff to make the necessary arrangements with respect their attendance.
 Where fire dampers are installed, access hatches are to be provided at either side of the damper for future maintenance, as per the requirements of DW/144.
 The contractor shall ensure that fire dampers are installed in accordance with the manufacturers tested and approved details, suitable for the installation position and building element materials.
 Where inspection openings are provided in fire rated ductwork they shall be designed to maintain the fire integrity of the system.

Ss_55_70_38/840 Documentation Type A

1. **Operating and maintenance instructions**
 - 1.1. **Scope:** Submit for the system giving optimum settings for controls.
 - 1.2. **Product information:** Include product description, date of purchase, performance characteristics, application (suitability for use), method of operation and control, and cleaning and maintenance requirements.
 - 1.3. **Format:** Paper copy and electronic
 - 1.4. **Number of copies:** Two of each
2. **Record drawings**
 - 2.1. **Content:** Location and arrangement of plant in plant rooms;
 Location, size and route of hot and cold water services;
 Location, route and depth of underground services;
 Location and identification of regulating, isolation and control valves;
 and Location of outlets.
 Record drawings shall provide the level of detail identified within the current version of BSRIA BG6-A design framework for building services.
 - 2.2. **Format:** A1 paper print and Electronic copy.
 - 2.3. **Number of copies:** Two.
3. **Submittal date:** At handover.

4. Wholesome water consumption notice: Submit within 30 days.

Ss_55_70_38/850 Water quality tests Type B

1. Standard: To BS 8558. And in full accordance with utility suppliers requirements
2. Samples
 - 2.1. Sample points: Main supply to site.
 - 2.2. Samples for analysis: Submit samples for bacteriological analysis.
 - 2.3. Testing procedure: The testing process and procedure shall comply with the minimum requirements of the selected utility supplier as well as the requirements defined within this specification.
3. Water temperature: Record at each sampling point at the time of taking the sample.
4. Test results
 - 4.1. Record: Details of all analyses.
 - 4.2. Submit: On completion.
 - 4.3. Number of copies: Two.

Ss_55_70_38/860 Spares Type A

1. Pipeline ancillaries
 - 1.1. Keys: Two of each type.
 - 1.2. Hose unions: Two of each type.
2. Belts and pulleys:

Ss_55_70_38/870 Operating tools Type A

1. Tools: Supply tools for operation, maintenance and cleaning purposes.
2. Keys: Supply keys for valves and vents.

Ss_55_70_38/880 Maintenance Type A

1. Servicing and maintenance: Undertake for 12 months after completion.

Ω End of System

Ss_55_70_38_65

Mains cold water and pumped cold water supply systems

Systems

Ss_55_70_38_65 Pumped cold water supply systems

1. **Contractors Responsibilities**

The Contractor shall develop the stage 3 design to completion, supply, install, co-ordinate with other contractors, test, commission and set to work the complete pumped cold potable water supply system and updates to the incoming main cold water supply system. This shall include all necessary tools, labour, materials and equipment required to provide a complete working installation that fully meets the functional and performance criteria specified within this specification.

The Contractor shall include for provision of maintenance to the system, seasonal commissioning activities and rectification as required by the Contract and the Mechanical & Electrical Specification.

Function/Objectives

To supply potable water for use within the building at its end use appliances at an appropriate pressure as identified on the contract drawings.

Applicable Standards

The Cold water to stage 3 has been sized using BS 8558 and CIPHE Guide.

In addition to this specification, the cold water installation shall comply with the following standards and guidelines current at the time of tender:

- Utility Suppliers Connection requirements & procedures
- Water Regulations and WRAS standards
- Building Regulations
- British Standards
- The requirements of the local Building Control Authority
- Relevant HSE Guidance
- BSRIA Standards & Guidance notes
- Client specific requirements
- CIBSE Guides & Notes
- HVCA Standards and Guidance Notes.
- The Institute of Plumbing Guide
- HSE ACOP L8 - 'The Control of Legionella Bacteria in Water Systems'.

Any discrepancies identified by the contractor between the specification and the above documents shall be brought to the attention of the CA immediately.

Environmental Performance Assessment

The specification shall be read in conjunction with the latest version of the BREEAM Environmental pre assessment to ensure that any credits targeted applicable to the design of this system are achieved. The specification shall also be read in conjunction with the "Bruntwoods Guide to Net Zero Carbon in Operation" guide and the "Stage 3 MEP report" to ensure all energy targets are met as part of the project

System Description

This section relates to boosted cold water service installations located within the buildings or any sub fed ancillary supply, as well as the mains cold water connection between the incoming main and the main cold water tank.

The Contractor shall extend the potable water network in the lower ground floor to a new main water storage tank in the lower ground water plantroom. A new packaged cold water booster set serves all water utilising appliances around the building from the main potable water break tank.

The water pressure shall be suitable to meet the minimum pressure requirement at all outlets positions as below:

All outlets minimum: 2 bar g
All outlets maximum: 3 bar g

Or as separately defined for equipment supplied by third party specialists. The water pressure shall be suitable for the pipework material and its rating, and any fittings provided in the system. Pressurised

systems must be designed in compliance with the requirements of the local utility supplier and the latest edition of the water regulations.

Pressure Reducing Valves will be provided where required to all outlets to provide a balanced pressure regime across the different floor levels.

As shown on the Contract drawings, local Category 5 water break units shall be provided adjacent to Hybrid VRF branch controllers on each floor. The boosted potable cold water shall be distributed to the Cat 5 water break units to provide an air gap between the potable supply and the Cat 5 supply. The Cat 5 supply will feed the Hybrid VRF branch controllers complete with the following:

- Strainer
- Pressure Reducing Valve
- Isolation Valve
- Pressure Gauge
- Expansion Vessel

Statutory Authorities

It will be the responsibility of the Contractor to liaise with the Statutory Authorities and provide any test notices required to ensure final connections are made in accordance with requirements of the testing and commissioning programme. Liaison with the Statutory Authorities during installation shall be carried out under this contract.

The Contractor shall provide all formalities in connection with test notices, agreement and application for supply forms etc.

All documents requiring the signature of the Employer are to be forwarded in time to meet the building programme in order for the necessary test and supply arrangements to be made.

No additional payments will be made for expenses incurred due to re-connections, re-visits etc. by supply authorities or any other officials.

The contractor shall include within their tender returns, cost for required infrastructure charges , section 106 charges etc., that may be levied by the utility company in connection with the new supply capacity.

Initial Testing Procedures

Immediately after project award, the Contractor shall undertake a water sample analysis of the potable water supply to ascertain mineral composition and identify its hardness.

The contractor shall subsequently confirm that the water treatment strategy, plus all equipment and materials procured for installation within the system are suitable for use with the hardness recognised.

Service Entry Requirements

The Contractor shall ensure that on entry to the building the following components shall be fitted to the supply pipeline, as a minimum, if not already in place or in good working condition :

- Lever operated Main Isolation stop cock.
- Drain Cock.
- Double Check Valve
- Watertight water management system shall be installed within the new incoming supply providing leak monitoring.

The condition of the existing external water utility meter shall be checked and where required replaced. This water meter shall include a pulsed output and linked back to the Watertight water management system providing leak monitoring.

Water Boosters

To achieve water circulation across the site and meet the minimum pressure requirements of the connected equipment and outlets, a pumped water supply system shall be provided.

A storage tank shall be provided at lower ground floor level, from which the booster pumps shall draw their supply. The water inlet to the booster pumps shall be arranged to gravity feed. This storage tank will provide category 5 backflow protection to the main and decouple the pumps from the utility supply. The specification of the water storage cistern is given in the following section.

A packaged booster system has been selected, the unit will incorporate three delivery pumps operating as duty/assist and standby. The pumps shall be vertical multistage type, variable speed to allow duty point control of the water network. Each pump shall be fitted with a line isolation and non-return valve and shall be fully WRAS or KIW UK approved. An accumulator tank shall be provided on the discharge side of the pumps, complete with service valve for re-charging.

The booster set will be provided with an integral microprocessor control unit that shall monitor and regulate its operation, the control panel shall provide the following minimum control functions:

- Automatic motor control of all pumps
- Auto-change-over of pump units
- Sequence control of pumps
- Pressure control via integral transducers
- Adjustable pump run on timers
- Hand/Off/Auto switches for all 3 pumps
- Overload protection of all motors
- Electronic low water protection
- BMS links for fault and status monitoring

The control panel shall be provided in a steel enclosure rated to a minimum IP55 rating with electrical installations in line with the latest edition of BS7671.

The Contractor shall fit a pressure gauge on the inlet and discharge connections to and from the booster set. The booster set shall incorporate EPDM flexible connections to isolate pump vibrations from the pipework system.

The booster set shall be installed on a concrete plinth and shall incorporate vibration isolation springs to avoid noise transfer to the local structure.

The final selection of equipment shall suit the installation environment and take due account of any hazardous or corrosive atmospheres or pumped medium which may dictate enhanced material selection in order to achieve CIBSE life expectancy figures or a safe working environment.

Water Storage

Water storage has been sized in line with the Building Council of Offices (BCO) recommendations. The tank, as specified in the technical schedules is selected to decouple the pump from the utility suppliers main and provide a minimum volume of storage to the building whilst ensuring a regular turnover of the stored water.

Water storage tanks shall incorporate an internal 50/50 splitter allowing the tank to be periodically cleaned, whilst maintaining the water supply, in accordance with HSE ACOP L8.

Water storage tanks shall be positioned to minimise any rise in water temperature. Tanks shall be insulated both to minimise temperature gain and protect against frost.

Generally tanks shall be fully externally flanged and insulated. The installation of the tanks shall allow installation within the basement through a narrow walkway

Water storage tanks shall as a minimum include the following fittings & components:

- Tight fitting lid
- Automatic tank level control and monitoring system
- Screened tank vents
- Twin Tank drains
- Manhole access
- Laddered access
- High/Low level sensors linked to BMS
- Water temperature sensor linked to BMS
- Screened Warning and overflow pipes

To maximise water turnover, a variable height control valve is to be installed in each side of the tank.

A BMS low level alarm is to be provided in the tank or alternatively on the booster pump set. No sensor is required on incoming water.

The Contractor shall be responsible for providing a suitable plinth or bearer installation to support any new tank. The strategy shall be in accordance with the water tank suppliers guidance and ensure a flat surface within acceptable tolerance level across the length of the tank base.

Every storage cistern should be placed and equipped so that the interior can be inspected and cleansed and the float-operated valve can be maintained. A clear space of not less than 350 mm should be provided between the top of the storage cistern and any ceiling or other obstruction above the cistern. For small storage cisterns the overhead, unobstructed space may be reduced to 225 mm provided no dimension of the cistern exceeds 450 mm in any plane.

Category Backflow Protection

The Contractor shall ensure that the potable water supply is provided category backflow protection in accordance with Water Supply (Water Fittings) Regulations.

Backflow protection will be provided via the installation of backflow prevention devices, selected at fluid category protection levels commensurate with the backflow risk as ascertained via the undertaking of a risk assessment. Devices shall be installed at points in the distribution network that are considered susceptible to backflow to the potable main.

Backflow protection shall be afforded not only to the utility main but also between outlets within the building network, where a risk is identified as part of any assessment.

Pipeline Materials & Distribution

All internal pipework shall be installed using Copper tubing to BS EN 1057. Jointing shall be undertaken using;

- Press-Fit Joints and fittings (Viega Profipress system or equal and approved)
- WRAS approved capillary joints and fittings

Pipework shall be brazed in non-accessible areas. Where exposed to view in WC areas, Kitchens and bathrooms all pipework shall be chrome plated with matching chrome valves.

Pipes shall be arranged, wherever practical, to take the shortest route, running as directly as possible and limiting the number of concealed joints to a minimum.

Generally pipework should be installed to avoid distribution above electrical equipment. Where avoidance of such equipment is not possible the installation of galvanised steel drip trays beneath the pipework section shall be provided, complete with a gravity drain connection routed to local foul waste downpipe.

Pipework shall not be jointed within the thickness of walls or floors and shall not be embedded in the building structure.

The Contractor shall be responsible for designing any thermal expansion requirements required in the pipework system. Where necessary thermal expansion of pipework shall be absorbed by expansion loops, sets or bellows units. Where no expansion devices are indicated, expansion movement shall be absorbed by changes in direction. Where necessary, bends shall be incorporated in connections to equipment and in branch connection in the mains. Cold draw shall be applied to all pipework where expansion occurs.

All exposed pipework shall be arranged to present a neat and tidy appearance and all vertical pipes are plumb or follow the building line. Pipes shall be parallel with other pipes, service runs and building structure subject to gradients for draining and venting. All pipework and fittings not "boxed in" or concealed but exposed to view shall be installed in chrome plated pipework, with chrome plated valves, fittings, pipework brackets, unions and supports.

All pipework shall be graded to allow system to be drained. Provide a means of draining at all low points. All high points of the domestic hot water system shall include Automatic Air Vents (AAV's).

Supports, accessories for equipment, appliances or ancillary fittings in pipe runs shall be arranged so that no undue strain is imposed on the pipes.

Where pipes pass through fire barriers pack annular space between pipe and sleeve or insulation and sleeve with non-flammable and fire resistant material to form a fire/smoke stop of required rating. Apply 12mm deep cold mastic seal at both ends within sleeve. Where fire regulations and other considerations require the ends of sleeves to be sealed, such sealing should be of a permanently flexible form to allow movement of the pipe.

Make final connections to equipment in accordance with manufacturer's instructions, with isolation valves for future equipment isolation, and as indicated on the contract drawings.

Where pipes of dissimilar metals are used appropriate means shall be taken to prevent galvanic action where dissimilar metals are connected together.

All non-ferrous components shall be thoroughly cleaned and de-greased.

All metallic pipework shall be electrically bonded in accordance with BS 7671.

All components of the water system are to be WRAS approved.

Insulation

All above ground pipework shall be insulated. The type and thickness of insulation is detailed elsewhere and the finish is to be as detailed below:

All pipework, except that which is exposed in occupied spaces, shall be insulated. The type and thickness of insulation is detailed elsewhere, and the finish is to be as detailed below:

- o Plantrooms up to 2m above floor level – Insulation to be over clad with Aluzinc cladding
- o Plantrooms above 2m above floor level – Foil finish
- o Plantroom Valves - Rigid PVC
- o External - Rigid PVC
- o External Valves - 6 ply white , Venture cladding self adhesive jacketing.
- o Internal Exposed - Rigid PVC
- o Internal Exposed Valve - No insulation
- o Roof Voids - Foil Finish
- o Ceiling voids - Foil finish
- o Internal Services Ducts - Foil Finish
- o Within Internal Boxing - Foil Finish
- o Valves in roof voids, internal ducts, boxings etc. - Foil finish

Load bearing insulated support inserts shall be provided at all bracket locations to ensure there is no break in the thermal properties, foil finish and protection. Supports shall be segmental supports suitable for the temperature range of the pipework. The insulation shall be fitted right up to the supports and the facing shall be continued through the brackets.

Cold water services shall be vapour sealed. Where the pipework contents are below ambient temperature it is essential that the vapour barrier is continuous. In this instance the permeance values shall be as follows.

Cold water pipework - 0.05g/sMN

Thermal insulating materials should conform to BS 5422 and should be installed in accordance with BS 5970.

Detailed guidance on the thermal insulation of pipework and ductwork is given in TIMSA guidance for achieving compliance with Part L of the Building Regulations.

Where externally routing, below ground pipework is installed at depths less than 750mm below the finish floor level insulation shall be provided for frost protection.

Trace Heating

Where water service pipelines are installed externally or within a void where temperature could cause freezing, frost protection shall be provided using an electrically operated, self-regulating, heated cable system.

Electric self-regulating trace heating should conform to BS EN 62395-1 and BS EN 60079-30-1, with the electrical installation conforming to BS 7671.

The trace heating tape shall be installed prior to the pipework insulation so that on completion the tape shall sit concealed within the insulation sleeve. The control module shall ensure that the fluid within the pipework is maintained at a set temperature along its length, the temperatures shall be set as follows:

- CWS - 5C min

Where trace heating tapes are applied to pipework, warning labelling shall be fitted to insulation casing alerting facility/maintenance staff to the presence of electricity beneath. The Contractor shall ensure that these warning labels are fit for purpose with regard their durability to the local environmental conditions.

Labelling

All piped services shall be identified complete with flow direction indication, using adhesive tapes in accordance with this specification (except where pipework is exposed to view and decorated). The basic identification colour and code indications shall be placed at junctions, at both sides of valves, serviced appliances, bulkheads, wall penetrations and at any other place where identification is necessary, to allow the safe and onward use of the system.

All valves located in plant rooms, service voids or where adjacent to plant shall be identified. The identification shall be in the form of either a brass or traffolyte disc, permanently chained to the valve with chromium plated brass chain, bearing a reference number corresponding with that defined on the framed and glazed valve chart, provided in the buildings principle plant room.

The Contractor shall supply and install at all nominated cold water drinking outlets, a small white traffolyte label with black lettering, to read - DRINKING WATER.

Pipework Accessories & Valves

The Contractor shall ensure at the point of procurement that all valves selected are suitable for the system medium and test pressure. Valves shall be installed where indicated on the contract drawings, or indicated in this specification. In addition, the Contractor shall include all valves necessary for the isolation, testing,

flushing, regulation and commissioning of the system.

All valves must be anti-clockwise operation closing. Spindles must be installed on all valves which should end no lower than 200mm below any valve chamber cover to facilitate ease of future operation.

All valves and cocks shall be installed in positions which permit easy access for operation and maintenance.

Primary water stop valves should be installed inside or outside the building, in a position to which every occupier of the premises supplied has access.

Where a building is divided into separately occupied parts, the supply to each part should be capable of being shut off by a second stop valve installed outside that part without shutting off the supply to other parts of the building,

Water Consumption Metering

Sub metering shall be provided to the DHW generation, Heating and Cooling Fill pipework and in accordance with any credits targeted within the environmental performance assessment and in compliance with building regulations.

Each meter shall have a pulsed output (Modbus RTU communications output) and shall be monitored by the BMS. It will be the Contractors responsibility to lay and connect communications wiring between the BMS outstations and any sub meter location. This will include any associated excavation, ducting or containment and integration/coordination with third party installations or equipment.

Isolation valves shall be fitted either side of any installed water meters to allow isolation and removal in the future. A drain valve shall also be fitted for this purpose. Bypass arrangements are not permitted. Care must be taken to install the meter at the correct orientation and with sufficient upstream and downstream length of pipework in line with manufacturers recommendations.

Labelling shall be provided adjacent to all meters identifying the meters function and any specific referencing identified in the contract schedules. This referencing shall be carried through to the BMS head end graphics for consistency.

Water meters shall be selected based upon the design flow rate anticipated for the site or circuit. Meters shall be WRAS approved for use with potable water. Meters shall have a minimum accuracy of $\pm 2\%$ for water temperatures $\leq 30^{\circ}\text{C}$ and $\pm 3\%$ for water temperatures $> 30^{\circ}\text{C}$, and all to be MID approved.

Water Connection Procedure

Upon completion of the onsite installation the Contractor shall ensure that the entire water network is flushed, chlorinated to disinfected in accordance with BS8558 and this specification. A water sample is taken and provided to show potable quality and pressure testing is undertaken and logged. These details shall be forwarded to the Utility provider along with a request for visual inspection.

Please be advised, once a pipeline has had a bacterial sample taken (which subsequently passes and is approved by the water supplier) it must be either connected to the mains or flushed within seven days. If only flushing is achieved in this time the pipeline must be connected within seven days or chlorination must be undertaken again and the time period restarts.

The Contractors shall plan and coordinate the water connection process in accordance with the project installation programme and in full accordance with the local utility company guidance.

Warning pipes and overflows

Every storage cistern shall be fitted with an overflow pipe and a suitable means of warning of impending overflow.

Overflow and warning pipes shall be positioned to exclude light and screened to prevent insect ingress. Screen mesh shall not exceed 0.65 mm.

Pipes shall be laid to a fall and discharge in a conspicuous location. If discharging to a drain, a WRAS category 5 air break shall be provided.

Potable Water Testing/Handover Procedures

The contractor shall provide a commissioning programme and methodology making due allowances for interfaces with all other systems and equipment. All systems shall be pressure tested, flushed, chemically cleaned, chlorinated and set to work.

All TMV points within the building shall be tested on completion.

All water temperature monitoring devices shall be proved and logged on completion and a legionella monitoring programme identified within the Operation and Maintenance manuals.

The Contractor shall ensure that all pressure testing results, chlorination certificates and water sampling results are made available for review at commissioning stage and inserted into the O&M manuals.

Plant test certificates for all major plant items installed upon the cold water network shall be presented for review and inserted into the O&M manuals at completion.

All valve charts, valve labelling, plant schematics shall be completed at the time of commissioning and will form an integral part of the sign off process.

System performance

Ss_55_70_38/210 Design and detailing hot and cold water systems Type A

1. Design: Complete the design and detailing of the hot and cold water supply.
2. Standard: To BS 8558 and in accordance with HSE publication L8: Legionnaires' disease. The control of Legionella bacteria in water systems. Approved Code of Practice and guidance on regulations.
3. Requirement: Submit proposals including detailed design drawings, technical information, calculations and manufacturer's literature.

Ss_55_70_38/220 Cold water supply

1. Incoming mains water supply: Identify site factors and submit report.
2. Type of system: Pumped from a break cistern or storage provision.
3. Design parameters: To BS 8558 and in accordance with CIPHE Plumbing engineering services design guide.
4. Storage capacity: See Schedules. To be inline with BCO guidance

Ss_55_70_38/250 Pipeline sizes for hot and cold water systems Type B

1. Sizing: Calculate sizes to meet simultaneous demand for the building in accordance with BS EN 806-3.
2. Proposals:
3. **Performance**
 - 3.1. Water velocity (maximum): 1.5m/s for hot water and cold water distribution outside of plant areas, 2.0m/s within plant areas.

System completion

Ss_55_70_38/810 Commissioning of hot and cold water supply systems type B

1. Pre-commissioning: In accordance with BSRIABG 2/2010 and CIBSECommissioning Code W.
2. Commissioning: In accordance with BS EN 806-4, BSRIABG 2/2010 and CIBSECommissioning Code W.
3. Notice (minimum): 1 week
4. Equipment: Check and adjust operation of equipment, controls and safety devices.
5. Outlets: Check operation of outlets for satisfactory rate of flow and temperature.

Ss_55_70_38/820 Inspection and test records

1. Construction phase reports: System commissionable.
2. Records for water systems: In accordance with BSRIABG 2/2010.
3. Record sheets
 - 3.1. Submission: On completion.
 - 3.2. Number of copies: two

Ss_55_70_38/830 Demonstrations

1. Running of plant
 - 1.1. Operation: Run, maintain and supervise the installations under normal working conditions.

- 1.2. Duration: One week.
2. Instruction: Instruct and demonstrate the purpose, function and operation of the installations. Provide completed commissioning sheets for all plant items and records of all successfully completed testing.
3. Witnessing Requirements: Handover material shall be provided in accordance with the recommendations of BSRIA BBG01/07 Handover, O&M manuals, and project feedback.
 A programme shall be agreed for pre-commissioning checks, setting to work, commissioning and performance testing of plant and installations, and allow for all costs incurred. Where required, formal method statements shall be provided supported by risk assessments detailing all commissioning procedures.
 Notice shall be given to all parties stating any requirements for attendance and co-operation of others, not less than fourteen working days in advance of the tests.
 The Employer's Agent will only witness test proceedings confirm recorded results and determine if the specified requirements have been satisfied. If following test or inspection any plant or part thereof is shown to be defective or not conforming to the specification the Employer's Agent will reject such defective parts by written notice, within reasonable time, indicating area of dispute.
 The Contractor shall appoint an approved commissioning specialist engineer, to supervise the whole of the testing, commissioning, performance testing and instruction of client's staff.
 The Contractor shall provide all specialised personnel (including manufacturer's representatives) and co-ordinate their activities.
 Equipment, material and systems shall be tested as detailed in Work Sections.
 If an inspection or test fails, repeat the procedure, until satisfactory results are obtained. All tests shall be completed before any paint; cladding or similar materials are applied or before services are concealed.
 Following satisfactory completion of testing and when the installations are in a safe and satisfactory condition, set to work, regulate and adjust the systems, as necessary, to meet the specified design requirements. All necessary instruments and recorders are to be provided to monitor systems during commissioning and performance testing. Test equipment shall be subject to a quality assurance procedure complying with BS 5781.
 Do not start performance testing, including system demonstration, system proving or environmental and capacity testing, until commissioning of the system is completed to the satisfaction of the Employer's Agent.
 Maintain on site full records of all commissioning and performance testing cross referenced to system components and on completion of the Works include a copy in each Operating and Maintenance Manual. All certification documents shall be provided for approval by the Employer's Agent before any system is offered for final acceptance. Gas, fuel oil, electricity and water for testing and commissioning will be provided by the Contractor.
 10-15% of all values should be checked by the mechanical designer.
 100% of all safety interlocks (and all fire dampers' operation) should be witnessed by the designer.
4. Demonstration Requirements: Once all systems have been commissioned and proved to be meeting the intent of the design with respect performance, control and operation the Contractor shall invite the client team to site and perform demonstrations of the operation of all key building services systems.
 The Contractor shall provide a minimum of 14 days notice of testing to allow staff to make the necessary arrangements with respect their attendance.
 Where fire dampers are installed, access hatches are to be provided at either side of the damper for future maintenance, as per the requirements of DW/144.
 The contractor shall ensure that fire dampers are installed in accordance with the manufacturers tested and approved details, suitable for the installation position and building element materials.
 Where inspection openings are provided in fire rated ductwork they shall be designed to maintain the fire integrity of the system.

Ss_55_70_38/840 Documentation

1. Operating and maintenance instructions
 - 1.1. Scope: Submit for the system giving optimum settings for controls.
 - 1.2. Product information: Include product description, date of purchase, performance characteristics, application (suitability for use), method of operation and control, and cleaning and maintenance requirements.
 - 1.3. Format: Paper copy and electronic
 - 1.4. Number of copies: Two of each
2. Record drawings
 - 2.1. Content: Location and arrangement of plant in plant rooms;
 Location, size and route of hot and cold water services;
 Location, route and depth of underground services;
 Location and identification of regulating, isolation and control valves;
 and Location of outlets.
 Record drawings shall provide the level of detail identified within the current version of BSRIA BG6-A design framework for building services.
 - 2.2. Format: A1 paper print and Electronic copy.

- 2.3. Number of copies: Two.
3. Submittal date: At handover.
4. Wholesome water consumption notice: Submit within 30 days.

Ss_55_70_38/850 Water quality tests

1. Standard: To BS EN 806-4. And in full accordance with utility suppliers requirements
2. Samples
 - 2.1. Sample points: Main supply to site.
 - 2.2. Samples for analysis: Submit samples for bacteriological analysis.
 - 2.3. Testing procedure: The testing process and procedure shall comply with the minimum requirements of the selected utility supplier as well as the requirements defined within this specification.
3. Water temperature: Record at each sampling point at the time of taking the sample.
4. Test results
 - 4.1. Record: Details of all analyses.
 - 4.2. Submit: On completion.
 - 4.3. Number of copies: Two.

Ss_55_70_38/860 Spares

1. Pipeline ancillaries
 - 1.1. Keys: Two of each type.
 - 1.2. Hose unions: Two of each type.
2. Belts and pulleys: Two of each type.

Ss_55_70_38/870 Operating tools

1. Tools: Supply tools for operation, maintenance and cleaning purposes.
2. Keys: Supply keys for valves and vents.

Ss_55_70_38/880 Maintenance

1. Servicing and maintenance: Undertake for 12 months after completion.

Ω End of System

Ss_60_40_36_05

Air source heat pump systems

Systems

Ss_60_40_36_05 Air source heat pump systems

1. Description: **Contractor's Responsibilities**

The Contractor shall develop the tender design to completion, supply, install, co-ordinate with other contractors, test, commission and set to work the complete air source heat pump system (ASHP). This shall include all necessary tools, labour, materials and equipment required to provide a complete working installation that fully meets the functional and performance criteria specified within this specification.

The Contractor shall include for provision of maintenance to the system, seasonal commissioning activities and rectification as required by the Contract and the Mechanical & Electrical Specification.

Function/Objectives

The Air Source Heat Pump (ASHP) system shall be designed and installed to achieve the following:

- Provide Low Temperature Hot Water to serve domestic hot water for the building
- Provide Low Temperature Hot Water to serve space heating for Air Handling Unit Coils

Applicable Standards

In addition to this specification, the ASHP installation shall comply with the following standards and guidelines current at the time of tender:

- Building Regulations
- British Standards
- The requirements of the local Building Control Authority
- Relevant HSE Guidance
- BSRIA Standards & Guidance Notes
- CIBSE Guides & Notes
- HVCA Standards and Guidance Notes
- F Gas Regulations
- Client specific requirements
- Project acoustic requirements
- Manufacturer's design, installation and operation recommendations

Any discrepancies identified by the contractor between the specification and the above documents shall be brought to the attention of the CA immediately.

Environmental Performance Assessment

The specification shall be read in conjunction with the latest version of the BREEAM Environmental pre assessment to ensure that any credits targeted applicable to the design of this system are achieved. The specification shall also be read in conjunction with the "Bruntwoods Guide to Net Zero Carbon in Operation" guide and the "Stage 3 MEP report" to ensure all energy targets are met as part of the project

Part L Building Regulation Compliance:

The Contractor shall ensure that prior to the final selection and order of any mechanical or electrical equipment they refer to the "Stage 3 MEP Report" and "Bruntwoods Guide to Net Zero Carbon in Operation" guide to ensure that the minimum equipment efficiencies as listed are achieved or bettered. As a bare minimum these will be as defined within the current edition of the Non-Domestic Compliance guide, but will typically exceed these values so must be checked.

Where variations or value engineering recognises equipment efficiency or control strategy changes that are potentially detrimental to the Part L compliance outcome, the Contractor must review and make the necessary enhancements to other areas of the proposed design in order to maintain a compliant project with respect to Part L at completion. Where applicable any equipment and strategy change must also be reviewed against any design stage BREEAM pre-assessment credits.

The Contractor shall be responsible for undertaking the EPC at completion of the project.

Planning Compliance

The Contractor shall ensure that prior to the final selection and order of any mechanical or electrical equipment they refer to Planning Approval documents and the Architect to ensure that the selected

outdoor equipment falls within the provision(s) noted within the approval.

System Description

Air source heat pumps (ASHP) shall be supplied to provide Low Temperature Hot Water (LTHW) for space heating to the air handling units and for domestic hot water for the site. 12No. packaged modular high temperature Two-Pipe ASHP's shall provide heating to the primary LTHW circuit and they shall be installed on the main Tower roof. The compound shall be arranged to provide the clear access to all elevations of each ASHP to facilitate free movement of air and routine maintenance procedures to be carried out and in full compliance with the manufacturers recommendations.

From the Tower roof, the primary pipework shall be routed via dedicated risers to the lower ground floor mechanical plant room.

The primary circuit shall incorporate a safety valve, pressurisation and expansion unit, air/dirt separator, dosing pot, twin pump set, heat meter, side stream filtration and buffer vessels to reduce short cycling of the compressors. All valves for control, regulation and isolation as well as any ancillaries required to provide a working system shall be included by the Contractor. Buffer vessels are currently based on 3No. 1500Litre vessels to fit within the constraints of the lower ground plant room space. Air source heat pumps shall provide LTHW to the DHW system via 2No. packaged plate heat exchanger and storage calorifier units and to the air handling unit heating coils.

The ASHP shall be capable of providing 65 deg C supply temperature.

Primary Distribution

The ASHP module shall be sequenced based on the flow demand of the secondary variable flow circuit to ensure that the flow rate within the common primary low-loss header always exceeds that within the secondary circuit. A temperature sensor shall be fitted to the common ASHP flow pipework.

Secondary heating distribution shall be provided as follows:

- 1 No. Constant temperature circuit to serve all air handling unit heating coils
- 1 No. Constant temperature circuit to serve 2No. DHW Calorifiers (package with PHX's)

All Pumps shall be arranged in a duty / standby parallel configuration and shall operate on a variable speed basis to maintain a constant differential pressure across the flow and return circuits.

Pumps shall incorporate flexible connections to limit noise carry over to the distribution network. Strainers shall be fitted prior to all pump units and heat exchangers and BMS linked differential pressure switches shall be fitted on the inlet/outlet side of pumps to highlight any loss of flow.

Isolation valves and pressure gauges shall be fitted on the inlet and outlet side of all pumps.

The ASHPs units shall typically include:

- Hermetic scroll compressors,
- Variable speed low noise EC axial-flow fans,
- Sequencing Controller (BACnet capability)
- Shut Off Valve
- Safety Valve
- Purge Valve
- Water Temperature Probe
- A water temperature probe and drain valve shall be fitted to the hydronic flow side.

All units shall be installed on big foot support system to raise them above the finished floor level avoiding issues relating to ponding of water and shall incorporate vibration isolation fittings to eliminate vibration and noise carry over to the local structure.

The ASHPs shall incorporate low noise fans and attenuation if required to meet the external ambient noise limits defined within the acoustic report.

The Air Source Heat Pumps shall be piped in reverse return to provide common flow and return primary connections to buffer vessels via integral primary pumps. The ASHP common flow from the buffer vessels shall be pumped to serve the building heating system.

All pipework, fittings, insulation, cladding, trace heating, valves and fittings serving the ASHP shall be as per section Ss_60_40_37_48 of this specification.

Refrigerant to be used is R407C (1774 GWP) or a lower GWP is to be used.

As a minimum, all ASHPs and their associated pumps shall be selected to meet the targeted recommended energy efficiency standards. Additional information is provided in the latest edition of the non-domestic compliance guide (in compliance with UK Building Regulations).

All ASHPs shall be fitted with an integral control panel complete with microprocessor that will modulate the ASHP daily operation. The control panel will also provide a facility for status monitoring and remote control via the site wide BMS system. Refer to section Ss_75_70_54_10 for details on control arrangements for all plant.

The heat pumps shall be power enabled via the MCC panel. The heat pumps shall be provided with integral microprocessor control for operation, monitoring and fault reporting.

For details of the LTHW systems, refer to Section Ss_60_40_37_48.

For details regarding the Controls and BMS System refer to Section Ss_75_70_54_10.

This section describes the air source heat pump system requirements only.

System performance

Ss_60_40_36/210 Design of heat pump systems

1. Design: Complete the design of the heat pump systems to BS EN 15450.
2. Requirement: Submit proposals including detailed design drawings, technical information, calculations and manufacturers' literature.

System completion

Ss_60_40_36/810 Commissioning of heat pump systems

1. Pre-commissioning: In accordance with Manufacturer's recommendations and CIBSE Commissioning Code R.
2. Commissioning: In accordance with CIBSE Commissioning Code R and In accordance with CIBSE Commissioning Code W.
3. Notice (minimum): One week.

Ss_60_40_36/820 Performance testing

1. General: Demonstrate the performance of the installations.
2. Guaranteed efficiency: Tolerances defined in this specification.
3. Environmental tests: Carry out environmental testing. If necessary, use artificial loads to simulate operating conditions.
4. Recorders
 - 4.1. Type: Supply and maintain portable seven day space temperature and relative humidity recorders, complete with charts.
 - 4.2. Number: Two.
 - 4.3. Duration of loan: Two weeks.
5. Reports: Submit on completion.

Ss_60_40_36/830 Inspection and test records

1. Construction phase reports: System commissionable.
2. Records for water systems: In accordance with BSRIA BG 2/2010.
3. Records for air systems: In accordance with BSRIA BG 49/2015.
4. Record sheets

- 4.1. Record sheets:
- 4.2. Submission: On completion.
- 4.3. Number of copies: Two

Ss_60_40_36/840 Demonstrations

- 1. Running of plant
 - 1.1. Operation: Run, maintain and supervise the installations under normal working conditions.
 - 1.2. Duration: One week.
- 2. Instruction: Instruct and demonstrate the purpose, function and operation of the installations.

Ss_60_40_36/850 Documentation

- 1. Operating and maintenance instructions
 - 1.1. Scope: Refer to general conditions section 00-80-70 Works Contract Completion
 - 1.2. Product information: Refer to general conditions section 00-80-70 Works Contract Completion
 - 1.3. Format: Refer to general conditions section 00-80-70 Works Contract Completion
 - 1.4. Number of copies: Refer to general conditions section 00-80-70 Works Contract Completion
- 2. Record drawings
 - 2.1. Content: Refer to general conditions section 00-80-70 Works Contract Completion
 - 2.2. Format: Refer to general conditions section 00-80-70 Works Contract Completion
 - 2.3. Number of copies: Refer to general conditions section 00-80-70 Works Contract Completion
- 3. Submittal date: Refer to general conditions section 00-80-70 Works Contract Completion

Ss_60_40_36/860 Servicing and maintenance

- 1. Requirement: Undertake for 12 months after completion.

Ω End of System

Ss_60_40_37_48

Low temperature hot water heating systems

Systems

Ss_60_40_37_48 Low temperature hot water heating systems

Contractors Responsibilities

The Contractor shall develop the stage 3 design to completion, supply, install, co-ordinate with other contractors, test, commission and set to work the complete low temperature hot water heating system. This shall include all necessary tools, labour, materials and equipment required to provide a complete working installation that fully meets the functional and performance criteria specified within this specification.

The Contractor shall include for provision of maintenance to the system, seasonal commissioning activities and rectification as required by the Contract and the Mechanical & Electrical Specification.

Function/Objectives

To supply and distribute Low Temperature Hot Water to the buildings heating coils for the purposes of space heating.

Applicable Standards

In addition to this specification, the heating installation shall comply with the following standards and guidelines current at the time of tender:

- Building Regulations
- British Standards
- The requirements of the local Building Control Authority
- Relevant HSE Guidance
- BSRIA Standards & Guidance notes
- CIBSE Guides & Notes
- BESA Standards and Guidance Notes.
- The Institute of Plumbing Guide
- Client specific requirements
- RHI guidance and requirements
- All relevant Local Authority requirements

Any discrepancies identified by the contractor between the specification and the above documents shall be brought to the attention of the CA immediately.

Environmental Performance Assessment

The specification shall be read in conjunction with the latest version of the BREEAM Environmental pre assessment to ensure that any credits targeted applicable to the design of this system are achieved. The specification shall also be read in conjunction with the "Bruntwoods Guide to Net Zero Carbon in Operation" guide and the "Stage 3 MEP report" to ensure all energy targets are met as part of the project

Part L Building Regulation Compliance:

The Contractor shall ensure that prior to the final selection and order of any mechanical or electrical equipment they refer to the "As Designed" Part L2 modelling report to ensure that the minimum equipment efficiencies as listed are achieved or bettered. As a bare minimum these will be as defined within the current edition of the Non Domestic Compliance guide, but will typically exceed these values so must be checked.

Where variations or value engineering recognises equipment efficiency or control strategy changes that are potentially detrimental to the anticipated Part L2 compliance outcome, the Contractor must review and make the necessary enhancements to other areas of the proposed design in order to maintain a compliant project with respect to Part L at completion. Where applicable any equipment and strategy change must also be reviewed against any design stage BREEAM pre-assessment credits.

The Contractor shall be responsible for undertaking the as built model & EPC at completion of the project.

System Description

LTHW Generation Plant

LTHW shall be generated by external heat pumps as described in section Ss_60_40_36_05 of this

specification. Air source heat pumps (ASHP) shall be supplied to provide Low Temperature Hot Water (LTHW) for the demands of the site DHW and LTHW AHU coils. 12No. Two-Pipe ASHPs shall provide heating of the LTHW circuit only.

LTHW systems shall operate on a 65°C/60°C flow and return temperature in order to maximise the efficiency of the heat generating units.

Heat pumps sequencing shall be controlled via the ASHP sequencing controller in order for scheduled switching of heat pumps in the most efficient manner.

LTHW Primary Circuit

The Primary LTHW circuit shall include a duty/standby pump arrangement, the pumps will be located in the lower ground floor plant room. A frequency inverter will be provided for each pump to allow it to be accurately commissioned to match the flow requirements the heat pumps and to operate the primary circuits variably.

Pumps shall be controlled via the associated heat pump integral control system

Each heat pump shall be sequenced and operated variably based on the temperature within the buffer vessels (3No. at 1500 Litres each). This shall ensure the availability of LTHW within buffer vessels always exceeds that demand of the secondary circuit. Temperature sensors shall be fitted to mid point within buffer vessels as indicated within the contract documentation.

The primary circuit shall feed a common flow and shall distribute LTHW water via a number of pumped secondary circuits as defined upon the LTHW schematic drawings.

LTHW Secondary Circuit

Secondary heating distribution shall be provided as follows:

- 1 No. Constant temperature circuit to serve all air handling unit heating coils
- 1 No. Constant temperature circuit to serve packaged domestic hot water calorifiers with integrated PHX's

Secondary heating circuits and sub circuits shall be fitted with in-line heat metering, connected to the BMS for Trend logging of energy consumption. Locations as identified on the contract documentation, to allow the buildings owners to monitor and hence manage their energy consumption in compliance with the Building regulations, BREEAM and CIBSE guidance.

Each secondary circuit shall be provided with dedicated pumps arranged in a duty / standby parallel configuration and shall operate on a variable speed basis to maintain a constant differential pressure across the flow and return circuits. Each circuit shall be operated dynamically for load matching in a variable flow arrangement. The low temperature hot water circuit shall be enabled when the external ambient falls below an adjustable set point initially set at 15°C.

Sub-circuit differential pressure sensors are to be incorporated to ensure more accurate secondary circuit pump control as recommended in CIBSE KS 09. These differential pressure sensors shall be BMS linked and will be used to modulate pump speed based on the changing load of the secondary circuit, based on an average reading of the differential pressure sensors across the system.

LTHW shall distributed from the secondary pumps out to all terminal devices via a pipework distribution system, as described below.

A minimum flow rate in the system shall be maintained through either bypass valves or end of line constant flow regulators to protect the circulation pumps from close head conditions.

Pumps in the primary and secondary circuits shall incorporate flexible connections to limit noise and vibration carry over to the distribution network. Isolation valves and pressure gauges shall be fitted on the inlet and outlet side of all pumps.

Pipework

All heating pipework is to be installed as follows:

- All 15mm to 50mm LTHW pipework to be medium grade carbon steel
- All 65mm to 150mm LTHW pipework to be heavy grade carbon steel

Pipework shall be jointed :

- screwed up to 50mm
- welded and flanged 65mm and above.

Crimp fit stainless steel pipework with approved fittings (67mm and above to be flanged fittings), such as Gerberit Mapress or equal and approved may also be considered on request with the CA.

Generally pipework should be installed to avoid distribution above electrical equipment. Where avoidance of such equipment is not possible the installation of galvanised steel drip trays beneath the pipework section shall be provided, complete with a gravity drain connection routed to local foul waste downpipe.

Pipework shall not be jointed within the thickness of walls or floors and shall not be embedded in the building structure.

The Contractor shall be responsible for designing any thermal expansion requirements required in the pipework system.

Where necessary thermal expansion of pipework shall be absorbed by expansion loops, sets or bellows units. Where no expansion devices are indicated, expansion movement shall be absorbed by changes in direction. Where necessary, bends shall be incorporated in connections to equipment and in branch connection in the mains. Cold draw shall be applied to all pipework where expansion occurs.

All exposed pipework shall be arranged to present a neat and tidy appearance and all vertical pipes are plumb or follow the building line. Pipes shall be parallel with other pipes, service runs and building structure subject to gradients for draining and venting.

All pipework shall be graded to allow system to be drained. Provide a means of draining at all low points.

Automatic air vents to be provided at all high points of the system.

Supports, accessories for equipment, appliances or ancillary fittings in pipe runs shall be arranged so that no undue strain is imposed on the pipes.

Where pipes pass through fire barriers pack annular space between pipe and sleeve or insulation and sleeve with non-flammable and fire resistant material to form a fire/smoke stop of required rating. Apply 12mm deep cold mastic seal at both ends within sleeve. Where fire regulations and other considerations require the ends of sleeves to be sealed, such sealing should be of a permanently flexible form to allow movement of the pipe.

Make final connections to equipment in accordance with manufacturer's instructions and as indicated on the contract drawings and provide isolation valves for future maintenance.

Where pipes of dissimilar metals are used appropriate means shall be taken to prevent galvanic action where dissimilar metals are connected together.

All non-ferrous components shall be thoroughly cleaned and degreased.

All metallic pipework shall be electrically bonded in accordance with BS 7671.

Valves and fittings

The Contractor shall ensure at the point of procurement that all valves selected are suitable for the system medium and operating pressure. Valves shall be installed where indicated on the contract drawings or indicated in this specification. In addition, the Contractor shall include all valves necessary for the isolation, testing, flushing, regulation and commissioning of the system.

At the point of order, the contractor shall ensure that where valves are provided for the regulation of flow rates that could be defined as 'low flow' or 'ultra-low flow' with respect to their duty, the valve selected is suitable for regulation within the flow range.

Where systems are arranged to operate on a variable volume strategy the Contractor shall ensure that adequate allowance is provided at terminal circuits to ensure suitable flow and control is achieved under changing system pressure.

Pressure independent control valves will be fitted on all plant items and across the secondary distribution network to allow stable control under changing load conditions. Constant flow regulators will be provided to circuits with a fixed duty and as identified on the LPHW schematic drawing. To ensure minimum pump flow rate volumes are achieved during periods of low system load and to maintain good circulation to remote areas of the system end of circuit bypass arrangements shall be provided as shown on the schematic drawings.

Binder type, self-sealing test points are to be provided on inlet/discharge connection to all plant items (pumps, coils, heat exchangers etc) and around all control valves, strainers and as defined on design drawings.

AAV's shall be fitted at all system high points and drain points are to be fitted at low points in positions conducive to system draining.

The system shall be designed to allow pre-commission cleaning and flushing of the system. Line sized

flush bypass loops are to be installed ahead of the control valves associated with all terminal units and as defined in the latest edition of BSRIA BG29.

All valves are to be arranged to afford the minimum clear access requirements defined by the valve supplier and to be orientated to allow ease of regulation. All valves must be anti-clockwise operation on closing.

The contractor shall allow for the installation of any valve or devices imposed upon the work at the request of the utility provider.

Pressurisation and Water Treatment

An automatic fill and pressurisation unit shall be provided to initially fill the heating system and to maintain system pressure. This shall include a break tank, pressurisation pump and expansion vessels. The fill pump shall be continuously rated for this purpose and shall be capable of refilling the entire heating system within a two hour period.

The pressurisation unit shall incorporate backflow protection, rated to meet the requirements of the water regulations.

An air and dirt separator shall be provided on the primary circuit.

The system shall be flushed and cleaned by a water treatment specialist in accordance with BSRIA Pre-Commission Cleaning of Pipework Systems BG 29/2020.

Before the system is handed over in the final operational format, the system shall be thoroughly flushed clean and water treatment applied to minimise corrosion and protect the system during operation.

Initially, the chemical treatment can be injected into the system, but as a minimum a dosing pot with valved connections shall be provided for checking and topping up the system as necessary. Where any doubt exists refer to the contract drawings or raise an RFI.

All water treatment shall be carried out by a treatment specialist and all chemicals used shall be suitable for the material of the system, operating temperatures of the system etc.

A specialist shall be employed at an early stage during the contract to advise on best practice cleaning methodologies.

Chemical treatment shall be in accordance with BSRIA BG 50/2013

Safety Relief Valves and Expansion vessels

All heat generating equipment and all vessels/pipework subjected to a pressure greater than atmospheric, shall be fitted with a Safety Relief Valve and suitably sized expansion vessel in accordance with current British Standards.

All valves shall incorporate a padlock or lead seal to lock the set pressure and to obviate unauthorised tampering. Safety Relief Valves shall be mounted vertically and fitted directly to the equipment/system with the minimum possible length of pipe and no intervening valve or other restriction.

Discharges from relief valves fitted to systems operating at up to 90°C shall be routed to terminate 200mm above floor level with an anti-drip profile.

All pipework routing from safety relief valves shall be installed in Copper tubing for the first 2 m and taken to drain via a tundish and drainage system suitably rated for the discharge temperature. The discharge to tundish shall be provided with a Type A air gap.

Maintenance of Existing Services

Where applicable, any existing services to existing premises shall be maintained during the progress of the Work. Any additional work and materials necessary to maintain these services at all times during the duration of the Works shall be included within the tender, including temporary heating, water, gas and electrical services.

Any existing services disturbed by the Works are to be reinstated fully in accordance with the standards of quality defined in the specification.

All connections to existing services shall be undertaken, out of normal working hours.

Insulation

All heating pipework shall be fully insulated and vapour sealed. Insulation shall comprise CFC/HCFC-free rigid phenolic insulation sections with zero Ozone Depletion Potential (ODP with fully bonded reinforced aluminium foil vapour barrier jacket).

The type and thickness of insulation is detailed elsewhere in this specification and the finish is to be as detailed below:

All above ground pipework shall be insulated. The type and thickness of insulation is detailed elsewhere and the finish is to be as detailed below:

- o Plantrooms - Rigid PVC
- o Plantroom Valves - Flexible valve jackets
- o External - 6 ply white , Venture cladding self adhesive jacketing.
- o External Ducts - 6 ply white , Venture cladding self adhesive jacketing.
- o External Valves - 6 ply white , Venture cladding self adhesive jacketing.
- o Internal Exposed - Rigid PVC
- o Internal Exposed Valve - No insulation
- o Roof Voids - Foil Finish
- o Ceiling voids - Foil finish
- o Internal Services Ducts - Foil Finish
- o Within Internal Boxing - Foil Finish
- o Valves in roof voids, internal ducts, boxings etc. - Foil finish

Insulation shall comply with BS 5422. Insulation to achieve an A or A+ rating according to the current version of the 'Building Research Establishment Green Guide to Specification'. All building services insulation shall meet the BREEAM criteria for responsible sourcing.

Load bearing insulated support inserts shall be provided at all bracket locations to ensure there is no break in the thermal properties, foil finish and protection. Supports shall be segmental supports suitable for the temperature range of the pipework. The insulation shall be fitted right up to the supports and the facing shall be continued through the brackets.

It shall be the Contractors design responsibility to provide and install all bracketry, thermal expansion strategies and anchors as necessary to accommodate the pipework distribution network defined upon the design drawings.

The contractor shall pressure test all pipework systems and make the test results available upon request. Insulation shall not be applied until the installation has been fully tested and all joints proved sound.

The pipework system shall be supported using brackets fitted around purpose made insulated pipe supports to limit thermal breaks fitted at intervals as recommended by the manufacturer.

Emitters and Controls

Air handling units shall be provided with two-port motorised pressure-independent control valves providing stable off-coil temperature control under varying load conditions.

Labelling

Pipework shall be identified in accordance with BS1710

All piped services shall be identified complete with flow direction indication, using adhesive tapes in accordance with this specification (except where pipework is exposed to view and decorated). The basic identification colour and code indications shall be placed at junctions, at both sides of valves, serviced appliances, bulkheads, wall penetrations , at any other place where identification is necessary, and at a minimum of 2.5 m intervals to allow the safe and onward use and maintenance of the system.

All valves located in plant rooms, service voids or where adjacent to plant shall be identified. The identification shall be in the form of either a brass or traffolyte disc, permanently chained to the valve with chromium plated brass chain, bearing a reference number corresponding with that on the framed and glazed valve chart provided in the buildings principle plant room.

Testing/Handover Procedures

The contractor shall provide a commissioning programme and methodology making due allowances for interfaces with all other systems and equipment. All systems shall be pressure tested, flushed and set to work.

The system shall be flushed and cleaned by a water treatment specialist in accordance with BSRIA Pre-Commission Cleaning of Pipework Systems BG 29/2020.

A proportional water balance shall be undertaken for all new heating circuits that will prove the design flowrates to each of the installed emitters at completion. The proportional balance shall be conducted by an approved commissioning specialist and follow the methodology identified within the CIBSE commissioning codes W.

All valve charts, valve labelling, plant schematics shall be completed at the time of commissioning and will form an integral part of the sign off process.

For full details of all Contractual requirements associated with handover and the O&M manuals the

Contractor shall refer to section 00-80-70 : Work Contract Completion located within the MEP general clauses.

Witnessing Requirements

Handover material shall be provided in accordance with the recommendations of BSRIA BBG01/07 Handover, O&M manuals, and project feedback.

A programme shall be agreed for pre-commissioning checks, setting to work, commissioning and performance testing of plant and installations, and allow for all costs incurred. Where required, formal method statements shall be provided supported by risk assessments detailing all commissioning procedures.

Notice shall be given to all parties stating any requirements for attendance and co-operation of others, not less than fourteen working days in advance of the tests.

The Employer's Agent will only witness test proceedings confirm recorded results and determine if the specified requirements have been satisfied. If following test or inspection any plant or part thereof is shown to be defective or not conforming to the specification the Employer's Agent will reject such defective parts by written notice, within reasonable time, indicating area of dispute.

The Contractor shall appoint an approved commissioning specialist engineer, to supervise the whole of the testing, commissioning, performance testing and instruction of client's staff.

The Contractor shall provide all specialised personnel (including manufacturer's representatives) and co-ordinate their activities.

Equipment, material and systems shall be tested as detailed in Work Sections.

If an inspection or test fails, repeat the procedure, until satisfactory results are obtained. All tests shall be completed before any paint; cladding or similar materials are applied or before services are concealed. Following satisfactory completion of testing and when the installations are in a safe and satisfactory condition, set to work, regulate and adjust the systems, as necessary, to meet the specified design requirements.

All necessary instruments and recorders are to be provided to monitor systems during commissioning and performance testing. Test equipment shall be subject to a quality assurance procedure complying with BS 5781.

Do not start performance testing, including system demonstration, system proving or environmental and capacity testing, until commissioning of the system is completed to the satisfaction of the Employer's Agent.

Maintain on site full records of all commissioning and performance testing cross referenced to system components and on completion of the Works include a copy in each Operating and Maintenance Manual. All certification documents shall be provided for approval by the Employer's Agent before any system is offered for final acceptance. Gas, fuel oil, electricity and water for testing and commissioning will be provided by the Contractor.

10-15% of all values should be checked by the mechanical designer.

100% of all safety interlocks (and all fire dampers' operation) should be witnessed by the designer.
Demonstration Requirements

Once all systems have been commissioned and proved to be meeting the intent of the design with respect performance, control and operation the Contractor shall invite the client team to site and perform demonstrations of the operation of all key building services systems.

The Contractor shall provide a minimum of 14 days notice of testing to allow staff to make the necessary arrangements with respect their attendance.

System performance

Ss_60_40_37/250 System operating parameters for water-based heating systems

1. Design flow temperature: 65°C
2. Temperature difference across primary heating circuit: 5°C

3. Water velocity: Pipe sizes
15-80mm maximum 1m/s
100mm and above maximum 1.5m/s

System completion

Ss_60_40_37/810 Commissioning water heating systems

1. Pre-commissioning: In accordance with BSRIA BG 2/2010 and CIBSE Commissioning Code W.
2. Commissioning: In accordance with BSRIA BG 2/2010 and CIBSE Commissioning Code W.
3. Seasonal commissioning: In accordance with BSRIA BG 44/2013.
4. Variable flow systems: In accordance with CIBSE Knowledge Series KS09.
5. Notice (minimum): One week.

Ss_60_40_37/830 Commissioning boiler plant

1. Pre-commissioning: In accordance with CIBSE Commissioning Code B.
2. Commissioning: In accordance with CIBSE Commissioning Code B.
3. Notice (minimum): One week.

Ss_60_40_37/840 Performance testing

1. General: Demonstrate the performance of the installations.
2. Guaranteed efficiency: Tolerances defined in this specification.
3. Environmental tests: Carry out environmental testing. If necessary, use artificial loads to simulate operating conditions.
4. Recorders
 - 4.1. Type: Supply and maintain portable seven day space temperature and relative humidity recorders, complete with charts.
 - 4.2. Number: Two.
 - 4.3. Duration of loan: Two weeks.
5. Reports: Submit on completion.

Ss_60_40_37/845 Demonstrations

1. Running of plant
 - 1.1. Operation: Run, maintain and supervise the installations under normal working conditions.
 - 1.2. Duration: Two weeks.
2. Instruction: Instruct and demonstrate the purpose, function and operation of the installations.

Ss_60_40_37/850 Inspection and test records

1. Construction phase reports: Post-installation;
System cleanliness;
and System commissionable.
2. Records for water systems: In accordance with BSRIA BG 2/2010.
3. Record sheets
 - 3.1. Submission: On completion.
 - 3.2. Number of copies: Refer to General conditions Specification

Ss_60_40_37/860 Documentation

1. Operating and maintenance instructions
 - 1.1. Scope: Submit for the system giving optimum settings for controls.
 - 1.2. Product information: Include product description, date of purchase, performance characteristics, application (suitability for use), method of operation and control, and cleaning and maintenance requirements.
 - 1.3. Format: Full size paper copy and Electronic Copy.
 - 1.4. Number of copies: Two of each

2. Record drawings
 - 2.1. Content: Location and arrangement of plant in plant rooms;
Location, size and route of mechanical services;
Location, route and depth of underground services;
Location and identification of pipework regulating, isolation and control valves;
and Location of outlets.
 - 2.2. Format: Full size paper print and Electronic drawing
 - 2.3. Number of copies: Two of each
3. Submittal date: At handover.

Ss_60_40_37/880 Servicing and maintenance

1. Requirement: Undertake for 12 months after completion.

Ω End of System

Ss_60_60_70_94

Hybrid variable refrigerant flow (HVRF) systems

Systems

Ss_60_60_70_94 Variable refrigerant flow systems

1. Description:

The Contractor shall develop the tender design to completion, supply, install, co-ordinate with other contractors, test, commission and set to work the complete room air conditioning system. This shall include all necessary tools, labour, materials and equipment required to provide a complete working installation that fully meets the functional and performance criteria specified within this specification.

The Contractor shall include for provision of maintenance to the system, seasonal commissioning activities and rectification as required by the Contract and the Mechanical & Electrical Specification.

Function/Objectives

To provide a source of heating or cooling in order to condition the space to achieve the internal design conditions.

Applicable Standards

In addition to this specification, the Air conditioning installation shall comply with the following standards and guidelines current at the time of tender:

- Building Regulations
- British Standards
- The requirements of the local Building Control Authority
- Relevant HSE Guidance
- BSRIA Standards & Guidance notes
- CIBSE Guides & Notes
- BESA Standards and Guidance Notes.
- F Gas Regulations

Any discrepancies identified by the contractor between the specification and the above documents shall be brought to the attention of the CA immediately.

Environmental Performance Assessment

The specification shall be read in conjunction with the latest version of the BREEAM Environmental pre assessment to ensure that any credits targeted applicable to the design of this system are achieved. The specification shall also be read in conjunction with the "Bruntwoods Guide to Net Zero Carbon in Operation" guide and the "Stage 3 MEP report" to ensure all energy targets are met as part of the project

Part L Building Regulation Compliance:

The Contractor shall ensure that prior to the final selection and order of any mechanical or electrical equipment they refer to the "Stage 3 MEP Report" and "Bruntwoods Guide to Net Zero Carbon in Operation" guide to ensure that the minimum equipment efficiencies as listed are achieved or bettered. As a bare minimum these will be as defined within the current edition of the Non-Domestic Compliance guide, but will typically exceed these values so must be checked.

Where variations or value engineering recognises equipment efficiency or control strategy changes that are potentially detrimental to the Part L compliance outcome, the Contractor must review and make the necessary enhancements to other areas of the proposed design in order to maintain a compliant project with respect to Part L at completion. Where applicable any equipment and strategy change must also be reviewed against any design stage BREEAM pre-assessment credits.

The Contractor shall be responsible for undertaking the EPC at completion of the project.

System Description

The environmental temperature occupied spaces (as detailed within the Contract Information) shall be controlled via a R32 Hybrid Variable Refrigerant Flow (HVRF) air conditioning system. A HVRF system operates using piped R32 refrigerant between the outdoor condensers and the floor by floor located branch controllers. From the branch controllers a water based distribution is used, where pipework to each indoor unit is taken directly from the branch controller. The water side of the system is a 2-pipe system which can alternate between LTHW and CHW. The system will be capable of simultaneously providing heating and cooling to different tertiary (indoor units), maximising opportunities for heat recovery.

Multiple systems will be used across the building as per the contract information and drawings. Generally, these are split by block and floor. External condensers are located on the roof of the block that they serve, Marsden Street block, King Street block or Tower Block with one external condenser per floor linked to branch controllers on the floor that they are serving.

Each of the systems will comprise the following components:

- 2 Pipe External Condenser unit located at roof level
- R32 refrigerant insulated pipework between external condenser and branch controller(s)
- R32 HVRF compliant heat recover branch controller(s) on each floor
- Local leak detection systems including audio and visual alarm which can be linked back to the BMS
- Indoor 2-pipe heating/cooling room Fan coil units to serve each zone/room as identified on the contract drawings
- A local wall mounted controller unit – providing tenant indication
- Pairs of Interconnecting water pipework between branch controllers and each indoor fan coil unit, laid on containment tray
- Controls and ancillary fittings as required by refrigerant manufacturer to provide a fully functional system.

Branch controllers are to include at least 2No. spare valves per system to assist with any future updates or changes.

The system shall be capable of operation between external ambient temperatures of minus 5°C and +45°C.

Any exposed containment tray is to be powder coated and painted to a colour agreed with the Architect.

The external units shall be mounted on anti-vibration pads to reduce the vibrations being transferred to the building structure during operation. The location of all outdoor units shall be arranged to meet the manufacturers recommendations with respect to adequate airflow over the exchanger body, maintenance access and short circuiting with adjacent units. Where the external condenser is mounted in a location that could make it vulnerable to accidental mechanical damage, the contractor shall provide a caged enclosure for protection of the unit. Details of the units shall be issued to and approved by the Architect. Condensers shall not be positioned where they may sit in pooled water. Condensers to be raised above the finished floor to avoid this.

The sound pressure noise level of the external unit should not exceed the ambient acoustic requirements of the project as detailed in this specification or the acoustic report. Where necessary attenuation is to be applied to reach these design targets.

The system must operate with Refrigerant R32. This refrigerant is a single component gas, classed as A2L: non-toxic, slightly flammable under the EN378 and EN60335-2-40. The refrigerant has a GWP value of 675. Leak detection shall be provided throughout the building in all confined spaces where R32 refrigerant will be present, the leak detection system shall link to the BMS

The HVRF system shall be controlled via a wired centralised controller. The system shall also have the ability to be connected to the BEMS via an open protocol system

All internal LTHW/CHW pipework shall be installed using Copper tubing to BS EN 1057. Jointing shall be undertaken using;

- Press-Fit Joints and fittings (Viega Profipress system or equivalent); and/or
- WRAS approved capillary joints and fittings

Pipework is to be insulated throughout. Thermal insulating materials should conform to BS 5422 and should be installed in accordance with BS 5970.

Detailed guidance on the thermal insulation of pipework and ductwork is given in TIMSA guidance for achieving compliance with Part L of the Building Regulations.

Final pipework sizing and details to be provided by the Manufacturer.

As shown on the Contract drawings, a Category 5 water supply is to feed each of the Hybrid VRF branch controllers complete with the following:

- Non-return Valve
- Strainer
- Pressure Reducing Valve
- Isolation Valve
- Pressure Gauge
- Expansion Vessel

Please see section Ss_65_80_45_72 for details of the refrigerant side of the system including pipework, outdoor units and ancillaries.

Fan Coil Units

Soffit mounted 2-pipe fan coil units (FCUs) shall be provided by the Contractor to control the temperature within the spaces and zones, as identified on the contract drawings. The FCU shall be matched with HVRF manufacturer for warrantee purposes.

FCU's shall be selected on achieving design duty at medium speed setting.

Each fan coil unit shall generally comprise of the following key components:

- Panel filter Grade G3
- Direct drive fan with variable speed EC motor
- Drip tray with condensate connection
- Inlet and supply Plenum with spigot connections
- Integral controller.
- matched attenuators to meet room noise levels (if required by acoustician)

Ventilation supply air from the air handling units shall terminate approx. 500mm onto the FCU to provide adequate fresh air to serve the occupants, as defined in the contract drawings and schematics. Ventilation to the building is as described within section Ss_65_40_33_51.

The combined cooling and heating coil shall be connected to the refrigeration system by a refrigeration to water BC controller. The FCU output shall be controlled through varying the supply air volume (minimum volume to maintain fresh air supply shall be set) to the temperature and |CO2 levels within the room. The FCUs shall supply treated air into the space through a series of ceiling grilles / diffusers connected to the fan coil unit by ductwork.

FCU shall be exposed, but where located behind a ceiling void, return air diffusers shall be included.

A drip tray shall be provided below the coil and pipework connections. The drip tray shall be connected via condensate pipework and a self-sealing, valve type dry trap (HepVo or equivalent) to the foul drainage system by gravity. Where gravity drainage is not possible, FCUs shall be fitted with condensate pumps. In all cases the condensate trays shall be fitted with a liquid sensor linked to the BMS to trigger an alarm prior to overflowing the drip tray.

The condensate pipework shall be installed using insulated plastic pipework to prevent formation of condensation on the external surface of the pipes. Pipes shall be supported continuously to prevent sagging and collection of condensate.

The FCUs will be positioned in such a manner that they can be accessed and maintained easily. The filter shall be accessed from the bottom of the unit and be arranged to allow its periodic removal for cleaning.

Local controllers will be provided in each room / zone to control the relevant FCU(s), linked to the centralised controller and which is then linked back to the buildings BMS.

An air flow failure alarm shall be provided on all FCUs and linked via the building BMS system to alert facilities management to unit failures and maintenance requirements.

The FCUs will be provided with a proprietary controller to operate all functions of the FCU. The FCU controller shall be compatible with the BMS system.

For all details regarding control, refer to section Ss_75_70_54_10.

Ductwork

Unless specified, ductwork shall be constructed from hot dip galvanised steel manufactured in accordance with BESA DW/144.

Rectangular duct bends with either dimension greater than 200 mm should have properly designed turning vanes installed. The angle of the turning vane should be the same as that of the bend. Information on the structural requirements of turning vanes as given in BESA specification DW/144.

All ductwork shall be adequately supported on hangers and/or brackets and shall be positioned and spaced in relation to one another and to the building structure so as not to interfere with any other services and to allow for the required thickness of insulation to be fitted.

Where ductwork is insulated, load bearing supports shall be provided at bracket positions to ensure that the insulation and vapour barrier are continuous.

All bolts, nuts, washers etc. shall be of a permanent nature with a non-corrosive finish such as cadmium plating, sheradising or galvanising as appropriate.

Hangers and supports complying with BS EN 12236 shall be provided throughout in accordance with DW 144 or DW 191 as appropriate.

Flexible ductwork may be employed for final connections to grilles and diffusers, these should not be more than 100mm in length, and all other ductwork should be of solid construction.

Flexible ducts shall be PVC/Polyester Laminate complying with BS EN13180. Where any flexible ductwork will carry air at temperatures below the dewpoint of the spaces in which it is installed (ceiling void etc) that flexible ductwork must be insulated.

PVC/Polyester laminate flexible duct connections shall be fastened in accordance with DW 144. Flexible duct connections shall be used in applications listed in DW 144.

Materials and accessories shall be compatible with ductwork and the finishes of accessories shall comply with any special requirements for ductwork.

Ensure casing losses of components are compatible with ductwork in which they are incorporated.

Test holes shall be provided in ductwork systems to allow complete testing and balancing of systems in accordance with CIBSE Commissioning Code Series A. Test holes shall be site drilled in accordance with DW 144. On completion of testing these test holes shall be fitted with plastic plugs.

Holes shall be provided in ductwork for controls/instruments in accordance with DW 144 to accommodate thermostats, humidistats and other control sensors in positions and sizes indicated on drawings.

Sensors and test points are to be provided to suit specialist control and sensing equipment as required. Flexible joint connections shall be installed as detailed in DW 144 or DW 154, as appropriate.

Flexible joints shall be used as shown on drawings; on fan inlet/outlets; and on building expansion joints. The arrangement shall comply with BS 476-6, BS 476-7, BS 476-20, BS 476-21, BS 476-22, BS 476-23 and BS 476-24.

Fire Rated Ductwork

Where dictated by the design, It is essential that any installed fire rated ductwork complies with BS 476. Fire inside (Type B) is rated for stability, integrity and insulation for the same period of time as the compartment through which the duct passes. In addition, the duct shall also be tested for fire outside (Type A) with the additional requirement that the internal surface of the ductwork within the compartment shall also meet the insulation criteria.

The construction of fire rated ductwork, which shall comply with BS 476, can either be provided by specialist companies producing proprietary systems, or by the addition of fire insulating materials to suitably constructed and supported ductwork.

General purpose ductwork cannot be converted into a fire rated system unless the materials and construction of the whole system is in accordance with the requirements of BS 476.

Unless otherwise stated, ductwork shall be tested to give the fire rating required (minimum 2 hours) constructed in accordance with BS 476-24.

Access doors to the ductwork as required for sterilisation and/or cleaning shall be provided and shall be an integral part of this ductwork system.

Fire protection with fire resisting enclosures shall be in accordance with DW144.

Note: Where any ducts transit through a protected corridor or fire escape on its distribution around the building it must be fire rated and will require stability, integrity and insulation for the same period of time as the compartment through which it passes.

Regulating Dampers

Stainless steel, opposed blade, volume control dampers are to be installed on all final branch ducts within the ventilation system to allow an accurate air balance on completion of the works.

Dampers shall be arranged to be accessible with clear and unrestricted operation of the damper regulation lever.

The spigots from all fan coil units shall be fitted with a volume control damper for regulation and commissioning.

Fire & Smoke Dampers

Fire Dampers shall be provided in air distribution systems for fire and smoke containment; generally, they are to be installed where ducts penetrate walls or floors forming fire barriers, as identified on the Architectural or fire engineering plans.

All fire dampers shall close securely against the working dynamic pressure of the system to which they are installed.

Fire dampers should be located within the thickness of a fire barrier. Where this is not possible, the section of ductwork between the damper and the fire barrier shall have a fire resistance equal to that of the damper itself and be to the approval of the Fire Officer and Building Control Officer.

Where fire dampers are installed, access hatches are to be provided in either side of the damper for future maintenance, as per the requirements of BESA DW 144.

The contractor shall ensure that fire dampers are installed in accordance with the manufacturers tested and approved details, suitable for the installation position and building element materials.

Air Diffusers & Terminals

Unless specifically identified within the contract documentation, all diffusers and air grilles shall be selected so that the air speed delivered to the occupied zone is < 0.25 m/s.

Grilles and diffusers shall be selected according to the sound levels required in the area being served as defined in the room data sheets or this specification.

Supply Diffusers shall be arranged to promote a uniform air distribution in the room in which they are installed. Supply & Extract diffusers shall be adequately separated to avoid short circuiting of the supply air stream. Separation shall be as per the diffuser supplier's recommendations.

Where any diffuser is designed to deliver air, at a temperature which will fall below the dew point of the space in which they diffuser is installed (ceiling void etc) the diffusers plenum box must be insulated to protect against condensation.

Air terminals shall, where possible be supported from the building structure. Where this is not possible and subject to the approval of the Employer's Agent air terminal units and their plenums shall be supported by the ceiling grids, as DW 144.

Prior to the order of any diffusers and their associated plenum boxes the Contractor shall review the proposed installation position to ensure adequate clearance exists assuring safe future access and maintenance to the diffuser.

Attenuation

Attenuation shall be applied to the fan coil unit system and its components in order to meet the noise criteria defined within the room data sheets, client briefing document or this specification.

Attenuation shall typically be provided via the installation of passive circular, or rectangular attenuation modules mounted inline within the ductwork system at the locations defined on the contract drawings.

Where ductwork passes between noise sensitive areas and creates a passageway for speech transmission between the two spaces, cross talk attenuators shall be provided to reduce induct noise levels.

Filtration

Fan coil units shall be provided with panel filters an integral part of the fan coil units at minimum of G3 grade.

Dial Type Differential Pressure Gauges shall be installed across the filter using PVC tubing. The gauge shall be mounted externally of the unit and within three metres of the filter to allow for easy observation and shall be clearly marked with the positions equivalent to "Filter Dirt" and "Filter Clean" conditions. A differential pressure sensor linked to the local BMS or control system shall also be provided.

Insulation

Insulation shall be fitted to all installed ductwork unless specifically stated on the contract drawings. Details of the specification of this insulation is given in the following clauses.

Cladding shall be applied to all exposed ventilation ductwork or where it routes externally from the building. Seagull resistant cladding should be provided to all external ductwork sections.

Identification

Ductwork shall be colour coded and labelled to HVCA Specification DW 144 (Appendix B).

Colour bands, 300mm wide shall be applied to each duct at least once in every room or enclosed area; at intervals of 2.5 metres; at every junction; at every damper; and at every inspection and access position into service shafts, false ceilings, bulkheads etc.

For ducts with longest side or diameter up to and including 225mm. Colour bands shall be included 50mm wide together with superimposed legends. For ducts with longest side or diameter over 225mm, paint or

apply transfers to identification triangles, or triangular plates, and superimpose or incorporate legends.

Triangular plates shall be attached to buckle bands or stool pieces and fixed to ducting with apex indicating direction or airflow. Details of plates and fixings are to be submitted for approval before painting and marking. (Equilateral triangle of side 150mm minimum shall be used).

Legends shall be in the form of transfers of an approved type applied to colour bands or triangles or triangular plates which shall identify floor and space served, associated equipment reference and direction of airflow.

Each item of equipment shall be identified by name and, where appropriate, by agreed reference characters.

Colour identification shall be employed with the exception of firefighting equipment which shall be red.

Primary and secondary identification colours of associated system shall be used.

Plates shall consist of rectangular metal or laminated plastic, securely fixed to each item of equipment, with the engraving filled with paint. Plates shall be engraved with an appropriate text and shall incorporate the operating duty of equipment where this is not incorporated in other labelling.

Air Intake & Discharge Louvres

Contaminated exhausts should be arranged to give the maximum separation distance possible from any air intake. As a minimum this should be 4 meters with the discharge exiting higher than the intake, but where practical the distance should be greater and ideally the intake/exhausts should be orientated at different angles.

Where any air intake is positioned within a 3m proximity to a drainage vent pipe the Contractor must ensure that the drainage vent is extended to a height of at least 900mm above the head of the air intake.

The maximum air velocity through intake louvres shall be restricted to 2.5 m/sec to avoid moisture carry over.

All intake and discharge grilles shall be fitted with an integrated bird mesh.

Inspection openings in ductwork

Due consideration should be given to access for inspection, maintenance and cleaning. Openings need to be safe and have sealed panels/covers designed so that they can be easily removed and re-fixed. The Contractor shall follow the recommendations of BESA DW/144 for the location and arrangement of such openings.

Where inspection openings are provided in fire rated ductwork they shall be designed to maintain the fire integrity of the system.

Cleaning openings in ductwork

Ventilation systems shall incorporate all the necessary requirements to maintain the systems in a clean and hygienic condition. To achieve this, the ductwork systems shall be accessible and adequate numbers of access doors of the requisite sizes shall be installed.

Large ducts may be cleaned by personnel operating within the ducts and in this situation support bars shall be provided within vertical ducts to avoid the risk of operative falling vertically down the ductwork system. Upon completion of the ductwork installation all grilles shall be covered with a filter medium to collect dust before first operating the system. The system shall then be fully cleaned and where specified sterilised by a specialist contractor who will also advise on the number, position and size of access doors. Access doors shown on tender drawing or described elsewhere are the minimum requirements and the Contractor shall include for all other access as required by the cleaning specialist.

Where Cleaning openings are provided in fire rated ductwork they shall be designed to maintain the fire integrity of the system.

Commissioning & Handover

Preliminary checks and procedures shall be carried out as detailed in CIBSE Commissioning Code A and shall ensure system is statically complete as defined in BSRIA BG 49/2015.

For the commissioning of the air systems the Contractor shall use the pre-commissioning checklist in BSRIA BG 49/2015.

The air distribution systems shall be set to work and regulated in accordance with CIBSE Commissioning Code A, BSRIA BG 49/2015.

Instruments for measurement and methods of measurement shall be as detailed in BSRIA BG 49/2015 and

CIBSE Commissioning Guide A.

Environmental testing shall be carried out to prove the performance of the systems including the application of artificial loads or provision of test arrangements to simulate the full range of operating conditions and duties.

Ambient air quality tests shall be carried out in accordance with BS EN 13528-1 and BS EN 13528-2.

Witnessing Requirements

Handover material shall be provided in accordance with the recommendations of BSRIA BG 01/07 Handover, O&M manuals, and project feedback.

A programme shall be agreed for pre-commissioning checks, setting to work, commissioning and performance testing of plant and installations, and allow for all costs incurred. Where required, formal method statements shall be provided supported by risk assessments detailing all commissioning procedures.

Notice shall be given to all parties stating any requirements for attendance and co-operation of others, not less than fourteen working days in advance of the tests.

The Employer's Agent will only witness test proceedings confirm recorded results and determine if the specified requirements have been satisfied. If following test or inspection any plant or part thereof is shown to be defective or not conforming to the specification the Employer's Agent will reject such defective parts by written notice, within reasonable time, indicating area of dispute.

The Contractor shall appoint an approved commissioning specialist engineer, to supervise the whole of the testing, commissioning, performance testing and instruction of client's staff.

The Contractor shall provide all specialised personnel (including manufacturer's representatives) and co-ordinate their activities.

Equipment, material and systems shall be tested as detailed in Work Sections.

If an inspection or test fails, repeat the procedure, until satisfactory results are obtained. All tests shall be completed before any paint; cladding or similar materials are applied or before services are concealed. Following satisfactory completion of testing and when the installations are in a safe and satisfactory condition, set to work, regulate and adjust the systems, as necessary, to meet the specified design requirements.

All necessary instruments and recorders are to be provided to monitor systems during commissioning and performance testing. Test equipment shall be subject to a quality assurance procedure complying with BS 5781.

Do not start performance testing, including system demonstration, system proving or environmental and capacity testing, until commissioning of the system is completed to the satisfaction of the Employer's Agent.

Maintain on site full records of all commissioning and performance testing cross referenced to system components and on completion of the Works include a copy in each Operating and Maintenance Manual. All certification documents shall be provided for approval by the Employer's Agent before any system is offered for final acceptance. Gas, fuel oil, electricity and water for testing and commissioning will be provided by the Contractor.

10-15% of all values should be checked by the mechanical designer.

100% of all safety interlocks (and all fire dampers' operation) should be witnessed by the designer.

Demonstration Requirements

Once all systems have been commissioned and proved to be meeting the intent of the design with respect performance, control and operation the Contractor shall invite the client team to site and perform demonstrations of the operation of all key building services systems.

The Contractor shall provide a minimum of 14 days notice of testing to allow staff to make the necessary arrangements with respect their attendance.

System performance

Ss_60_60_70/210 Design of variable refrigerant flow systems

1. Design: Complete the design of the hybrid variable refrigerant flow system.
2. Requirement: Submit proposals including detailed design drawings, technical information, calculations and manufacturers' literature.

System completion

ss_60_60_70/810 Commissioning of refrigerating systems

1. Pre-commissioning: In accordance with CIBSE Commissioning Code R.
2. Commissioning: In accordance with CIBSE Commissioning Code R.
3. Notice (minimum): one week

Ω End of System

Ss_65_40_33_45

Kitchen extract ventilation systems

Systems

Ss_65_40_33_45 Kitchen extract ventilation systems

1. Description: **Contractors responsibilities**

The Contractor shall develop the Stage 3 design to completion, supply, install, co-ordinate with other contractors, test, commission and set to work the complete kitchen extract ventilation system. This shall include all necessary tools, labour, materials and equipment required to provide a complete working installation that fully meets the functional and performance criteria specified within this specification.

The Contractor shall include for provision of maintenance to the system, seasonal commissioning activities and rectification as required by the Contract and the Mechanical & Electrical Specification.

Function/Objectives

The purpose of the kitchen ventilation system is to remove contamination from the cooking processes, ventilate the surrounding ancillary areas and provide safe and comfortable conditions for the occupants.

Applicable Standards

In addition to this specification, the kitchen ventilation installation shall comply with the following standards and guidelines current at the time of tender:

- Building Regulations
- British Standards
- The requirements of the local Building Control Authority
- Relevant HSE Guidance
- BSRIA Standards & Guidance notes
- CIBSE Guides & Notes
- BESA Standards and Guidance Notes.

Any discrepancies identified by the contractor between the specification and the above documents shall be brought to the attention of the CA immediately.

Environmental Performance Assessment

The specification shall be read in conjunction with the latest version of the BREEAM Environmental pre assessment to ensure that any credits targeted applicable to the design of this system are achieved. The specification shall also be read in conjunction with the "Bruntwoods Guide to Net Zero Carbon in Operation" guide and the "Stage 3 MEP report" to ensure all energy targets are met as part of the project

Part L Building Regulation Compliance:

The Contractor shall ensure that prior to the final selection and order of any mechanical or electrical equipment they refer to the "Stage 3 MEP Report" and "Bruntwoods Guide to Net Zero Carbon in Operation" guide to ensure that the minimum equipment efficiencies as listed are achieved or bettered. As a bare minimum these will be as defined within the current edition of the Non-Domestic Compliance guide, but will typically exceed these values so must be checked.

Where variations or value engineering recognises equipment efficiency or control strategy changes that are potentially detrimental to the Part L compliance outcome, the Contractor must review and make the necessary enhancements to other areas of the proposed design in order to maintain a compliant project with respect to Part L at completion. Where applicable any equipment and strategy change must also be reviewed against any design stage BREEAM pre-assessment credits.

The Contractor shall be responsible for undertaking the EPC at completion of the project.

System Description

The Stage 3 proposals include for a commercial kitchen located in the lower ground floor of the Marsden Street block. This kitchen is to serve the food and beverage area front of house on the same floor level. The details of the kitchen at Stage 3 are unknown, as such only allowances for services have currently been made at this stage. The Contractor shall work with the architect and kitchen specialist to ensure all servicing needs are met.

Current proposals are that all services to the kitchen shall be electrical, and no gas services are proposed. If gas services are being proposed, then this should be brought to the attention of the CA immediately.

The kitchen extract fan is to be located on the Marsden street roof and ducted via the dedicated risers as indicated on the Contract drawings.

Any local planning requirements regarding the exhaust of kitchen extract air should be adhered to and where required additional cleaning systems, such as Ultra Violet and Ozone filtration shall be included.

Kitchen Extract Flowrate

Ahead of the purchase of any system components relating to the kitchen ventilation system the Contractor will be required to re-confirm the final air flow rate for the Kitchen via the selected catering specialist. Finalisation of the kitchen design will occur post tender and therefore, still has the potential to change. Accordingly, the Contractor shall check ventilation plant capacities and ductwork sizes to ensure that they continue to meet the requirements of the final kitchen arrangement and equipment installation in line with DW172 and amend where necessary.

The 'Thermal Convection Method' of calculation should be the only method used to calculate the kitchen ventilation and shall be based upon the final equipment selections proposed by the catering specialist. The methodology as defined within BESA DW172 shall be used to calculate flowrates.

Ductwork Installation

For the distribution of supply air to the canopy, the ductwork should be manufactured in low pressure, Class A, galvanised steel ductwork in accordance with BESA specification DW/144.

As it is not possible to immediately discharge the captured air within the confines of the kitchen fire zone, fire resistant ductwork must be used to comply with BS EN1366-1/BS 9999.

Internal thermal or acoustic lining of extract ductwork should not be used and turning vanes should be avoided wherever possible. Flexible ductwork must not be used on any part of the kitchen exhaust system.

Particular attention shall be paid to the design of ductwork to extract steam from dishwasher and pot washing machines due to the very high level of humidity present. With the risk of condensation, the following precautions shall be applied to prevent leakage through the duct joints.

- o Use of stainless steel ductwork with slip joints in the direction of the flow of condensation.
- o Ductwork installed with a fall back to the machine.
- o Apply external thermal insulation to minimise the condensation.
- o Ensure that longitudinal joints are not on the bottom of the ductwork.
- o Site-weld cross joints on stainless steel ductwork, particularly across the bottom and for 50mm up each side.
- o Ensure that cleaning doors are not on the underside of the ductwork.

All interior surfaces of the ductwork shall be accessible for cleaning and inspection purposes. In the absence of a detailed cleaning specification/method, access doors shall be installed at 2m centres and thereby enabling full cleaning of the system without manned entry.

The access doors shall be of at least the same thickness material as the ductwork, be grease tight using a heat-proof gasket and contain minimum projections into the duct. If the access doors are part of a fire resisting duct, then it needs to be verified that any new access doors are also fire resisting and are compatible with the ductwork they are being fitted to. Refer to the ductwork manufacturer, or if that is unknown obtain an opinion from a fire test laboratory accredited by UKAS for fire resisting ducts or a suitably qualified fire consultant.

Access panels should ideally be fitted at the side of the duct, a minimum of 10mm above the base to minimise the risk of grease leakage. On vertical ducts, cleaning doors shall be provided at each floor level.

Discharge points shall be positioned such that the extracted air cannot be entrained into a supply system.

All exterior ductwork should be supported with fixings that do not penetrate the duct wall. Where this is not possible, the duct wall shall be made good with sealant and steel washers.

Drains shall be installed at the base of all risers

Fire Rated Ductwork

It is essential that the installed system complies with BS EN 1366-1. Fire inside (Type B) is rated for Integrity (E) and Insulation (I) for the same period of time as the compartment through which the duct passes. Refer to the fire strategy for details on compartment protection periods. In addition, the duct shall also be tested for fire outside (Type A) with the additional requirement that the internal surface of the ductwork within the adjacent compartment shall also meet the insulation criteria.

The fire resistance of kitchen extract ductwork shall also include insulation, to ensure that a fire outside the duct does not cause any grease that has built up on the inside of the duct to ignite. The insulation shall ensure that temperatures on the inside of the duct shall not exceed 140°C average above ambient and 180°C at any one point.

In all cases where fire resistant ductwork is supplied, particular care shall be taken with the design of both fixings and supports to ensure that they are suitable for the specified duration of fire protection. If a fire originates in or is transferred to the ductwork system, then it may spread beyond its original location due to heat radiation or direct contact between the ductwork material and an adjacent combustible material. The ductwork route shall therefore take account of this risk, have a minimum separation of 500mm between uninsulated ductwork and any combustible material. Any reduction in the performance of the insulation criteria needs to form part of a fire risk assessment and should be agreed with the local authority and a written record retained.

Access doors fitted must be the same construction and must not compromise the fire protection integrity of the system.

Cleaning openings in ductwork

Cleaning of ductwork shall be carried out in line with TR19. All interior surfaces of the ductwork shall be accessible for cleaning and inspection purposes. In the absence of a detailed cleaning specification/method, access doors shall be installed at 2m centres and thereby enabling full cleaning of the system without manned entry. Ventilation systems shall incorporate all the necessary requirements to maintain the systems in a clean and hygienic condition. To achieve this, the ductwork systems shall be accessible and adequate numbers of access doors of the requisite sizes shall be installed.

Large ducts may be cleaned by personnel operating within the ducts and in this situation support bars shall be provided within vertical ducts to avoid the risk of operative falling vertically down the ductwork system.

Upon completion of the ductwork installation all grilles shall be covered with a filter medium to collect dust before first operating the system. The system shall then be fully cleaned and where specified sterilised by a specialist contractor who will also advise on the number, position and size of access doors. Access doors shown on tender drawing or described elsewhere are the minimum requirements and the Contractor shall include for all other access as required by the cleaning specialist.

Where cleaning openings are provided in fire rated ductwork they shall be designed to maintain the fire integrity of the system.

Air Filtration

Make up air filtration shall include Filters made of synthetic materials and having a minimum efficiency of ePM1 70% or 75% under the ISO 16890 classification scheme. Glass fibre products shall not be used.

Dampers

Volume control dampers are often necessary but should be kept to a minimum and incorporate the following features:

- o For extract systems, the damper blades shall be fabricated from stainless steel.
- o The operating mechanism shall be outside the airstream and be capable of withstanding the higher air temperatures associated with kitchen extract systems.

In accordance with BS 9999, fire dampers shall not be used in the extract system from a kitchen.

Back-draught dampers should not be used as they are difficult to clean and prevent a natural 'stack' effect from the kitchen which would otherwise release overnight lingering smells

All dampers shall close securely against the working dynamic pressure of the system.

Fire dampers should be located within the thickness of a fire barrier. Where this is not possible, the section of ductwork between the damper and the fire barrier shall have a fire resistance equal to that of the damper itself and be to the approval of the Fire Officer and Building Control Officer.

Ensure access is provided to damper mechanisms on fire dampers; smoke dampers; combined smoke and fire dampers; and volume control dampers through access doors, false ceilings etc. Demonstrate that damper blades close completely.

Demonstrate that fire links can be replaced. Where more than one fire damper is installed in a frame ensure access is provided to all fire dampers.

Attenuators

Attenuation will be required to achieve the following maximum internal noise level within the kitchen
Kitchen 50dBA - 55dBA, Restaurant 40dBA - 55dBA

Insulation

Insulation shall be fitted to all installed ductwork unless specifically stated on the contract drawings.

The fire resistance of kitchen extract ductwork shall also include insulation, to ensure that a fire outside the duct does not cause any grease that has built up on the inside of the duct to ignite (duct A scenario). The insulation shall ensure that temperatures on the inside of the duct shall not exceed 140°C average above ambient and 180°C at any one point.

Cladding shall be applied to all exposed ventilation ductwork or where it routes externally from the building. Seagull resistant cladding should be provided to all external ductwork sections.

Identification

Ductwork shall be colour coded and labelled to HVCA Specification DW 144 (Appendix B).

Colour bands, 300mm wide shall be applied to each duct at least once in every room or enclosed area; at intervals of 2.5 metres; at every junction; at every damper; and at every inspection and access position into service shafts, false ceilings, bulkheads etc

For ducts with longest side or diameter up to and including 225mm. Colour bands shall be included 50mm wide together with superimposed legends. For ducts with longest side or diameter over 225mm, paint or apply transfers to identification triangles, or triangular plates, and superimpose or incorporate legends.

Triangular plates shall be attached to buckle bands or stool pieces and fixed to ducting with apex indicating direction or airflow. Details of plates and fixings are to be submitted for approval before painting and marking. (Equilateral triangle of side 150mm minimum shall be used).

Legends shall be in the form of transfers of an approved type applied to colour bands or triangles or triangular plates which shall identify floor and space served, associated equipment reference and direction of airflow.

Each item of equipment shall be identified by name and, where appropriate, by agreed reference characters. Colour identification shall be employed with the exception of fire fighting equipment which shall be red. Primary and secondary identification colours of associated system shall be used.

Plates shall consist of rectangular metal or laminated plastic, securely fixed to each item of equipment, with the engraving filled with paint. Plates shall be engraved with an appropriate text and shall incorporate the operating duty of equipment where this is not incorporated in other labelling.

Gas Interlocking

Gas appliances are not anticipated for use in the kitchen or in the building in its entirety. If gas appliances are being proposed, this should be brought to the attention of the CA immediately.

Installation

Exhaust ventilation system should have a straight vertical run with few or no horizontal sections where practical. Horizontal runs create more opportunity for the build up of heavier than air particles therefore creating a higher fire risk.

Extract fan units should be positioned as near as possible to the point of discharge to ensure that the ductwork system remains under negative pressure.

Because of the many canopy sizes, access routes should be established to ensure that components can be easily manoeuvred into the building at the appropriate stage of construction. Consideration shall be given by all parties to special access or lifting provisions that may be required.

All ductwork shall be adequately supported on hangers and/or brackets and shall be positioned and spaced in relation to one another and to the building structure so as not to interfere with any other services and to allow for the required thickness of insulation.

Air terminals shall, where possible be supported from the building structure. Where this is not possible and subject to the approval of the Employer's Agent air terminal units and their plenums shall be supported by the ceiling grids, as DW 144.

Glass traps shall be provided on the drain trays from all AHU cooling coils and Heat exchangers. A trace heating system shall be provided by the Contractor that will be wrapped around the glass trap to prevent the water/bleach solution freezing during cold weather.

Testing & Commissioning

Preliminary checks and procedures shall be carried out as detailed in CIBSE Commissioning Code A, Section A1, and shall ensure system is statically complete as defined in section 7 of BSRIA BG 49/2015. For the commissioning of the air systems the Contractor shall use the pre-commissioning checklist in BSRIA BG 49/2015.

The air distribution systems shall be set to work and regulated in accordance with CIBSE Commissioning Code A, Section A2, and sections C3, C4 and C5 in BSRIA BG 49/2015.

Instruments for measurement and methods of measurement shall be as detailed in BSRIA Application Guide BG 49/2015 and CIBSE Commissioning Guide, section A3.

System performance

[Ss_65_40_33/230](#) Design parameters for ventilation systems

1. External climatic data
 - 1.1. Winter
 - 1.1.1. Outside temperature: Minus 5°C, 100% RH
 - 1.2. Summer
 - 1.2.1. Outside temperature: 32°C DB, 22°C WB

[Ss_65_40_33/240](#) Ductwork design type B

1. Air velocity
 - 1.1. Standard: As DW172
2. Ductwork cleaning
 - 2.1. Standard: In accordance with BESATEchnical Report TR/19.
 - 2.2. Level of protection: Intermediate PDI.
 - 2.3. Cleanliness quality class: Medium.

System completion

[Ss_65_40_33/810](#) Commissioning of air distribution systems type A

1. Pre-commissioning: In accordance with BSRIABG 49/2015 and CIBSECommissioning code A.
2. Commissioning: In accordance with BSRIABG 49/2015 and CIBSECommissioning code A.
3. Notice (minimum): One week.

[Ss_65_40_33/820](#) Performance testing type A

1. General: Demonstrate the performance of the installations.
2. Guaranteed efficiency: The Contractor shall provide a report which proves the systems performance against design efficiency targets.
3. Environmental tests: Carry out environmental testing. If necessary, use artificial loads to simulate operating conditions. Refer to system description for specific requirements.
4. Recorders
 - 4.1. Type: Supply and maintain portable seven day space temperature and relative humidity recorders, complete with charts.
 - 4.2. Number : As defined within the system description
 - 4.3. Duration of loan: One Week (minimum) or as defined in the system description
5. Reports: Submit on completion.

[Ss_65_40_33/830](#) Inspection and test records type A

1. Construction phase reports: Post-installation; System cleanliness; and System commissionable.
2. Records for air systems: In accordance with BSRIABG 49/2015.

3. Record sheets
 - 3.1. Submission: On Completion
 - 3.2. Number of copies: Two

Ss_65_40_33/840 Demonstrations type A

1. Running of plant
 - 1.1. Operation: Run, maintain and supervise the installations under normal working conditions.
 - 1.2. Duration: One Week
2. Instruction: Instruct and demonstrate the purpose, function and operation of the installations.
3. Witnessing Requirements : Handover material shall be provided in accordance with the recommendations of BSRIA BBG01/07 Handover, O&M manuals, and project feedback.

A programme shall be agreed for pre-commissioning checks, setting to work, commissioning and performance testing of plant and installations, and allow for all costs incurred. Where required, formal method statements shall be provided supported by risk assessments detailing all commissioning procedures.

Notice shall be given to all parties stating any requirements for attendance and co-operation of others, not less than fourteen working days in advance of the tests.

The Employer's Agent will only witness test proceedings confirm recorded results and determine if the specified requirements have been satisfied. If following test or inspection any plant or part thereof is shown to be defective or not conforming to the specification the Employer's Agent will reject such defective parts by written notice, within reasonable time, indicating area of dispute.

The Contractor shall appoint an approved commissioning specialist engineer, to supervise the whole of the testing, commissioning, performance testing and instruction of client's staff.

The Contractor shall provide all specialised personnel (including manufacturer's representatives) and co-ordinate their activities.

Equipment, material and systems shall be tested as detailed in Work Sections.

If an inspection or test fails, repeat the procedure, until satisfactory results are obtained. All tests shall be completed before any paint; cladding or similar materials are applied or before services are concealed. Following satisfactory completion of testing and when the installations are in a safe and satisfactory condition, set to work, regulate and adjust the systems, as necessary, to meet the specified design requirements. All necessary instruments and recorders are to be provided to monitor systems during commissioning and performance testing. Test equipment shall be subject to a quality assurance procedure complying with BS 5781.

Do not start performance testing, including system demonstration, system proving or environmental and capacity testing, until commissioning of the system is completed to the satisfaction of the Employer's Agent.

Maintain on site full records of all commissioning and performance testing cross referenced to system components and on completion of the Works include a copy in each Operating and Maintenance Manual. All certification documents shall be provided for approval by the Employer's Agent before any system is offered for final acceptance. Gas, fuel oil, electricity and water for testing and commissioning will be provided by the Contractor.

10-15% of all values should be checked by the mechanical designer.

100% of all safety interlocks (and all fire dampers' operation) should be witnessed by the designer.

4. Demonstration Requirements: Once all systems have been commissioned and proved to be meeting the intent of the design with respect performance, control and operation the Contractor shall invite the client team to site and perform demonstrations of the operation of all key building services systems.

The Contractor shall provide a minimum of 14 days notice of testing to allow staff to make the necessary arrangements with respect their attendance.

Ss_65_40_33/850 Documentation for ventilation systems type A

1. Operating and maintenance instructions
 - 1.1. Scope: Submit for the system as a whole giving optimum settings for controls.

- 1.2. Product information: Handover material shall be provided in accordance with the recommendations of BSRIA BBG01/07 Handover, O&M manuals, and project feedback.

Include product description, date of purchase, performance characteristics, application (suitability for use), method of operation and control, and cleaning and maintenance requirements.

Operation and Maintenance manuals shall be offered for review of the client team ahead of any planned handover process. The approval of O&M information forms an integral part of the handover process and may delay handover unless provided and signed off in advance.

- 1.3. Format: Paper copy and electronic
- 1.4. Number of copies: Two.
2. Record drawings
 - 2.1. Content: Record drawing details are to be developed to meet the minimum content requirements as defined within BSRIA BG6 "A design framework for Building Services"

Typically, but not limited too:

 - Location and arrangement of plant in plant rooms;
 - Location, size and route of ductwork;
 - Location and identification of regulating dampers and fire dampers;
 - and Location of outlets.
 - Plant and Equipment references
 - Design Flowrates
 - Any Health & Safety Information
 - 2.2. Format: A1 paper print and Electronic.
 - 2.3. Number of copies: Two Paper, Two electronic
3. Submittal date: At handover.

Ss_65_40_33/860 Spares and consumables type A

1. Filters
 - 1.1. Filter media: Supply one complete replacement for every filter.
 - 1.2. Retaining clips and rubber gaskets: Two sets for each type of filter.
 - 1.3. Cleaning solution: Supply coating solution for one complete cleaning of metal plate filters.
2. Detectors: Supply two of each type.
3. Air terminal device keys: Supply a set for adjusting each type of grille and diffuser damper.

Ss_65_40_33/870 Maintenance type A

1. Servicing and maintenance: Undertake for 12 months after completion.

Ω End of System

Ss_65_40_33_51

Mechanical supply and extract ventilation systems

Systems

Ss_65_40_33_51 Mechanical supply and extract ventilation systems

Description: Contractors Responsibilities

The Contractor shall develop the stage 3 design to completion, supply, install, co-ordinate with other contractors, test, commission and set to work the complete mechanical supply and extract ventilation systems. This shall include all necessary tools, labour, materials and equipment required to provide a complete working installation that fully meets the functional and performance criteria specified within this specification.

The Contractor shall include for provision of maintenance to the system, seasonal commissioning activities and rectification as required by the Contract and the Mechanical & Electrical Specification.

Function/Objectives

Supply & Extract ventilation systems shall be installed within the building in the locations defined upon the stage 3 drawings or as otherwise agreed. The system shall be designed to provide the following functionality:

- Deliver fresh air to the occupants, meeting the minimum requirements of the associated standards.
- Where applicable to provide control of the space air temperatures in rooms
- To work in tandem with the heating and cooling systems
- To work in an energy efficient manner by only providing air to the spaces that require it during the periods that they need it
- To remove airborne contaminants, odour or moisture in rooms

Applicable Standards

In addition to this specification, the Mechanical supply and extract system installation shall comply with the following standards and guidelines current at the time of tender:

- Building Regulations
- British Standards
- The requirements of the local Building Control Authority
- Relevant HSE Guidance
- BSRIA Standards & Guidance Notes
- CIBSE Guides & Notes
- BESA Standards and Guidance Notes.

Any discrepancies identified by the contractor between the specification and the above documents shall be brought to the attention of the CA immediately.

Environmental Performance Assessment

The specification shall be read in conjunction with the latest version of the BREEAM Environmental pre assessment to ensure that any credits targeted applicable to the design of this system are achieved. The specification shall also be read in conjunction with the "Bruntwoods Guide to Net Zero Carbon in Operation" guide and the "Stage 3 MEP report" to ensure all energy targets are met as part of the project

Part L Building Regulation Compliance:

The Contractor shall ensure that prior to the final selection and order of any mechanical or electrical equipment they refer to the "Stage 3 MEP Report" and "Bruntwoods Guide to Net Zero Carbon in Operation" guide to ensure that the minimum equipment efficiencies as listed are achieved or bettered. As a bare minimum these will be as defined within the current edition of the Non-Domestic Compliance guide, but will typically exceed these values so must be checked.

Where variations or value engineering recognises equipment efficiency or control strategy changes that are potentially detrimental to the Part L compliance outcome, the Contractor must review and make the necessary enhancements to other areas of the proposed design in order to maintain a compliant project with respect to Part L at completion. Where applicable any equipment and strategy change must also be reviewed against any design stage BREEAM pre-assessment credits.

The Contractor shall be responsible for undertaking the EPC at completion of the project.

System Description

There shall be a number of different mechanical ventilation systems installed to serve the building. The systems shall be as detailed upon the contract plans, schematics and associated technical schedules.

All air intakes and air discharges shall have a 4.5m separation distance with extract higher than the intake.

The following section provides an overview of the various systems to be provided :

General AHU

The general AHU is used to serve the front of house entrance area of the building including the following:

- Basement Gym and Lounge areas
- Lower Ground entrance, food and beverage and Pay and Go Lounge areas (Tower Block)
- Ground Floor Meeting rooms and lounge areas (Tower Block)

Supply air and extract air to these areas shall be provided via 1 No. central air handling unit located externally on the Marsden Steet Block roof. The air handling unit will be designed for external weather conditions. Supply and extract ductwork shall be ducted through dedicated risers as indicated on the contract drawings. Air intake shall be hard ducted to louvres with plenum boxes on the perimeter of the roof plant room compound and air discharge shall be within the roof plant compound, but directed away from any potential recirculation with intake air.

The air handling units shall contain; panel filter, bag filter, main LTHW heater battery, supply fan, extract fan and a thermal wheel and motorised isolating dampers. A purge section shall be included within this air handling unit to limit any potential contamination of supply air from the exhaust air which includes a gym. LTHW Heating coils shall be provided in the air handling units to control supply air to achieve room design condition. The air handling units shall be attenuated to ensure sound levels in rooms do not exceed the required NR Levels and to ensure that the local authority's requirements for external ambient noise limits are met. Fans shall be variable speed to permit energy efficient system balancing and operation and to work with a variable air volume (VAV) system. Where necessary the use of fan walls may need to be considered to achieve an appropriate level of turndown on the air volume.

Air ventilation rates to the front of house areas (excluding the gym) are generally based on 12l/s/p and aligned to the number of occupants indicated on the FF&E layouts.

The supply and extract to/from the rooms and zones shall use variable air volume (VAV) dampers, with the supply air linked to CO2 sensors with the zones served (sensors to be located out of direct sun light). Extract air will be a bell-mouth near to the riser position and the VAV will be controlled to match supply air flow for the floor plate being served. The gym shall have a ducted extract to the room from the riser position. The gym shall be designed to be under negative pressure (supply at 85% of extract rate)

Return air from other enclosed spaces shall utilise appropriately sized cross talk attenuators to create an air path back to the bell mouth positions.

A description of the general ventilation control strategy is included in section Ss_75_70_52_52 of this specification.

Balancing dampers shall be provided in accessible locations to ensure the system can be balanced effectively and efficiently. Smoke and fire dampers shall be provided in accordance with the building fire strategy. Adequate access doors and panels will be provided in the ductwork system in accordance with BESA DW/144 Level 1 and Guide TR17.

All ductwork shall be low pressure class A, zinc coated sheet steel to BESA specification DW/144. All ductwork in risers and back of house areas shall be insulated, and vapour sealed.

Exposed ductwork within occupied areas is to be powder coated and painted to a colour agreed with the Architect.

Air Handling Units

The air handling units shall be suitable for external mounting and fitted with an integral roof. AHU material selection shall be suitable for the local atmosphere which it will be subject to in its normal operation.

The air handling unit shall distribute the air, via a ductwork distribution system to a series of diffusers and fan coil units installed within the buildings rooms. Air shall be extracted from the rooms via a number of diffusers or the use of cross talk attenuators to make an air path back to the floor bell mouth. Similar to the supply air, the extract air shall be ducted back to the AHU typically via the ceiling voids and risers of the building.

Attenuators shall be provided on the Supply and extract downstream of the air handling unit to limit noise generation to below the levels defined within the room data sheets, client brief or this specification.

The atmospheric side attenuators shall also be installed on the upstream side of the air handling units to limit noise breakout to within the targets defined in the acoustic report or this specification.

Air handling plant shall be demand controlled and will modulate based on CO2 readings within the spaces served. The air handling unit shall be fitted with an integral microprocessor controller and allow dedicated control, independent from the BMS. The AHU will have a BACNET or similar interface module that will allow its connection to the BMS for monitoring and control where required or indicated.

Office Spaces

The office spaces are served via 3 No. separate AHUs as follows:

- AHU01 – King Street Office Block (floors 1-4, with future allowance for GF)
- AHU02 – Marsden Street Office Block (floors GF-5)
- AHU03 – Tower Office Block (floors 1-10)

Supply air and extract air to these areas shall be provided via 3 No. central air handling unit located externally on the associated roof to the block which they serve, as indicated on the Contract Drawings. The air handling unit will be designed for external weather conditions. Supply and extract ductwork shall be ducted through dedicated risers as indicated on the contract drawings. Air intake shall be hard ducted to louvres with plenum boxes on the perimeter of the roof plant room compound and air discharge shall be within the roof plant compound, but directed away from any potential recirculation with intake air.

The air handling units shall contain; panel filter, bag filter, main LTHW heater battery, supply fan, extract fan and a thermal wheel and motorised isolating dampers. LTHW Heating coils shall be provided in the air handling units to control supply air to achieve room design condition. The air handling units shall be attenuated to ensure sound levels in rooms do not exceed the required NR Levels and to ensure that the local authority's requirements for external ambient noise limits are met. Fans shall be variable speed to permit energy efficient system balancing and operation and to work with a variable air volume (VAV) system. Where necessary the use of fan walls may need to be considered to achieve an appropriate level of turndown on the air volume.

Air ventilation rates to the office areas are generally based on 12l/s/p and aligned to the number of occupants indicated on the FF&E layouts. Ventilation incorporates a level of diversity and where there are focus rooms, tea points or similar, it is anticipated that these will be serving the same people as per the office areas. Therefore, these spaces shall still be supplied with the required ventilation rates to suit the maximum occupancy levels, but the main riser ductwork and AHU flow rates are to be diversified to account for these on the minimum flow rate set by the VAV.

Where CAT A offices are indicated, air volumes are to be based on an occupancy level of 8m²/person.

The supply and extract to/from the rooms and zones shall use variable air volume (VAV) dampers, with the supply air linked to CO2 sensors with the zones served (sensors to be located out of direct sun light). Extract air will be a bell-mouth near to the riser position and the VAV will be controlled to match supply air flow for the floor plate being served.

Return air from enclosed spaces shall utilise appropriately sized cross talk attenuators to create an air path back to the bell mouth positions.

A description of the general ventilation control strategy is included in section Ss_75_70_52_52 of this specification.

Balancing dampers shall be provided in accessible locations to ensure the system can be balanced effectively and efficiently. Smoke and fire dampers shall be provided in accordance with the building fire strategy. Adequate access doors and panels will be provided in the ductwork system in accordance with BESA DW/144 Level 1 and Guide TR17.

All ductwork shall be low pressure class A, zinc coated sheet steel to BESA specification DW/144. All ductwork in risers and back of house areas shall be insulated, and vapour sealed.

Exposed ductwork within occupied areas is to be powder coated and painted to a colour agreed with the Architect.

Air Handling Units

The air handling units shall be suitable for external mounting and fitted with an integral roof. AHU material selection shall be suitable for the local atmosphere which it will be subject to in its normal operation.

The air handling unit shall distribute the air, via a ductwork distribution system to a series of diffusers and fan coil units installed within the buildings rooms. Air shall be extracted from the rooms via a number of diffusers or the use of cross talk attenuators to make an air path back to the floor bell mouth. Similar to the supply air, the extract air shall be ducted back to the AHU typically via the ceiling voids and risers of the building.

Attenuators shall be provided on the Supply and extract downstream of the air handling unit to limit noise

generation to below the levels defined within the room data sheets, client brief or this specification.

The atmospheric side attenuators shall also be installed on the upstream side of the air handling units to limit noise breakout to within the targets defined in the acoustic report or this specification.

Air handling plant shall be demand controlled and will modulate based on CO2 & Temperature readings within the spaces served. The air handling unit shall be fitted with an integral microprocessor controller and allow dedicated control, independent from the BMS. The AHU will have a BACNET or similar interface module that will allow its connection to the BMS for monitoring and control where required or indicated.

Changing Facilities and Bike Store Supply and Extract

The changing facilities and the bike store shall have ducted supply and extract ventilation to be provided by dedicated mechanical ventilation with heat recovery (MVHR) units. There shall be one unit to serve the bike store, drying room and perimeter spaces and then two units to serve the changing facilities (1 per changing room). The units shall be soffit mounted in the car park area with insulated supply and extract ductwork routed to the spaces they serve. The room side ductwork to the unit shall incorporate attenuators.

Fresh air intake and exhaust air discharge shall be directed into/out of the unit separation ducts c/w attenuators. The intake shall be drawn from the Marsden street side of the car park at louvres located at street level. The exhaust air shall be ducted to louvres at street level facing the car park ramp entrance point.

The MVHR units shall incorporate the following components:

- Attenuated inlet and exhaust dampers
- EU7/F7/MERV14 panel filter (supply and extract)
- Counter flow plate heat exchanger (with bypass)
- Inverter driven supply and extract fans
- LTHW Heater Battery
- Attenuated supply and extract duct
- Integral control and controller

Balancing dampers shall be provided in accessible locations to ensure each system can be balanced effectively and efficiently. Smoke and fire dampers shall be provided in accordance with the building fire strategy. Adequate access doors and panels shall be provided in ductwork in accordance with BESA DW/144 Level 1 and Guide TR17. All new ductwork will be low pressure class A zinc coated sheet steel to BESA specification DW/144. All ductwork will be insulated, and vapour sealed.

Changing rooms shall be put under negative pressure.

Toilet supply and extract

There are 2No. toilet block locations for the development, the first of these is located in the Marsden Street block and the second in the Tower Block. The toilet facilities in the tower block shall be dealt with on a floor by floor basis utilising the existing louvre positions which are located within the WC demise. These toilet facilities shall be provided by a dedicated MVHR unit which shall be linked to presence detection and run at a minimum flow rate in line with Part F of the building regulations

The toilet facilities in the Marsden Street block shall be dealt with by a centralised MVHR unit located in the lower ground floor plant room. This shall utilise the existing louvre positions at ground floor level facing onto the service yard at the rear of the site. These toilet facilities shall be provided by a dedicated MVHR unit which shall run at a minimum flow rate in line with Part F of the building regulations

Fresh air intake and exhaust air discharge shall be directed into/out of the unit separation ducts c/w attenuators. Extract air from the space shall be drawn into a series of extract grilles and a sheet steel rigid ductwork network to the MVHR unit which shall recover heat and cooling from the exhaust air. Supply air shall be provided with the WC lobby, Air transfer grilles shall be provided between each cubicle and the lobby.

The MVHR units shall incorporate the following components:

- Attenuated inlet and exhaust dampers
- EU7/F7/MERV14 panel filter (supply and extract)
- Counter flow plate heat exchanger (with bypass)
- Inverter driven supply and extract fans
- Attenuated supply and extract duct
- Integral control and controller

Balancing dampers shall be provided in accessible locations to ensure each system can be balanced

effectively and efficiently. Smoke and fire dampers shall be provided in accordance with the building fire strategy. Adequate access doors and panels shall be provided in ductwork in accordance with BESA DW/144 Level 1 and Guide TR17. All new ductwork will be low pressure class A zinc coated sheet steel to BESA specification DW/144. All ductwork will be insulated, and vapour sealed.

Retail Unit

The retail unit (located at Ground Floor level facing King Street) shall be served by a dedicated MVHR unit. The unit shall be soffit mounted in the retail demise and ducted including room side ductwork to the unit shall incorporate attenuators.

Fresh air intake and exhaust air discharge shall be directed into/out of the unit separation ducts c/w attenuators. The intake and exhaust shall be ducted from louvres located at the rear of the retail facility facing the service yard (located off Brown Street).

The MVHR units shall incorporate the following components:

- Attenuated inlet and exhaust dampers
- EU7/F7/MERV14 panel filter (supply and extract)
- Counter flow plate heat exchanger (with bypass)
- Inverter driven supply and extract fans
- Attenuated supply and extract duct
- Integral control and controller

Balancing dampers shall be provided in accessible locations to ensure each system can be balanced effectively and efficiently. Smoke and fire dampers shall be provided in accordance with the building fire strategy. Adequate access doors and panels shall be provided in ductwork in accordance with BESA DW/144 Level 1 and Guide TR17. All new ductwork will be low pressure class A zinc coated sheet steel to BESA specification DW/144. All ductwork will be insulated, and vapour sealed.

Ductwork

Unless otherwise specified, ductwork shall be constructed from hot dip galvanised steel manufactured in accordance with BESA DW/144.

Final ductwork material is to be selected based upon the anticipated local environmental conditions and its potential impact on that ductwork achieving a normal installation life expectancy (as defined within the latest edition of CIBSE guide M.) Examples of areas where enhanced material selection may be required will include coastal environments, corrosive atmospheres and where a high level of internal ductwork cleanliness are dictated by design. Where any doubt exists about the equipment or ductwork material please liaise with the consultant.

Rectangular duct bends with either dimension greater than 200 mm should have properly designed turning vanes installed. The angle of the turning vane should be the same as that of the bend. Information on the structural requirements of turning vanes as given in BESA specification DW/144.

All ductwork shall be adequately supported on hangers and/or brackets and shall be positioned and spaced in relation to one another and to the building structure so as not to interfere with any other services and to allow for the required thickness of insulation to be fitted.

Where ductwork is insulated, load bearing supports shall be provided at bracket positions to ensure that the insulation and vapour barrier are continuous.

All bolts, nuts, washers etc. shall be of a permanent nature with a non-corrosive finish such as cadmium plating, sheradising or galvanising as appropriate.

Hangers and supports complying with BS EN 12236 shall be provided throughout in accordance with DW 144 or DW 191 as appropriate.

Flexible ductwork may be employed for final connections to grilles and diffusers, these should not be more than 100mm in length, and all other ductwork should be of solid construction.

Flexible ducts shall be PVC/Polyester Laminate complying with BS EN13180. Where any flexible ductwork will carry air at temperatures below the dewpoint of the spaces in which it is installed (ceiling void etc) that flexible ductwork must be insulated.

PVC/Polyester laminate flexible duct connections shall be fastened in accordance with DW 144. Flexible duct connections shall be used in applications listed in DW 144
Materials and accessories shall be compatible with ductwork and the finishes of accessories shall comply with any special requirements for ductwork.

Ensure casing losses of components are compatible with ductwork in which they are incorporated.

Test holes shall be provided in ductwork systems to allow complete testing and balancing of systems in accordance with CIBSE Commissioning Code Series A. Test holes shall be site drilled in accordance with DW 144. On completion of testing these test holes shall be fitted with plastic plugs.

Holes shall be provided in ductwork for controls/instruments in accordance with DW 144 to accommodate thermostats, humidistats and other control sensors in positions and sizes indicated on drawings.

Sensors and test points are to be provided to suit specialist control and sensing equipment as required.

Flexible joint connections shall be installed as detailed in DW 144 or DW 154, as appropriate.

Flexible joints shall be used as shown on drawings; on fan inlet/outlets; and on building expansion joints.

The arrangement shall comply with BS 476-6, BS 476-7, BS 476-20, BS 476-21, BS 476-22, BS 476-23 and BS 476-24.

All exposed ductwork shall be powder coated and painted to a colour of the Architects choosing.

Fire Rated Ductwork

Although not anticipated to be required, if future evolutions of the design dictate the need for fire rated ductwork it is essential that it is installed in line with and complies with BS 476

Regulating Dampers

Stainless steel, opposed blade, volume control dampers are to be installed on all final branch ducts within the ventilation system to allow an accurate air balance on completion of the works.

Dampers shall be arranged to be accessible with clear and unrestricted operation of the damper regulation lever.

For Office AHU's and the General AHU, VAV dampers are to be included linked to located temperature and CO2 sensors to serve each zone/room. AHU's shall be designed to work as part of a VAV system.

Fire & Smoke Dampers

Fire Dampers shall be provided in air distribution systems for fire and smoke containment; generally, they are to be installed where ducts penetrate walls or floors forming fire barriers, as identified on the Architectural or fire engineering plans.

All fire dampers shall close securely against the working dynamic pressure of the system to which they are installed.

Fire dampers should be located within the thickness of a fire barrier. Where this is not possible, the section of ductwork between the damper and the fire barrier shall have a fire resistance equal to that of the damper itself and be to the approval of the Fire Officer and Building Control Officer.

Where fire dampers are installed, access hatches are to be provided at either side of the damper for future maintenance as per the requirements of DW/144.

The contractor shall ensure that fire dampers are installed in accordance with the manufacturers tested and approved details, suitable for the installation position and building element materials.

Air Diffusers & Terminals

Unless specifically identified within the contract documentation, all diffusers and air grilles shall be selected so that the air speed delivered to the occupied zone is < 0.25 m/s.

Grilles and diffusers shall be selected according to the sound levels required in the area being served as defined in the room data sheets or this specification.

Supply Diffusers shall be arranged to promote a uniform air distribution in the room in which they are installed. Supply & Extract diffusers shall be adequately separated to avoid short circuiting of the supply air stream. Separation shall be as per the diffuser supplier's recommendations.

Where any diffuser is designed to deliver air at a temperature which will fall below the dew point of the space in which they diffuser is installed (ceiling void etc) the diffusers plenum box must be insulated to protect against condensation.

Air terminals shall, where possible be supported from the building structure. Where this is not possible and subject to the approval of the Employer's Agent air terminal units and their plenums shall be supported by the ceiling grids, as DW 144.

Prior to the order of any diffusers and their associated plenum boxes the Contractor shall review the proposed installation position to ensure adequate clearance exists assuring safe future access and

maintenance to the diffuser.

Attenuation

Attenuation shall be applied to the ductwork system and its components in order to meet the noise criteria defined within the room data sheets, client briefing document or this specification.

Attenuation shall typically be provided via the installation of passive circular, or rectangular attenuation modules mounted inline within the ductwork system at the locations defined on the contract drawings.

Where ductwork passes between noise sensitive areas and creates a passageway for speech transmission between the two spaces, cross talk attenuators shall be provided to reduce induct noise levels.

Filtration

Air filtration shall typically be provided as an integral part of the air plant serving the ductwork system, typically either via AHU or MVHR unit.

Typically, where installed as part of a centralised AHU two levels of filtration shall be provided at the following efficiency levels:

Pre-Panel Filter Module Coarse 75% Efficiency (to ISO 16890)

Bag Filter Module ePM2.5 65-75% Efficient (to ISO 16890)

Where installed, MVHR units shall be fitted with an integral pleated panel filter providing the following efficiency levels:

Pre-Panel Filter Module Coarse 75% Efficiency (to ISO 16890)

Where filters are provided as part of an AHU installation, Dial Type Differential Pressure Gauges shall be installed across the filter using PVC tubing. The gauge shall be mounted externally of the unit and within three metres of the filter to allow for easy observation and shall be clearly marked with the positions equivalent to "Filter Dirt" and "Filter Clean" conditions. A differential pressure sensor linked to the local BMS or control system shall also be provided.

Insulation

Insulation shall be fitted to all installed ductwork unless specifically stated on the contract drawings. Details of the specification of this insulation is given in the following clauses.

Cladding shall be applied to all exposed ventilation ductwork or where it routes externally from the building. Seagull resistant cladding should be provided to all external ductwork sections.

Identification

Ductwork shall be colour coded and labelled to HVCA Specification DW 144 (Appendix B).

Colour bands, 300mm wide shall be applied to each duct at least once in every room or enclosed area; at intervals of 2.5 metres; at every junction; at every damper; and at every inspection and access position into service shafts, false ceilings, bulkheads etc

For ducts with longest side or diameter up to and including 225mm. Colour bands shall be included 50mm wide together with superimposed legends. For ducts with longest side or diameter over 225mm, paint or apply transfers to identification triangles, or triangular plates, and superimpose or incorporate legends.

Triangular plates shall be attached to buckle bands or stool pieces and fixed to ducting with apex indicating direction or airflow. Details of plates and fixings are to be submitted for approval before painting and marking. (Equilateral triangle of side 150mm minimum shall be used).

Legends shall be in the form of transfers of an approved type applied to colour bands or triangles or triangular plates which shall identify floor and space served, associated equipment reference and direction of airflow.

Each item of equipment shall be identified by name and, where appropriate, by agreed reference characters. Colour identification shall be employed with the exception of firefighting equipment which shall be red. Primary and secondary identification colours of associated system shall be used.

Plates shall consist of rectangular metal or laminated plastic, securely fixed to each item of equipment, with the engraving filled with paint. Plates shall be engraved with an appropriate text and shall incorporate the operating duty of equipment where this is not incorporated in other labelling.

Air Intake & Discharge Louvres

Contaminated exhausts should be arranged to give the maximum separation distance possible from any air intake. As a minimum this should be 4 meters with the discharge exiting higher than the intake, but where practical the distance should be greater and ideally the intake/exhausts should be orientated at different angles.

Where any air intake is positioned within a 3m proximity to a drainage vent pipe the Contractor must ensure that the drainage vent is extended to a height of at least 900mm above the head of the air intake.

The maximum air velocity through intake louvres shall be restricted to 2.5 m/sec to avoid moisture carry over.

All intake and discharge grilles shall be fitted with an integrated bird mesh.

Air Leakage Testing

Where indicated within this specification or within the design stage Part L2A modelling report the Contractor shall allow to undertake air leakage testing on the ductwork system on completion of the works.

The designer shall select at random a maximum of 10% of the duct system to be tested for air leakage. The duct shall be tested at the pressure recommended in DW/144 for the classification for the section of the ductwork that is to be tested.

The tests shall be carried out as the work proceeds and prior to the application of thermal insulation.

In the event of test failure of the randomly selected section, the designer shall have the right to select two further sections at random for testing. Where successive failures are identified there shall be a right to require the contractor to apply remedial attention to the complete ductwork system.

The contractor shall provide documented evidence of the calculations used to arrive at the allowable loss for the section to be tested and the client, or his agent, shall witness and sign the results of the test.

Inspection openings in ductwork

Due consideration should be given to access for inspection, maintenance and cleaning. Openings need to be safe and have sealed panels/covers designed so that they can be easily removed and re-fixed. The Contractor shall follow the recommendations of BESA DW/144 for the location and arrangement of such openings.

Where inspection openings are provided in fire rated ductwork they shall be designed to maintain the fire integrity of the system.

Cleaning openings in ductwork

Ventilation systems shall incorporate all the necessary requirements to maintain the systems in a clean and hygienic condition. To achieve this, the ductwork systems shall be accessible and adequate numbers of access doors of the requisite sizes shall be installed.

Large ducts may be cleaned by personnel operating within the ducts and in this situation support bars shall be provided within vertical ducts to avoid the risk of operative falling vertically down the ductwork system.

Upon completion of the ductwork installation all grilles shall be covered with a filter medium to collect dust before first operating the system. The system shall then be fully cleaned and where specified sterilised by a specialist contractor who will also advise on the number, position and size of access doors. Access doors shown on tender drawing or described elsewhere are the minimum requirements and the Contractor shall include for all other access as required by the cleaning specialist.

Where cleaning openings are provided in fire rated ductwork they shall be designed to maintain the fire integrity of the system.

Commissioning & Handover

Preliminary checks and procedures shall be carried out as detailed in CIBSE Commissioning Code A and shall ensure system is statically complete as defined in BSRIA BG 49/2015 For the commissioning of the air systems the Contractor shall use the pre-commissioning checklist in BSRIA BG 49/2015.

The air distribution systems shall be set to work and regulated in accordance with CIBSE Commissioning Code A, BSRIA BG 49/2015.

Instruments for measurement and methods of measurement shall be as detailed in BSRIA BG 49/2015 and CIBSE Commissioning Guide A.

Environmental testing shall be carried out to prove the performance of the systems including the application of artificial loads or provision of test arrangements to simulate the full range of operating conditions and duties.

Ambient air quality tests shall be carried out in accordance with BS EN 13528-1 and BS EN 13528-2.

Witnessing Requirements

Handover material shall be provided in accordance with the recommendations of BSRIA BBG01/07 Handover, O&M manuals, and project feedback.

A programme shall be agreed for pre-commissioning checks, setting to work, commissioning and performance testing of plant and installations, and allow for all costs incurred. Where required, formal method statements shall be provided supported by risk assessments detailing all commissioning procedures.

Notice shall be given to all parties stating any requirements for attendance and co-operation of others, not less than fourteen working days in advance of the tests.

The Employer's Agent will only witness test proceedings confirm recorded results and determine if the specified requirements have been satisfied. If following test or inspection any plant or part thereof is shown to be defective or not conforming to the specification the Employer's Agent will reject such defective parts by written notice, within reasonable time, indicating area of dispute.

The Contractor shall appoint an approved commissioning specialist engineer, to supervise the whole of the testing, commissioning, performance testing and instruction of client's staff.

The Contractor shall provide all specialised personnel (including manufacturer's representatives) and co-ordinate their activities.

Equipment, material and systems shall be tested as detailed in Work Sections.

If an inspection or test fails, repeat the procedure, until satisfactory results are obtained. All tests shall be completed before any paint; cladding or similar materials are applied or before services are concealed. Following satisfactory completion of testing and when the installations are in a safe and satisfactory condition, set to work, regulate and adjust the systems, as necessary, to meet the specified design requirements. All necessary instruments and recorders are to be provided to monitor systems during commissioning and performance testing. Test equipment shall be subject to a quality assurance procedure complying with BS 5781.

Do not start performance testing, including system demonstration, system proving or environmental and capacity testing, until commissioning of the system is completed to the satisfaction of the Employer's Agent.

Maintain on site full records of all commissioning and performance testing cross referenced to system components and on completion of the Works include a copy in each Operating and Maintenance Manual. All certification documents shall be provided for approval by the Employer's Agent before any system is offered for final acceptance. Gas, fuel oil, electricity and water for testing and commissioning will be provided by the Contractor.

10-15% of all values should be checked by the mechanical designer.

100% of all safety interlocks (and all fire dampers' operation) should be witnessed by the designer.

Demonstration Requirements

Once all systems have been commissioned and proved to be meeting the intent of the design with respect performance, control and operation the Contractor shall invite the client team to site and perform demonstrations of the operation of all key building services systems.

The Contractor shall provide a minimum of 14 days notice of testing to allow staff to make the necessary arrangements with respect their attendance.

Additional documentation

See document issue sheet for all relevant drawings and schedules.

System performance

Ss_65_40_33/240 Ductwork design type A

1. Air velocity
 - 1.1. Standard: As CIBSE Guide B2. Values given below are a guide and may be subject to local variance in order to meet requirements of the brief or constraints of the site.
 - 1.2. Primary ducts & Risers: 6 m/s. Supply Air , 6m/s Extract Air
 - 1.3. Main Horizontal Distribution: 4.0 m/s Supply Air, 4.0m/s Extract Air
 - 1.4. Runouts: 3.0 m/s or less to suit the NR requirements of the room as given in the RDS, client briefing document or this specification
2. Ductwork cleaning
 - 2.1. Standard: In accordance with BESATechnical Report TR/19. Values given below are a guide and may be subject to local variance in order to meet requirements of the brief or constraints of the site.
 - 2.2. Level of protection: Basic PDI.

2.3. Cleanliness quality class: Low.

Ss_65_40_33/250 Fan performance

1. Standard: In accordance with BS 6583.
2. Flow rate: Refer to technical schedules
3. System pressure: Refer to technical schedules
4. Operation: Refer to technical schedules
5. Specific fan power: Contractor shall review the SFP target values of the 'Bruntwood Guide to Net Zero Operational Carbon' document

Where no part L model assessment is provided the Contractor shall ensure the SFP values meet the minimum figures defined in the latest edition of the Non Domestic Compliance Guide supporting ADPL2

6. Classification: As per fans application

Ss_65_40_33/260 Attenuator performance

1. Performance requirements
 - 1.1. Standards: To BS EN ISO 7235 and BS EN ISO 11691.
 - 1.2. Insertion loss: In line with Acoustic Consultants requirements

System completion

Ss_65_40_33/810 Commissioning of air distribution systems type A

1. Pre-commissioning: In accordance with BSRIABG 49/2015 and CIBSECommissioning code A.
2. Commissioning: In accordance with BSRIABG 49/2015 and CIBSECommissioning code A.
3. Notice (minimum): One week.

Ss_65_40_33/820 Performance testing type A

1. General: Demonstrate the performance of the installations.
2. Guaranteed efficiency: The Contractor shall provide a report which proves the systems performance against design efficiency targets.
3. Environmental tests: Carry out environmental testing. If necessary, use artificial loads to simulate operating conditions. Refer to system description for specific requirements.
4. Recorders
 - 4.1. Type: Supply and maintain portable seven day space temperature and relative humidity recorders, complete with charts.
 - 4.2. Number : As defined within the system description
 - 4.3. Duration of loan: One Week (minimum) or as defined in the system description
5. Reports: Submit on completion.

Ss_65_40_33/830 Inspection and test records type A

1. Construction phase reports: Post-installation; System cleanliness; and System commissionable.
2. Records for air systems: In accordance with BSRIABG 49/2015.
3. Record sheets
 - 3.1. Submission: On Completion
 - 3.2. Number of copies: Two

Ss_65_40_33/840 Demonstrations type A

1. Running of plant
 - 1.1. Operation: Run, maintain and supervise the installations under normal working conditions.
 - 1.2. Duration: One Week
2. Instruction: Instruct and demonstrate the purpose, function and operation of the installations.

3. Witnessing Requirements : Handover material shall be provided in accordance with the recommendations of BSRIA BBG01/07 Handover, O&M manuals, and project feedback.

A programme shall be agreed for pre-commissioning checks, setting to work, commissioning and performance testing of plant and installations, and allow for all costs incurred. Where required, formal method statements shall be provided supported by risk assessments detailing all commissioning procedures.

Notice shall be given to all parties stating any requirements for attendance and co-operation of others, not less than fourteen working days in advance of the tests.

The Employer's Agent will only witness test proceedings confirm recorded results and determine if the specified requirements have been satisfied. If following test or inspection any plant or part thereof is shown to be defective or not conforming to the specification the Employer's Agent will reject such defective parts by written notice, within reasonable time, indicating area of dispute.

The Contractor shall appoint an approved commissioning specialist engineer, to supervise the whole of the testing, commissioning, performance testing and instruction of client's staff.

The Contractor shall provide all specialised personnel (including manufacturer's representatives) and co-ordinate their activities.

Equipment, material and systems shall be tested as detailed in Work Sections.

If an inspection or test fails, repeat the procedure, until satisfactory results are obtained. All tests shall be completed before any paint; cladding or similar materials are applied or before services are concealed. Following satisfactory completion of testing and when the installations are in a safe and satisfactory condition, set to work, regulate and adjust the systems, as necessary, to meet the specified design requirements. All necessary instruments and recorders are to be provided to monitor systems during commissioning and performance testing. Test equipment shall be subject to a quality assurance procedure complying with BS 5781.

Do not start performance testing, including system demonstration, system proving or environmental and capacity testing, until commissioning of the system is completed to the satisfaction of the Employer's Agent.

Maintain on site full records of all commissioning and performance testing cross referenced to system components and on completion of the Works include a copy in each Operating and Maintenance Manual. All certification documents shall be provided for approval by the Employer's Agent before any system is offered for final acceptance. Gas, fuel oil, electricity and water for testing and commissioning will be provided by the Contractor.

10-15% of all values should be checked by the mechanical designer.

100% of all safety interlocks (and all fire dampers' operation) should be witnessed by the designer.

4. Demonstration Requirements: Once all systems have been commissioned and proved to be meeting the intent of the design with respect performance, control and operation the Contractor shall invite the client team to site and perform demonstrations of the operation of all key building services systems.

The Contractor shall provide a minimum of 14 days notice of testing to allow staff to make the necessary arrangements with respect their attendance.

Ss_65_40_33/850 Documentation for ventilation systems type A

1. Operating and maintenance instructions

1.1. Scope: Submit for the system as a whole giving optimum settings for controls.

1.2. Product information: Handover material shall be provided in accordance with the recommendations of BSRIA BBG01/07 Handover, O&M manuals, and project feedback.

Include product description, date of purchase, performance characteristics, application (suitability for use), method of operation and control, and cleaning and maintenance requirements.

Operation and Maintenance manuals shall be offered for review of the client team ahead of any planned handover process. The approval of O&M information forms an integral part of the handover process and may delay handover unless provided and signed off in advance.

1.3. Format: Paper copy and electronic

1.4. Number of copies: Two.

2. Record drawings

- 2.1. Content: Record drawing details are to be developed to meet the minimum content requirements as defined within BSRIA BG6 "A design framework for Building Services"

Typically, but not limited too:

Location and arrangement of plant in plant rooms;
Location, size and route of ductwork;
Location and identification of regulating dampers and fire dampers;
and Location of outlets.
Plant and Equipment references
Design Flowrates
Any Health & Safety Information

- 2.2. Format: A1 paper print and Electronic.
- 2.3. Number of copies: Two Paper, Two electronic
3. Submittal date: At handover.

Ss_65_40_33/860 Spares and consumables type A

1. Filters
 - 1.1. Filter media: Supply one complete replacement for every filter.
 - 1.2. Retaining clips and rubber gaskets: Two sets for each type of filter.
 - 1.3. Cleaning solution: Supply coating solution for one complete cleaning of metal plate filters.
2. Detectors: Supply two of each type.
3. Air terminal device keys: Supply a set for adjusting each type of grille and diffuser damper.

Ss_65_40_33/870 Maintenance type A

1. Servicing and maintenance: Undertake for 12 months after completion.

Ω End of System

Ss_65_40_94_10

Car park extract systems

Systems

Ss_65_40_94_10 Car park extract systems

1. Description: **Contractors Responsibilities**

The Contractor shall develop the tender design to completion, supply, install, co-ordinate with other contractors, test, commission and set to work the complete car park extract system. This shall include all necessary tools, labour, materials and equipment required to provide a complete working installation that fully meets the functional and performance criteria specified within this specification.

The Contractor shall include for provision of maintenance to the system, seasonal commissioning activities and rectification as required by the Contract and the Mechanical & Electrical Specification.

Function/Objectives

To provide a ventilation system for underground or enclosed car parks to comply with the air flow requirements of Approved Documents B and F of the Building Regulations with respect to smoke clearance and general fume ventilation.

To provide compliance with the project fire strategy report.

Applicable Standards

In addition to this specification, the Mechanical extract system installation shall comply with the following standards and guidelines current at the time of tender:

- Building Regulations
- British Standards
- The requirements of the local Building Control Authority
- Relevant HSE Guidance
- BSRIA Standards & Guidance Notes
- CIBSE Guides & Notes
- BESA Standards and Guidance Notes.
- MoD Specifications, Design and Maintenance Guides and Technical Bulletins.

Any discrepancies identified by the contractor between the specification and the above documents shall be brought to the attention of the CA immediately.

Environmental Performance Assessment

The specification shall be read in conjunction with the latest version of the BREEAM Environmental pre assessment to ensure that any credits targeted applicable to the design of this system are achieved. The specification shall also be read in conjunction with the "Bruntwoods Guide to Net Zero Carbon in Operation" guide and the "Stage 3 MEP report" to ensure all energy targets are met as part of the project

Part L Building Regulation Compliance:

The Contractor shall ensure that prior to the final selection and order of any mechanical or electrical equipment they refer to the "Stage 3 MEP Report" and "Bruntwoods Guide to Net Zero Carbon in Operation" guide to ensure that the minimum equipment efficiencies as listed are achieved or bettered. As a bare minimum these will be as defined within the current edition of the Non-Domestic Compliance guide, but will typically exceed these values so must be checked.

Where variations or value engineering recognises equipment efficiency or control strategy changes that are potentially detrimental to the Part L compliance outcome, the Contractor must review and make the necessary enhancements to other areas of the proposed design in order to maintain a compliant project with respect to Part L at completion. Where applicable any equipment and strategy change must also be reviewed against any design stage BREEAM pre-assessment credits.

The Contractor shall be responsible for undertaking the EPC at completion of the project.

System Description

The car park ventilation system shall comply with the airflow requirements of Approved Documents F and B (2000) to the Building Regulations in instances where natural car park ventilation cannot be achieved. This generally requires an airflow rate of at least 6ACH per floor under normal conditions and 10 ACH on the fire floor under fire conditions.

The mechanical car park extract system comprises:

- 2No Duty, variable speed, extract fans with F300 classification (300C continuous operation for 1 hour) as per BS EN 12101-3 and CE marked
- Inlet ventilation provided via the entrance ramp and any additional natural ventilation opening which can

connect directly to external air. Area to be determined by specialist designer

- Full height extract grilles at each car park level served complete with motorised fire smoke control damper
- Builders work shaft or fire rated duct
- Exhaust termination louvre
- Fire rated ducting to link builders work shaft to fans and duct fire rated duct termination
- A network of impulse fans mounted to the car park ceiling with F300 classification as per BS EN 12101-3
- Main control panel plus mimic panel for fire service use
- Fire alarm interface to main control panel
- A series of carbon monoxide (CO) sensors, suitably positioned within the car park in areas with the potential for high concentrations

The extract points shall be, as far as practicable, on the opposite side of the car park to the air inlet and will be located to take into account the means of escape locations within the car park.

Duct work and fixings within the car park should be temperature rated to 800°C and maintain their stability and integrity under fire conditions

The system shall be independent of any other ventilating system (other than a system providing normal ventilation to the car park).

The extract plant shall include for inlet and exhaust side attenuators to achieve a maximum noise level of NR55 within the car park at 3 m away from any item of equipment and 55 dBA externally at 3m from the extract fan discharge grilles under general ventilation conditions

The impulse fans shall be supplied fully assembled with all necessary attenuators, guards and guide vanes. The units shall comprise 100N thrust, with a single speed motor suitable for inverter control, tested to the latest version of BS EN 12101-3. The unit shall be fitted above the circulation areas and in locations to direct exhaust fumes (in day to day mode) and smoke in a controlled manner towards the main extract positions of the car park, to ensure there are no stagnant areas and a good level of ventilation is provided throughout the car park.

The main extract system should be designed to run on at least two parts, such that the total exhaust capacity does not fall below 50% of the maximum required duty (10ACH) in the event of failure of any one part. The fault or failure of one will not jeopardize operation of the other.

Power for smoke extract fans shall be derived independently from the main intake positions or standby generators/mains auto changeover bus bars, and not taken from sub distribution supplies.

Isolators for all smoke extract fans shall be lockable in the off and on positions and shall be rated to the same temperature as the fans i.e. 300C for 60 minutes.

Fire resistant cabling shall be used to supply all smoke ventilation equipment and auxiliary devices including control cabling to enable operation under extreme temperatures.

A full design report including all calculations and CFD analyses shall be provided for submission to Building Control prior to installation.

All clips and cable ties used to support fire rated cabling shall be of metal construction throughout their length.

Control Logic

Normal Ventilation mode

- The system shall be capable of providing up to 6 air changes per hour to ensure CO levels do not exceed: 30ppm over an 8 hour period
90ppm over a 15 minute period

- The car park tender shall include for CO monitoring control. The CO monitoring control shall significantly reduce the running cost for the ventilation system particularly when there is little traffic. The CO monitoring is to run the system at a lower flow rate, providing 3 ACH under normal circumstances, with the system only going to 6 ACH if the CO detection system detects higher CO levels typically above 35 ppm (parts per million).

- The impulse fans shall be controlled based on local CO levels. Upon detection of high concentrations of CO at any local sensor, the impulse fans shall switch on and direct air towards the extract point. The system shall be designed so that each impulse fan can work independently, controlled via separate CO sensors.

Fire mode

- On detection of the fire (by either smoke detection, rapid heat rise detection, multi-criteria fire detection,

sprinkler flow switch or fire service override), the main extract fans will start immediately providing the required 10 ACH extract rate.

- The control panel shall shut the smoke dampers on the louvres to all floors with the exception of the fire floor, thus focussing the whole delivery volume of the fan systems through the fire floor and achieving in excess of the minimum 10ACH required by regulation.

- After an appropriate delay the impulse fans will operate to direct smoke efficiently towards the main extract points. The delay period will reflect the designed means of escape period. It is possible that if the impulse fans are set into operation too early they may actually worsen conditions for means of escape by encouraging smoke circulation and descent of the smoke layer, as such commissioning of this system is critical.

- A mimic switch for fire service use shall be mounted in a position accessible to and agreed with the fire service and shall incorporate manual override for fire service use.

Impulse ventilation as a system is not intended to maintain any area of a car park clear of smoke, to limit smoke density or temperature to within any specific limits or to assist means of escape. It will help to reduce smoke density and temperature during the course of the fire and later assist fire fighters by providing ventilation to allow speedier clearance of the smoke once the fire has been extinguished.

Testing and commissioning

The installation, wiring and commissioning of the complete system shall be carried out by the appointed specialist and their approved sub-contractors. The specialist company shall be responsible for demonstrating and gaining approval for the ventilation system.

The Specialist Company shall be a BSI registered firm for the design, manufacture, installation and commissioning of smoke control systems in accordance with ISO 9000. Proof of certification shall be provided with tender submission.

In accordance with BS 7346-7 Table 2, the system shall be tested to ensure the agreed "cause and effect" requirements are correctly implemented and the system responds to any planned method of initiation.

All extract fans shall be resistance tested in both the on and off positions.

Allowance for training to be provided to site maintenance staff to be included

Full commissioning of fan systems, controls and detection systems to include witnessing by the appropriate authorities – allow for separate visits for commissioning and handover.

System performance

Ss_65_40_94/210 Design of car park ventilation

1. Design: Complete the design of the car park ventilation system.
2. Standard: In accordance with BS 7346-7.
3. Application: Vehicle exhaust pollution and smoke clearance.
4. Smoke and heat control system: Smoke and heat exhaust ventilation system and Impulse ventilation system.
5. Vehicle pollution control systems: Mechanical ventilation to limit concentration of carbon monoxide.
6. Requirement: Submit design documentation in accordance with BS 7346-7.

Ss_65_40_94/220 Performance criteria

1. Smoke control: To assist fire-fighters to clear smoke from a car park during and after a fire and To protect means of escape from the car park.
2. Air change rate
 - 2.1. Ventilation of fumes generally: Up to 6 air changes per hour per floor
 - 2.2. Exits and ramps:
 - 2.3. Fire situation: Minimum of 10 air changes per hour on fire floor
3. Standby plant: Secondary power supplies from standby generators/mains auto changeover bus bars.
4. Ventilation openings: Extract - 50% High and 50% low level. Area to be confirmed by specialist;
Intake – Entrance ramp (Area requirements to be confirmed by specialist)

Ss_65_40_94/250 Activation and operation of systems

1. Ventilation mode: At CO levels of 0–20 ppm run extract fans;
At CO levels of 20–30 ppm run extract fans and jet fans at low speed;
and At CO levels of 30 ppm and above run extract fans and jet fans at high speed.
2. Fire mode
 - 2.1. Activation: Building fire detection system;
Smoke detection;
Rapid rate of rise heat detection;
Multi-criteria fire detectors;
Sprinkler flow switch;
and Fire service switch.
 - 2.2. Operation: Run extract fans and Initially run extract fans at high speed with jet fans off. After five minutes switch on jet fans at high speed.
3. Fan control: Inverter controlled for normal ventilation;
High speed in fire situation

System completion

Ss_65_40_94/810 Commissioning car park ventilation systems

1. Standard: In accordance with BS 7346-7, clause 17.

Ss_65_40_94/820 Inspection and test records

1. Reports: Submit details of inspections and tests in accordance with BS 7346-7, Table 2.
2. Record sheets
 - 2.1. Submission: On completion.
 - 2.2. Number of copies: Two.

Ss_65_40_94/830 Demonstrations

1. Running of plant
 - 1.1. Operation: Run, maintain and supervise the installations under normal working conditions.
 - 1.2. Duration: Two weeks.
2. Instruction: Instruct and demonstrate the purpose, function and operation of the installations.

Ss_65_40_94/840 Documentation

1. Operating and maintenance instructions
 - 1.1. Scope: Submit details in accordance with BS 7346-7, clause 18.
 - 1.2. Product information: Include product description, date of purchase, performance characteristics, application (suitability for use), method of operation and control, and cleaning and maintenance requirements.
 - 1.3. Format: Electronic and Paper copy.
 - 1.4. Number of copies: Two of each
2. Record drawings
 - 2.1. Content: Location and arrangement of plant;
Location, size and route of ductwork;
and Location and identification of regulating dampers and fire dampers.
 - 2.2. Format: A1 paper print and Electronic.
 - 2.3. Number of copies: Two of each
3. Submittal date: At handover.

Ss_65_40_94/850 Spares and consumables

1. Filters
 - 1.1. Filter media: Supply one complete replacement for every filter.
 - 1.2. Retaining clips and rubber gaskets: Two sets for each type of filter.
 - 1.3. Cleaning solution: Supply coating solution for one complete cleaning of metal plate filters.

Ss_65_40_94/860 Maintenance

1. Servicing and maintenance: Undertake for 12 months after completion.

Ω End of System

Ss_65_80_45_72

Room air conditioning systems

Systems

Ss_65_80_45_72 Room air conditioning systems

1. Description: **Contractors responsibilities**

The Contractor shall develop the tender design to completion, supply, install, co-ordinate with other contractors, test, commission and set to work the complete room air conditioning system. This shall include all necessary tools, labour, materials and equipment required to provide a complete working installation that fully meets the functional and performance criteria specified within this specification.

The Contractor shall include for provision of maintenance to the system, seasonal commissioning activities and rectification as required by the Contract and the Mechanical & Electrical Specification.

Function/Objectives

To provide a source of heating or cooling in order to condition the space to achieve the internal design conditions.

Applicable Standards

In addition to this specification, the Air conditioning installation shall comply with the following standards and guidelines current at the time of tender:

- Building Regulations
- British Standards
- The requirements of the local Building Control Authority
- Relevant HSE Guidance
- BSRIA Standards & Guidance notes
- CIBSE Guides & Notes
- BESA Standards and Guidance Notes.
- F Gas Regulations

Any discrepancies identified by the contractor between the specification and the above documents shall be brought to the attention of the CA immediately.

Environmental Performance Assessment

The specification shall be read in conjunction with the latest version of the BREEAM Environmental pre assessment to ensure that any credits targeted applicable to the design of this system are achieved. The specification shall also be read in conjunction with the "Bruntwoods Guide to Net Zero Carbon in Operation" guide and the "Stage 3 MEP report" to ensure all energy targets are met as part of the project

Part L Building Regulation Compliance:

The Contractor shall ensure that prior to the final selection and order of any mechanical or electrical equipment they refer to the "Stage 3 MEP Report" and "Bruntwoods Guide to Net Zero Carbon in Operation" guide to ensure that the minimum equipment efficiencies as listed are achieved or bettered. As a bare minimum these will be as defined within the current edition of the Non-Domestic Compliance guide, but will typically exceed these values so must be checked.

Where variations or value engineering recognises equipment efficiency or control strategy changes that are potentially detrimental to the Part L compliance outcome, the Contractor must review and make the necessary enhancements to other areas of the proposed design in order to maintain a compliant project with respect to Part L at completion. Where applicable any equipment and strategy change must also be reviewed against any design stage BREEAM pre-assessment credits.

The Contractor shall be responsible for undertaking the EPC at completion of the project.

System Description

The environmental temperature of a number of the buildings zones (as detailed upon the contract drawings) will be controlled via a refrigerant based air conditioning system.

A direct expansion air conditioning strategy will be provided. The system will be capable of either heating and cooling each area/zone supplied. The system will comprise the following components:

- 2 Pipe External Condenser unit located at roof level (Coated for corrosion limitation, pending local environment)

- A number of indoor heating/cooling room units. Typically ceiling concealed or wall mounted type with power derived from the external condenser.
- A local wall mounted controller unit (1 per room/zone)
- Pairs of Interconnecting refrigerant pipework from each indoor unit, laid on cable tray
- Controls and ancillary fittings as required by refrigerant manufacturer to provide a fully functional system.

The outdoor condenser shall be an air-cooled type incorporating heat exchanger coils manufactured from copper tubes and aluminium fins. The system shall be capable of operation between external ambient temperatures of minus 5°C and +45°C.

The external units shall be mounted on anti-vibration pads to reduce the vibrations being transferred to the building structure during operation. The location of all outdoor units shall be arranged to meet the manufacturers recommendations with respect to adequate airflow over the exchanger body, maintenance access and short circuiting with adjacent units. Where the external condenser is mounted in a location that could make it vulnerable to accidental mechanical damage, the contractor shall provide a caged enclosure for protection of the unit. Details of the units shall be issued to and approved by the Architect. Condensers shall not be positioned where they may sit in pooled water. Condensers to be raised above the finished floor to avoid this.

The sound pressure noise level of the external unit should not exceed the ambient acoustic requirements of the project as detailed in this specification or the acoustic report. Where necessary attenuation is to be applied to reach these design targets.

The system must operate with Refrigerant R32. This refrigerant is a single component gas, classed as A2L: non-toxic, slightly flammable under the EN378 and EN60335-2-40. The refrigerant has a GWP value of 675. Low level refrigerant leak detection, incorporating visual and audible alarm and linked back to the BMS, is to be included in all rooms where refrigerant is distributed.

Each room containing an indoor unit shall be provided with a local wall mounted controller. As a minimum, controllers shall offer the following key features:

- On/Off button
- Weekly timer
- Setpoint limit
- Function lock
- Night Setback

Wall mounted controllers shall be provided for each zone/room and be fully commissioned and set up to ensure minimum energy use. Wireless hand-held remote controllers shall not typically be utilised.

A central controller shall be provided to override all set points and provide a time schedule and optimisation control. The central controller shall be provided with a BACnet, Lonworks or Modbus communications protocol to provide communication of all parameters to the BMS system. The outdoor units shall provide a common fault signal to the BMS.

Pipelines & Distribution

The installation must follow the guidance issued in BS EN 378 (BSI, 2016a) and the Institute of Refrigeration's A1 Refrigerant (HFC) Code of Practice (IOR, 2015) as well as specific manufacturers' instructions for pipework installation.

Degreased copper tube complying with EN 12449 is to be used, either in soft coiled condition, (for small diameter lines) or half-hard condition in straight lengths. The copper used in tube for refrigerant lines is required to be oxygen-free or de-oxidised. The tube shall be supplied with its ends fitted with rubber caps to prevent moisture or other contaminants entering and these should be kept in place and used as a temporary seal during installation.

The copper tubing shall be of a suitable thickness to be capable of withstanding pressure test as detailed in the current revision of BS/EN378.

The copper tubing shall be suitably selected with a wall thickness capable of withstanding the system test pressures of the system refrigerant.

To minimise the possibility of refrigerant losses to atmosphere, pipework joints shall be kept to a minimum.

All pipework fittings are to be manufactured specifically for the refrigeration industry and are based on OD sizes. Pipework shall be jointed by brazing method. Brazing carried out to EN 14324 using copper-phosphorous (CP) filler metals complying with EN ISO 17672 is the preferred method for making non-detachable joints. The fittings shall conform to ASME D16.22.-1995.

Only suitably qualified personnel should undertake brazing, e.g. holders of BRA Brazing Assessment or CITB Assessment or an appropriate NVQ including this activity with assessment.

Dry nitrogen shall be passed continuously through the pipework at minimal pressure and at an adequate velocity during brazing or soldering to eliminate internal oxidation. All excess solder and flux shall be removed on completion of joints.

Piping and other components which have been prepared and are not to be used immediately shall be capped and sealed. During installation no component or length of tubing shall be left un-blanked longer than necessary for installation.

Suction lines shall be sized to provide a minimum practical pressure drop commensurate with sufficient velocity for oil entrainment.

The maximum installed refrigerant vertical and horizontal pipe lengths must be in accordance with the manufacturer's recommendations. Where alterations to the final pipework routing are undertaken as part of the Contractor installation or design works, the limitations of the supplier in respect to horizontal and vertical pipework must be observed and achieved.

The suction lines shall be designed to slope back to the compressor to avoid oil logging around the system.

Refrigerant pipework shall be laid on cable tray along its entire length.

Electrical cables shall not be fixed to refrigerant pipework.

Discharge pipes likely to cause burns to personnel shall be shielded.

Where pipework drops from roof level into risers or floors below they will do so via pre-formed slots in the structural floor slab at that level. To provide a sound waterproofing detail to these slots a roofed service hut which sits above the holes that pipework must drop within shall be provided. The Contractor shall review the arrangement detailed upon the design drawings and arranged the pipework to suit the layouts highlighted.

Condensate drainage is required to the indoor unit to take the condense vapour associated with the coils to drain. All condensate pipework shall be arranged to drain under gravity (where possible) to local connection points into the above ground drainage system. Typically, a fall gradient of 1:80 shall be achieved to permit the above. Where necessary, the indoor unit will be supplied with an integral condensate pump that will provide the lift to take the condensate into the ceiling void, once in the ceiling void it will run at a gravity fall to drain locally within the foul system.

Where wall mounted indoor units are provided they will typically not be fitted with an integral condensate pump and the Contractor shall provide a standalone pump separate from the unit to lift the condensate to a height that will permit onward gravity drainage.

Any condensate drainage installed in cold rooms or areas operating below 0C will require trace heating
All connections to the soil vent stack shall be made via a waterless trap.

All condensate pipework shall be in uPVC.

Condensate from the external units shall be allowed to discharge directly onto the floor.

All piping and ventilation ducting, which passes through fire compartment walls, ceiling and floors, shall be sealed where it passes through the structural line. The sealing shall have at least equivalent fire resisting properties as the fire compartment.

Pipework Insulation

All Refrigerant pipework to be insulated with slip-on close cell elastomeric pipe insulation, with a fire performance rating class "O", having a wall thickness in accordance with BS 5422. After commissioning, all joints to be properly sealed to provide an adequate vapour barrier and clearly marked for ease of identification.

Insulation shall be continuous throughout the pipework length and be carried unbroken through all brackets and clipping points.

Externally running refrigerant pipework shall be fitted UV & Seagull protective layer as Armacheck R, or Equal and approved

Ceiling concealed indoor units

Where units are concealed ducted type, these will distribute conditioned air to the room via ducted

connections to ceiling diffusers. Refer to section 65-10-95/130 for specification details for ductwork systems.

Ductwork connections between the ceiling diffusers and the indoor units shall be made via a rectangular header duct feeding spirally wound rigid ductwork branches with the final connection to the diffusers (<0.1m) being completed in flexible ductwork to limit vibration transmission through the ductwork system and ceiling. All air conditioning ductwork shall be fully insulated, and vapour sealed.

Ceiling diffusers shall be complete with plenum boxes, diffuser plates. All ductwork plenums within the ceiling void shall be fully insulated and vapour sealed to avoid condensation issues.

The indoor units will operate on a recirculation strategy, as such make up air to the rear of the indoor units will be drawn directly from the room via open ceiling diffusers within the ceiling grid. The recirculation grilles shall be matched to the supply diffusers within the space.

Indoor units shall be selected to deliver the heating/cooling duty defined within the technical data sheets at low speed settings thus limiting the noise to the associated room.

Wall mounted indoor units

Final position of all indoor units shall be agreed with the architect on site.

Wall units shall be mounted at a height meeting the minimum recommendations of the equipment supplier and so not to cause any constraint to the rooms normal use or impinge on opening of doors or furniture.

The installation position shall ensure a solid fixing, suitable to carry the unit's weight. Wall pattresses shall be provided in any partition wall to carry the weight of installed units.

Wall units shall not be installed above electrical equipment such as televisions to avoid signal interference and damage from potential leaks.

The units shall be arranged so that the airflow from the units is not obstructed and allows a thorough coverage of the room to which it is installed within.

Indoor units shall be selected to deliver the heating/cooling duty defined within the technical data sheets at low speed settings thus limiting the noise to the associated room.

AC General Notes

The selections of air conditioning equipment will be based on the outdoor units limiting the off coil temps by increasing the evaporating temps, to ensure 10 deg C temperature differential (fan coil units/room.)

All air conditioning ductwork and grilles boxes shall be fully insulated and vapour sealed to avoid condensation risk and heat loss.

The Contractor should position indoor units to be fully accessible from below and to achieve the maintenance space requirements as defined by the manufacturer.

All air conditioning controller units shall be mounted on column positions, ideally orientated out of direct sunlight.

Refrigeration equipment shall have a strength pressure test and a leakage pressure test after manufacture. Tests on the refrigerant side shall be made in accordance with the current version of BS EN 378-1.

All grilles and diffusers are to be supported independent of the ceiling grid. A safety gripple wire shall be provided in the event the diffuser falls.

Operatives engaged on work to refrigeration systems shall be fully trained and be registered with the appropriate body.

Installations shall only be carried out by competent persons with appropriate training and certification (e.g. C&G Level 2 Award in F-Gas and ODS Regulations 1-4, C&G Levels 2 and 3 courses 6127 and 6087), employed by companies that have attained approved installer status for the system being installed e.g. BSP status for Mitsubishi and D1 approval for Daikin equipment and approved installer status for LG.

A 5-year manufacturer's warranty for split type systems must be provided. Replacement spares shall be readily available for 10 years following product cessation.

Commissioning

Commissioning of all systems shall include programming of set points, setbacks, time schedules and

holiday schedules, this should be witnessed by the designer at completion. Functional testing regimes shall be undertaken at completion to verify that the commissioning has been undertaken to prove system operation and interoperation with other systems is as per the design requirement.

Preliminary checks and procedures shall be carried out as detailed in CIBSE Commissioning Code A, Section A1, and shall ensure system is statically complete as defined in section 7 of BSRIA BG 49/2015. For the commissioning of the air systems the Contractor shall use the pre-commissioning checklist in BSRIA BG 49/2015.

Strength tests will normally be carried out before a leak tightness test, using oxygen free nitrogen (OFN) or other inert gas. Oxygen, air, ammonia, fluorocarbons, combustible gas or any combustible mixture shall not be used as a strength test medium.

Refer to design documentation for details of pressures to be achieved with time periods for the mechanical strength and leak tightness test. These shall comply with BSEN378:2008.

If there is a need to complete a leak tightness test prior to strength test to confirm system or part system integrity this test shall be completed at very low pressure, say 5% of design.

The leak tightness test shall be carried out with oxygen free nitrogen (OFN) or a mixture of OFN and a tracer. The tracer should be zero ODP and low GWP. Mixtures of HCFCs or HFCs with air should not be used.

All joints shall be checked for leaks using either a leak detecting bubble spray or an electronic leak detector suitable for use with the tracer.

Following satisfactory testing, test certificates shall be completed and included to system operation end user manual.

For further guidance on strength pressure and leak tightness testing refer to BSEN 378 1:2008 and BSEN 378 2:2008. In addition, refer to the IOR Safety Code for Refrigerating systems using A1 Refrigerants which is a comprehensive guide bringing together a number of regulations and directives that should be complied with.

Leak tightness pressure test to permit detection of leaks and then demonstrate system integrity to contain refrigerant, along with refrigerant charging, reclaiming, leak detection methods including labelling and records shall comply with the F-Gas regulations No 842/2006. Refer to BRA Code of Practice for Refrigerant Leak Tightness published 2007 for a comprehensive interpretation of regulation into practice.

The system refrigerant charge should be recorded on the outdoor unit label and in the F-Gas logbook for each system on site, so that subsequent leak checks can be carried out in an effective manner.

System Performance

Ss_65_80_45/210 Design of local air conditioning system

1. Design: Complete the design of the local air conditioning system.
2. Standard: Performance to BS EN 16798-3
3. Method: In accordance with BS EN ISO 52016-1
4. Requirement: Submit proposals including detailed design drawings, technical information, calculations and manufacturers' literature
5. Calculations
 - 5.1. Submittals: Final heat loads for proposed ICT equipment in Retail, Server, Comms and MER rooms.

System completion

Ss_60_40_36/810 Commissioning of heat pump systems Type A

6. Pre-commissioning: In accordance with Manufacturer's recommendations and CIBSE Commissioning Code R.
7. Commissioning: In accordance with CIBSE Commissioning Code R and In accordance with CIBSE Commissioning Code W.
8. Notice (minimum): One week.

Ss_65_80_45/810 Commissioning of air distribution systems

1. Pre-commissioning: In accordance with [BSRIABG 49/2015](#) and [CIBSECommissioning Code A](#).
2. Commissioning: In accordance with [BSRIABG 49/2015](#) and [CIBSECommissioning Code A](#).
3. Notice (minimum): One week.

Ss_65_80_45/820 Performance testing

1. General: Demonstrate the performance of the installations.
2. Guaranteed efficiency: Tolerances defined in this specification.
3. Environmental tests: Carry out environmental testing. If necessary, use artificial loads to simulate operating conditions.
4. Recorders
 - 4.1. Type: Supply and maintain portable seven day space temperature and relative humidity recorders, complete with charts.
 - 4.2. Number : Two.
 - 4.3. Duration of loan: Two weeks.
5. Reports: Submit on completion.

Ss_65_80_45/830 Inspection and test records

1. Construction phase reports: System commissionable.
2. Records for water systems:
3. Records for air systems: In accordance with [BSRIABG 49/2015](#).
4. Record sheets
 - 4.1. Submission: On completion.
 - 4.2. Number of copies: Three.

Ss_65_80_45/840 Demonstrations

1. Running of plant
 - 1.1. Operation: Run, maintain and supervise the installations under normal working conditions.
 - 1.2. Duration: Two weeks.
2. Instruction: Instruct and demonstrate the purpose, function and operation of the installations.

Ss_65_80_45/850 Documentation

1. Operating and maintenance instructions
 - 1.1. Scope: Submit for the system as a whole giving optimum settings for controls.
 - 1.2. Product information: Include product description, date of purchase, performance characteristics, application (suitability for use), method of operation and control, and cleaning and maintenance requirements.
 - 1.3. Format: Paper and electronic
 - 1.4. Number of copies: Two.
2. Record drawings
 - 2.1. Content: Location and arrangement of plant
Location, size and route of ductwork and pipework;
Location and identification of regulating dampers and fire dampers;
and Location of outlets.
 - 2.2. Format: A1 paper print and Electronic.
 - 2.3. Number of copies: Two.
3. Submittal date: At handover.

Ss_65_80_45/860 Spares and consumables

1. Filter
 - 1.1. Filter media: Two filters for each individual unit
 - 1.2. Retaining clips and rubber gaskets: Two sets for each type of filter.

- 1.3. Cleaning solution: Supply coating solution for one complete cleaning of metal plate filters.
2. Detectors: Supply two of each type.
3. Air terminal device keys: Supply a set for adjusting each size and type of grille and diffuser and Supply a set for adjusting each type of grille and diffuser damper.

Ss_65_80_45/870 Maintenance

1. Servicing and maintenance: Undertake for 12 months after completion.

Ω End of System

Ss_75_70_52_52

Office Mechanical ventilation control systems

Systems

Ss_75_70_52_52 Office Mechanical ventilation control systems

1. Description:

The main office floors will be based on a mechanical ventilation strategy.

The net zero aspirations of the project have led to ensuring that ventilation systems only run when needed and to serve the locations where it is required.

Mechanical supply and extract ventilation to the main office floors will be provided via centralised mechanical ventilation air handling units (AHU's), located on the roof of the block they serve (Tower/Marsden Street/King Street) with ductwork routed down the associated risers. The ventilation to each zone/space shall be controlled via Variable Air Volume (VAV) dampers, with local CO₂ controls for each room/zone. For the Cat A office floor plates, zone are based on the BCO requirements of 4.5m x 6m perimeter zones and 50-70m² internal zones.

Ventilation is based on 12l/s/p for office and meeting areas.

During periods when the AHU is active, the VAV units shall vary their flow rate based on the following conditions which shall also be interlocked with the FCU to ensure all systems operate at the correct demand

The ventilation system shall respond to the conditions as follows:

CO₂

Above 1000 ppm	- VAV _{max} unit operates at max design flow rate conditions (12 l/s/p)
800-1000ppm	- VAV _{midh} units operates at 66% of the total design flow rate (8 l/s/p)
600-800ppm	- VAV _{midl} units operates at 42% of the total design flow rate (5 l/s/p)
<600ppm	- VAV _{min} units operates at 25% of the total design flow rate. (3 l/s/p)

All set points to be fully adjustable from the BMS.

Incoming supply air will be filtered and heated by the AHU units to deliver air at room design temperature.

Where required, fire dampers shall be provided within the ventilation ductwork to maintain the integrity of fire compartmentation in accordance with the Fire Strategy and the requirements of Building Control.

Where ductwork passes through spaces that are at different temperatures to that of the transferred air where external to the building, it shall be insulated.

All unit shall be provided with CO₂ monitoring linked back to the central BMS system.

Ss_75_70_54_10

Building monitoring and management systems

Systems

Ss_75_70_54_10 Building monitoring and management systems

1. Description: **General**

A fully functional Building Management System shall be provided by the Contractor to monitor and control the various building services installations.

The system serving this project shall be compatible with the Burntwood BMS systems and shall be open protocol in its nature. The final integration shall be agreed with the PM prior to adoption.

All mechanical plant shall be powered from the MCC panels unless stated on the electrical documents and drawings.

It must be capable of stand alone operation, but have the ability to be linked to the wider project monitoring system via an ethernet link.

The controls specialist is to provide for the complete design, supply, configuration, documentation, graphical displays and commissioning of the BMS including all hardware, software and supply of all connected sensors and actuators, manufacture and commission of the Motor Control Centres and Controls wiring including the provision of all power wiring from the BMS MCP's and all outstations including that located within and external or associated plant room. The controls specialist will also allow for all containment, conduit and trunking required to provide the BMS controls wiring installation.

Standard text pages showing information from all connected points shall be available on graphic pages. From these it shall be possible to access logged items & to adjust set point values. In addition a text page shall be set up for each item of plant (all pumps, chillers etc.) shown on the colour displays with push-button access from the plant symbol. The Text Page shall be configured to show the basic plant item description and hours-run total. To ensure operator consistency the text displayed shall be an exact representation of text labels programmed into the controller.

Calendars and zones shall be set up as agreed with the Project Manager. For tender purposes each plant shall be considered to use a separate zone.

Alarm panels shall be set up as follows:

" Critical Alarms: sounder, print and log.

" General Alarms: print and log.

Alarms shall be grouped by general location and type, generally as agreed with the Project Manager. A display page(s) shall be set up showing the condition of all critical alarms.

An alarm database shall be provided to obtain reports on alarms received Today, This Week, This Month, This Year. The alarm database shall be provided with a Standard Query Language enquirer to permit specific searches and data extraction. The alarm database shall be provided with an automatic filtering so that only conditions currently in alarm are displayed.

Diagrams and schematics will be used at the operator's facility. Sequential and cross indexing/paths to allow movement between the pages in a logical manner shall be provided. An exit to the head/index page will be available from each page. The correct performance of the pages will form part of the plant commissioning procedures.

The exact format and appearance of the pages plus their operation shall be subject to recommendation and improvement by the specialist controls company during the contract period to interpret and satisfy the client's requirements.

The BMS shall have sufficient memory within the server/hard drive to allow the storage and recovery of the values of all monitored points for six months at the normal polling interval.

Smart Controls

Elements of the BMS are to be linked with the Smart Controls design for the project. The Contractor and Controls Specialist are to coordinate with the Smart Controls Consultant to ensure that all requirements are met and a collaborative approach is achieved. As a minimum the Smart Controls Consultant requires the following:

- The BMS is to be a 'Niagara 4' solution operating over the buildings enterprise network through a dedicated VLAN

- The system is to include a 'Tridium Niagara 4' supervisor licence with 50,000 points and 3 years maintenance, to be loaded on the Bruntwood cloud (to be discussed with the BEL connectivity team)
- Include a head-end BMS work station on site for engineering and operator access
- Each MCC and control panel to have a 'Niagara 4' Jarva Application Control Engine (JACE) controller to have a fully open NIC's statement)
- JACE(s) to connect to distributed unitary controllers via BACnet MS/TP field network
- JACE(s) to connect to meters (electrical and heat meters) via Modbus RTU or Modbus IP via IP/serial converters)
- JACE(s) to serve meter data points onto the enterprise network in BACnet I/P format for acquisition by the AMR/AM&T solution
- JACE(s) to serve data points, as required, onto the enterprise network in BACnet I/P format for communications with the EDGE server
- JACE(s) to interface to Mitsubishi HVRF system via BACnet/IP (over the building enterprise network)
- JACE(s) to interface to Lifts via BACnet/IP or Modbus I/P (over the building enterprise network)
- JACE(s) to interface to Lighting system via open protocol I/P (BACnet/Dali/other – over the building enterprise network)
- JACE(s) to interface to Packaged Air Source Heat Pumps via open protocol BACnet I/P (over the building enterprise network)
- MCC and panel designs to be submitted to BEL representative for comment and approval
- All MCC's to have an internal UPS to support the JACE and controls circuit (sensors/interfaces) – 30 mins minimum
- Graphic and supervisor functional design to be submitted to BEL representative for comment and approval
- All BMS points to tagged as 'Haystack' together with a created 'Bruntwood tagging palette' to be submitted to BEL representative for comment and approval
- All alarm descriptors to be clearly defined and submitted to BEL representative for comment and approval
- All HVAC control devices (valve and damper actuators) to have position feedback via end switch or potentiometer

Environmental Performance Assessment

The specification shall be read in conjunction with the latest version of the BREEAM Environmental pre assessment to ensure that any credits targeted applicable to the design of this system are achieved. The specification shall also be read in conjunction with the "Bruntwoods Guide to Net Zero Carbon in Operation" guide and the "Stage 3 MEP report" to ensure all energy targets are met as part of the project

Part L Building Regulation Compliance:

The Contractor shall ensure that prior to the final selection and order of any mechanical or electrical equipment they refer to the "Stage 3 MEP Report" and "Bruntwoods Guide to Net Zero Carbon in Operation" guide to ensure that the minimum equipment efficiencies as listed are achieved or bettered. As a bare minimum these will be as defined within the current edition of the Non-Domestic Compliance guide, but will typically exceed these values so must be checked.

Where variations or value engineering recognises equipment efficiency or control strategy changes that are potentially detrimental to the Part L compliance outcome, the Contractor must review and make the necessary enhancements to other areas of the proposed design in order to maintain a compliant project with respect to Part L at completion. Where applicable any equipment and strategy change must also be reviewed against any design stage BREEAM pre-assessment credits.

The Contractor shall be responsible for undertaking the EPC at completion of the project.

System Features Configuration

Trend logs shall be extended to record/display all analogue inputs and calculated flows and totals.

Archives shall be extended to record the daily total for every new energy and utility monitoring meter.

Degree days shall be calculated from the outside temperature input and trend logged.

Following a mains power failure, the plant at the MCP shall start in a sequenced manner with time delays incorporated so as to limit the total surge in demand.

The controls specialist shall undertake all programming of controller/controllers using a CAD package that provides both the data files for the controllers & the end documentation at the same time. This shall ensure that documentation is available by the time of commissioning.

The CAD package shall provide a "What You See Is What You Get" result thus ensuring accuracy between drawings & controller data file.

Points Schedule

The controls specialist shall provide a points schedule showing each proposed connected point to the system. The points shall be arranged as schedules showing the points allocated on a plant by plant basis, the controller specification(s) selected, I/O capacity supplied and the spare I/O available for future use. The controls specialist shall be responsible for ensuring the correct allocation of points required for meeting the performance specification.

The controls specialist shall provide a schedule of field devices, cross-referenced to the points schedule and showing the total number and specification of the device to be supplied. It shall show the manufacturer, model, range, accuracy, flow characteristics, working, operating and static pressure ranges, all as applicable to the transducer or actuator. The controls specialist shall be responsible for the correct output and positioning for sensors.

OEM Supplied Controllers

Where controllers are supplied as dedicated controllers and mounted within OEM supplied packaged plant (A/C Units, AHU's, Fan Coils etc.). The controls specialist shall complete all the necessary work to connect into the networks, commission the communications and provide the necessary displays. The controls specialist shall not change any pre-configuration of the OEM supplied control/monitoring strategies without written permission of the unit manufacturer. OEM suppliers will supply the colour displays for their equipment and all supporting documentation for inclusion in the O&M manuals.

Demonstration & Training

The Contractor shall demonstrate the operation and general maintenance requirements of all the mechanical services systems. The demonstrations shall be conducted by suitably qualified representatives from the specialist controls supplier and the appropriate specialist equipment supplier and shall include information packs which shall be made available at the demonstrations. The demonstrations shall be arranged with the Project Manager. The Contractor should allow for a full days demonstration for two facilities operatives from the clients team.

BUILDING MANAGEMENT SYSTEM (BMS)

System Capabilities

The building management system must comprise intelligent stand alone controllers not requiring an external device for any automatic control and monitoring function, i.e. it must be possible to install a controller as a direct replacement to an analogue dedicated device such as a compensator, time switch etc.

Peer to peer communications are to be utilised. All devices connected to the hardwired communication network must have equal access to the network and be capable of sending messages directly to, and receiving messages directly from any device on the system without the need of any external message handling hardware. The use of token, master/slave and other forms of communications are not acceptable.

Each controller shall be capable of being configured locally and at a system supervisor. All configuration facilities must be accessible to the client once suitable training has been provided, no part of the software system being hidden. The use of blown PROMs and non-configurable strategy is not permitted.

The system must be capable of supporting a remote A4 size printer. The printer shall be capable of recording all out-of-hours critical and system alarms and print the event type, time and date along with text commands for action when alarms are re-transmitted by an engineer's terminal. An audible alarm with reset button to silence shall be provided.

The system shall be capable of sending alpha-numeric alarms automatically to mobile phone devices of the facilities team.

The system shall be capable of sending critical alarms on a time of day and day of the week basis to the mobile phone devices without the need of manual intervention.

The system shall be capable of remote access via the PSTN from other supervisors and from laptop PCs utilising dedicated software provided by the system manufacturer.

There should be no practical limit to the number and type of controllers, modems, printers, display panels and supervisors which can be connected to the system.

The Data Monitoring and Analysis facility mentioned above shall be provided and accessible from quick selection routes set up from the head display page of an engineers supervisor. The application shall be capable of being set up to monitor inputs from each of the electricity and utilities meters connected to the system. The analysis section inputs shall be set up with tariffs, constants and formulae as agreed with the

engineer so that the total cost of the energy services can be ascertained on a weekly, 4-4-5 week period and annual basis.

Safety of Equipment

The controls specialist shall ensure that all data communications equipment is designed, installed and commissioned in accordance with BS EN 60950.

The controls specialist shall ensure that all monitoring system equipment is compatible, will not adversely affect any other equipment installed in the same location and ensure all monitoring system equipment meets the requirements of BS EN 60 950, BS EN 55 022, BS 6667 Part 1, BS EN 60 801 2, BS EN 55 014 and BS 7671 (IEE Wiring Regulations).

Fire Alarm

The fire detection and alarm system will, when activated, give an input signal to the BMS that the fire alarm has activated. The BMS shall:

Bring up a screen message and/or print out the fire alarm status. This is to advise users of the reason for plant and equipment stopping and that they may need to reset some items once the situation is over.

Give directly to the motor control panel(s), not via the BMS, a signal via volt-free contact(s) in the MCP, to stop all plant and equipment powered from that panel.

The Contractor must ensure that a facility to override this function is provided during fire alarm testing, generally this will be provided via a key switch at the fire alarm panel.

Start/Stop Control

The software routines shall be capable of starting and stopping plant as scheduled.

Included shall be any specific requirements for 'off' position or status of plant items, valves and dampers etc.

Standby plant shall operate automatically on failure of duty plant, unless specified otherwise elsewhere in this specification. The outstations shall report plant failure alarms to the central operator facility.

The outstation shall be capable of alternating the lead plant where duty and standby equipment is installed. Ensure this can be achieved both by an operator command and/ or on a time scheduled basis.

The operator shall have the option to override any start/stop action programmed within the outstations. When reverting to normal automatic control, ensure that the original programme is automatically reinstated and updated to the correct time.

Delayed plant starting facilities shall be available at outstations to reduce power surges with plant starting sequentially by adjusting the delay period for each item.

The operator shall have the facility to specify minimum on/off cycle times and maximum number of starts per hour.

Plant Protection During Shut down

A plant protection routine shall be included to enable the operator to select and automatically run items of plant (such as pumps etc) for short periods during out of season shut down. The run periods shall be adjustable by the operator.

The plant protection routines shall be overridden by the normal seasonal sequence of plant operation.

Duty Cycle Control

Multiple plants or drives which are arranged in duty and standby configuration, shall be duty cycled by the BMS via software commands conducted at the central operator facility.

Duty and Standby components shall changeover on operator command or on a timed basis. The duty cycle method shall be selectable by the operator.

A duty selection register shall be maintained at the central operator facility to ensure that on initial or plant restart, (power failure or restoration) the selected duty plant attempts to re-start first and the standby remains in-operable unless required due to duty plant failure.

The duty cycle register shall be available for viewing by the operator, presented as a screen dynamic graphic, with the facility to switch and select duty and standby plant items.

The duty cycle register shall also be available as a text file that can be printed on a selected printer. The printed register shall contain the time and date as well as all duty and standby plant status, etc.

Sequence Control

Sequence control routines shall be included to automatically sequence the operation of plant by monitoring load parameters and efficiently match the plant to the load, with the facility to programme different automatic sequences of control.

The operator shall have the facility to override the automatic sequence and programme an alternative sequence.

Set point values for each control action shall be variable and adjustable by the operator.

An operator adjustment shall be included in routines for switching control differentials to prevent short cycling. When the maximum number of start/ stop cycles for a particular plant is reached ensure routines automatically modify it's schedule, eg:

- by rotating standby equipment
- or changing the lead machine.

The facility to operate all plant ancillaries associated with sequence control shall be included. The facility shall be available to proceed with the defined sequence when one of the items of plant in the sequence is isolated, or fails to operate, unless the safety requirements dictate otherwise. On restoration of electrical supplies after the consequences of power failure or restoration of the normal supplies, all plant under the control of the BMS shall be sequentially started by the central supervisory software.

Weather Compensation Control

Weather compensation routines shall be provided to control the heating system in relation to external weather conditions and shall include optimum start. The operator shall have the option to adjust temperature and flow rate settings for the heating system to re-define the weather compensation.

Automatic adjustment to the weather compensation shall be by comparing measured and required space temperatures with the outside conditions and correcting the compensation where a significant difference between the two space temperatures occurs. Ensuring abrupt changes in the heating system performance or space temperature do not adversely affect the automatic adaptive compensation process.

A single weather compensation curve shall be used for each zone irrespective of the number of temperature sensors provided in that zone.

The routines shall respond to the reset signals arranged to achieve boost, night set back and heat pump safety.

Frost Protection

Frost protection routines shall be included to operate plant and pumps in order to protect buildings services systems and their components from frost damage:

When outside air temperature falls to operator set minimum frost protection temperature, start selected pumps and establish circulation through the pipework systems and their components.

Ensure operator can pre-select which plant is to be started and that automatic standby plant operates on failure of duty plant.

When system temperature falls below operator pre-set minimum, initiate the full frost protection facility:

For heating systems, turn on and operate the heat source to maintain return flow temperature above the pre-set minimum.

For other liquid systems, activate specified protective routines.

Fire Control

The BMS shall interface with all fire systems. The Fire Alarm system will shut down plant via switchboard, MCP or plant control panel, as appropriate, not via the BMS. The BMS will automatically "re-set", to re-start plant in the appropriate and scheduled manner once the Fire Alarm system has given the "all clear". Otherwise the interface is for monitoring only to give information at the central operator facility. The BMS shall not input to the fire systems, except where so described in this specification.

A facility to override this shut down should be available to facilitate weekly testing of the fire alarm system.

Communication

General

Two way data communications shall be provided between the various stations (outstations or operator facilities) within the BMS. Facilities shall be included at each station to allow both the automatic establishment of data communications with the other stations within the BMS and the ability to exchange data.

The BMS network shall be structured to respect the need to report alarms and events within an acceptable time from occurrence in the field (input to plant controller) to being displayed on the monitor and printed on the appropriate printer.

The BMS specialist shall state in his Tender Submission the maximum time for this to happen.

Network Arrangement

The BMS communication shall be by a Site Wide Network (LAN or WAN) that encompasses all aspects of the control and monitoring requirements.

The prime function of the BMS is to control all the mechanical services plant and components. As a secondary function, the BMS shall monitor selected sub-system items, e.g. utility fuel consumption. The BMS network shall consist of a high level network, encompassing the central operator facility, that communicates, through network controllers, with multiple networks that connect to plant controllers.

Network Components

The site-wide network shall link all networks, via the network controllers, to the system servers and the central operator facility and shall include all bridges and other network devices that are required to permit the network to operate in a safe and efficient manner. Fibre-optic cables may be used throughout this network if appropriate. The network shall be based on Industry - Standard transport media and protocols. The networks shall link the network controllers to the plant controllers.

The actual number of building networks and the number of network controllers shall be determined by the following factors:

- Plant physical location.
- The number of plant controllers connected to the network.
- Spare capacity for possible additional plant controllers on each network.
- The required speed of response for control and monitoring functions e.g. the need to ensure a fast response to plant alarms being reported to the workstations.

Stand Alone Operation

Connect sensors and actuators associated with primary control loops for any one item of plant to a single outstation such that a communication failure between outstations does not adversely affect the operation of the plant.

On failure of an outstation, or loss of its power supply, ensure plant or devices under its control are set to a safe/predetermined condition as:

- The schedule of actions on BMS failure.
- Detailed plant operational requirements.

Plant shall start and stop in normal operation, including any specific requirements for 'off' position or status of plant items, valves, dampers etc., according to the sequences detailed in the schedules and in the plant operational requirements. Where no sequence is detailed, ensure plant starts and stops in a safe manner with due regard to electrical and mechanical constraints.

The control panels shall be manufactured from stout gauge sheet metal suitably finished to an approved BS colour in stove enamel to Form 2 specification. The panels shall be fitted with lockable hinged doors with a door interlocked isolator.

Each Form 2 control panel shall be divided vertically into two compartments:

- a) Power and motor control (LV) with door interlocked isolator and key lock,
- b) Control (ELV) with key lock.

Each control panel shall to be IP rated to suit the location where it is located.

The panel fascia shall contain all selector switches, indicator lamps, override switches etc., each being clearly labelled.

The BMS shall specifically monitor, control and operate the following plant items as described in the paragraphs below :

2. Water supply systems linked to BMMS: Items to be monitored by the BMS system shall include :
 - The Tenant water meters meeting the requirements of current Building Regulations.
 - Temperature monitoring and logging of storage vessels for both the hot water and cold water to allow the client to perform his weekly Legionella checks in compliance with HSE ACOP L8.
 - High / Low Level monitoring of water storage tanks with alarm links.
 - Pump enable and time control of all water service pumps (Circulation etc.)
 - Pump differential pressure switches for flow fail indication on all water service pumps.
 - Remote hot water circulation temperature monitoring (allow three remote points) and logging for HSE ACOP L8 monitoring.
 - A fault alarm shall be monitored from the booster set control panel unit.
 - Integration of ASHP within BMS
 - 2 port ASHP control valve
 - High limit shut off to PHX
3. Fire fighting systems linked to BMS:

Items to be monitored by the BMS system shall include :

 - Fault monitoring of the fire alarm systems, BMS to shut down in the event of fire.
 - Fault monitoring of the AOV's in the stair cores
 - Fault monitoring of the sprinkler control system
 - Fault monitoring of the car park smoke extract fans
4. Heating systems linked to BMMS: Items to be monitored by the BMS system shall include :
 - Optimisation/time control (on non 24 hour circuits).
 - Heat exchanger Sequence, temperature control and alarms
 - Heat exchanger run time and energy monitoring
 - Pressurisation unit control and alarms
 - Safety control
 - Pump control with auto change over
 - Water flow failure control of all pump units
 - 2 stage Frost protection
 - Room temperature / zone control and modulation of all sub circuit zone valves.
 - Monitor and trend logging of all heat meters
 - Buffer Vessel temperatures
 - Circuit temperature monitoring as defined on system drawings.
 - Modulation / monitor of all terminal unit or coil mounted control valves.
 - Air Source Heat Pumps
5. Ventilation systems linked to BMS: Items to be monitored by the BMS system shall include :
 - Air set point control.
 - Control of all MVHR/AHU coils via air temperature monitoring.
 - Include frost protection of all MVHR/AHU coils
 - Provide and monitor frequency inverters for all fans.
 - Demand based ventilation controls
 - Fireman's override switch to be integrated into the main fire alarm panel for ventilation override.
 - Include for rain sensors and for automatic opening of stair smoke clearance devices to prevent overheating.
 - Provide local room controllers.
 - Provide face and bypass damper control for cross-plate type recuperators based on exhaust and external air conditions to maximise heat recovery effectiveness.
 - Air flow failure control and indication.
 - Dirty filter indication.
 - Heat recovery control and status.
 - Room air temperature & humidity monitoring.
 - Fan coil units shall include high level alarms on drip trays
 - CO₂ levels within spaces to provided demand controlled ventilation
 - VAV damper setpoints
6. Air conditioning systems linked to BMMS: Items to be monitored by the BMS system shall include :

- Hybrid VRF and Split DX systems
- Fault indication and alarm
- interface with central controller
- provide variable flow based on demands from sensors
- filter dirty conditions

System performance

Ss_75_70_54/210 Design

1. Design: Complete the design of the building monitoring and management system.
2. Standards
 - 2.1. Communications network: To BS EN 50174-1.
 - 2.2. Communications protocol: To BS EN ISO 16484-5.
 - 2.3. Documentation of plant and application specific functions: To BS EN ISO 16484-3.
3. Requirements: Submit proposal including detailed design drawings, technical information, calculations and manufacturers' literature.

Ss_75_70_54/215 Meter data

1. Software functions: Acceptance of data from other sources;
Automatic production of routine reports;
Comprehensive input of tariff definitions;
Display of additional electrical data such as power factor, frequency, reactive power;
Historical analysis of energy consumptions;
Immediate warning of exceptions, such as parameters exceeding preset limits;
Instant access on demand to data from individual meters;
Retrieval, checking and collation of metered data;
and Review of data in flexible format, allowing comparison between different time periods and meter locations.

System completion

Ss_75_70_54/810 Inspection and testing

1. Standard: To BS 7671.
2. Notice before commencing tests (minimum): 1 week.
3. Certificates
 - 3.1. Submission: On completion.
 - 3.2. Number of copies: 2.
4. Test equipment identity: Record on test certificates.
5. Certificates of calibration: Submit for each test instrument.
6. Control panel test certificates
 - 6.1. Submission: On completion.
 - 6.2. Number of copies: 2.

Ss_75_70_54/820 Commissioning

1. General: Commission in accordance with BSRIAAG 9/2001 and BCIAS start up and commissioning guide.

Ss_75_70_54/830 Documentation

1. Operation and maintenance instructions
 - 1.1. Scope: Submit giving optimum settings for controls.
 - 1.2. Product information: Include product description, date of purchase, performance characteristics, application (suitability for use), method of operation and control, and cleaning and maintenance requirements.
 - 1.3. Format: Paper copy.

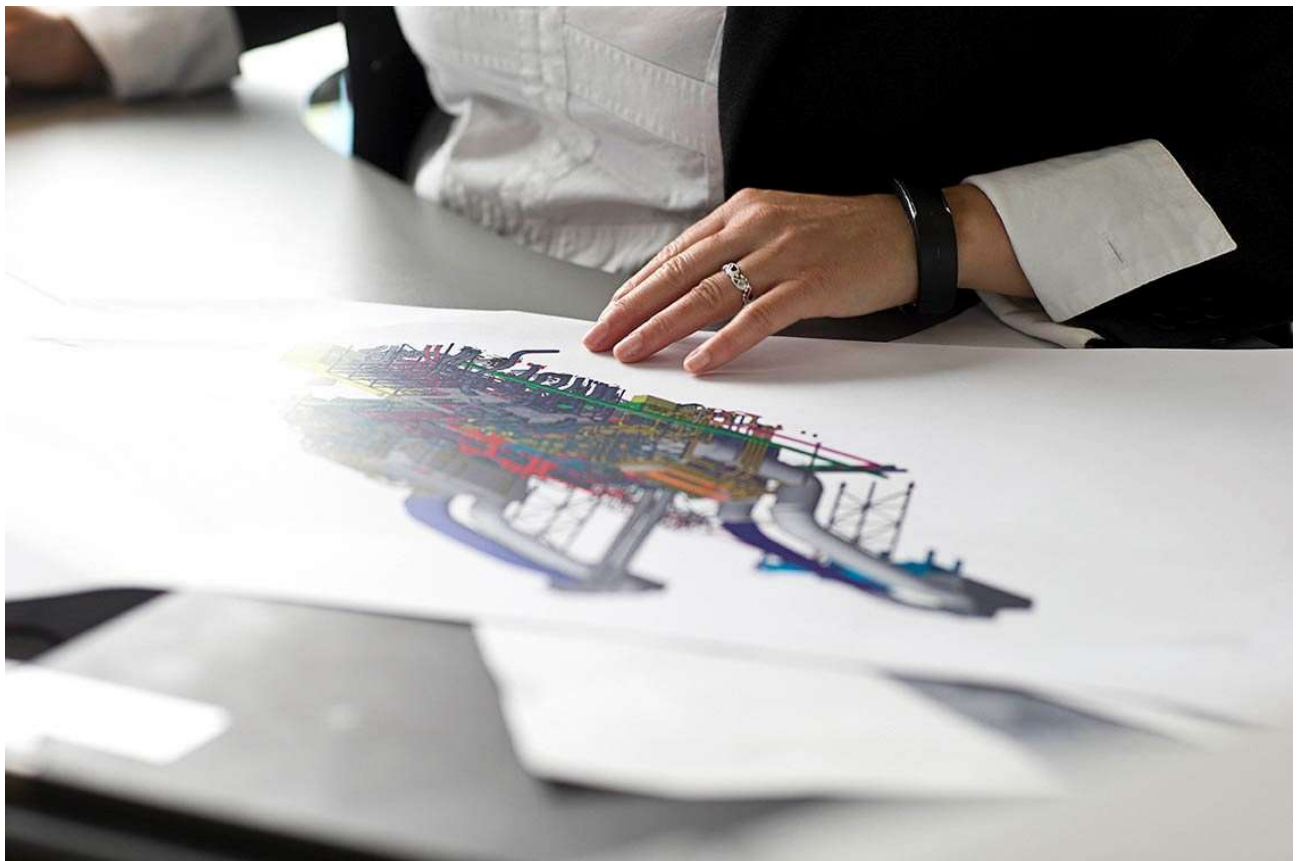
- 1.4. Number of copies: Two.
2. Record drawings
 - 2.1. Content: For all controls cabling, the cable origin, circuit designation, route, conductor material and insulation type and colour, number of cores per cable, number of cables in ducts, on tray or ladder and Location of control panels, equipment and repeater panels.
 - 2.2. Format: A1 paper print and Electronic.
 - 2.3. Number of copies: Two.
3. Cable schedules
 - 3.1. Location: Contractor's choice .
 - 3.2. Format: Contractor's choice .
 - 3.3. Size: Contractor's choice .
 - 3.4. Contents: Contractor's choice .
4. Submittal date: At handover.

Ω End of System

Intended for
Bruntwood
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Specification
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Pall Mall Court - Stage 3 MEP

Electrical Performance Specification



Pall Mall Court - Stage 3 MEP Specification

Pall Mall Court MEP Performance Specification

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Ss_70_30_25_25 Earthing and bonding systems

Systems

Ss_70_30_25_25 Earthing and bonding systems

1. Description: **Contractors Responsibilities:**

The Contractor shall develop the tender design to completion, supply, install, co-ordinate with other contractors, test, commission and set to work the complete earthing and bonding system. This shall include all necessary tools, labour, materials and equipment required to provide a complete working installation that fully meets the functional and performance criteria specified within this specification.

The Contractor shall include for provision of maintenance to the system, seasonal commissioning activities and rectification as required by the Contract and the Mechanical & Electrical Specification.

Function / Objectives:

A complete and fully operational building earthing and bonding system installation shall be provided.

Applicable Standards:

In addition to this specification, the earthing and bonding installation shall comply with the following standards and guidelines current at the time of tender:

- Building Regulations
- British Standards
- CIBSE Guides & Notes
- Electricity Safety, Quality and Continuity Regulations 2002
- Electrical Supply Regulations 1992
- Requirements of the health and safety executive under the health and safety at work act
- Electricity at Work Regulations 1989

Any discrepancies identified by the contractor between the specification and the above documents shall be brought to the attention of the CA immediately.

System Description:

The Contractor shall supply, install, test and commission the earthing in accordance with this specification, earthing drawings, applicable standards, and the project specific documentation listed above.

The system shall facilitate for the transfer of electrical current to earth to protect personnel, buildings, structure, plant and equipment in the case of an electrical fault within the supply system and from interference from electro-magnetic fields and electrostatic forces.

The Earthing system will be installed in accordance with the requirements of BS7671, 'Requirements for Electrical Installations' and BS 7430 'Earthing'.

The earthing and equipotential bonding system will provide protection against electric shock due to indirect contact by preventing the occurrence of a voltage of such magnitude and duration between simultaneously accessible conductive parts that danger could arise.

Copper earth bars shall be provided within the following:

- All LV switchrooms
- Generator plant rooms
- Mechanical plant rooms
- Electrical riser cupboards
- MER, server, comms rooms

The earth bars shall be wall mounted using insulation type mountings. Earth bars shall be arranged with a spare capacity of 50% to allow for connection of future equipment at a later date.

The Earth Bar(s) should have removable test links to allow for testing without interference with Earthing conductor connections.

All earth bars shall be 50 x 6mm copper (Not tinned).

Sub-main and final circuit cables will use circuit protective conductors to distribute earth connections throughout the installation.

High-integrity earthing shall be provided where appropriate within the installation.

Supplementary bonding will be provided where required to meet the requirements of BS 7671.

The switchgear earth bars, main incoming utility services, lightning protection system, mechanical pipework, cable containment systems, lift guide rails and any other extraneous conductive parts are to be connected to the main earthing terminal.

All internal earthing cables of sizes indicated shall be sheathed with a green/yellow LSOH over sheath. Main earthing conductors and connections shall be clearly labelled with traffolyte labels adjacent to the main earth bar.

The size of the earthing and bonding conductors shall be as prescribed by BS 7671 or the supply authority, whichever is the greater. Bonding connections shall be made to structural steelwork, major metallic services i.e. gas, water, compressed air, heating, ductwork, sprinkler system etc., and lightning protection.

Supplementary bonding shall also be carried out where bonded services have insulated sections or inserts such as flexible ductwork connections to plant, antivibration inserts of insulating material etc.

The bonding / supplementary bonding shall be carried out in accordance with the I.E.T Regulations BS 7671.

For other locations referred to in BS 7671 as "special locations" e.g. swimming pools, hot air saunas, construction sites, agricultural and horticultural premises, restrictive conductive locations, I.T. installations, electrical installations in caravan parks, electrical installations in marinas, highway power supplies and street furniture, the Contractor shall observe the requirements of BS 7671.

The Contractor shall provide a warning notice at each earthing and bonding connection point as required by BS 7671.

Provide a permanent label durably marked in letters 4.75mm minimum height "SAFETY ELECTRICAL CONNECTION - DO NOT REMOVE", in visible position, at each bonding conductor connection to extraneous conductive parts.

Allow provision to enable testing of the earth system to be carried out in accordance with the requirements for electrical installations BS 7671.

Drawings:

See all relevant drawings in the drawing issue sheet.

Schematics:

See all relevant drawings in the drawing issue sheet.

2. System performance: To provide a complete and fully operational building earthing and bonding system installation.
3. Main incoming earth: Establish with the Electricity Distributor.
4. Main earth electrode type: Establish with the Electricity Distributor.
5. Main protective bonding conductors: [Pr_65_70_48_75 Single-core non-sheathed \(LHSF\) insulated cables Type A](#)
6. Supplementary bonding conductors: [Pr_65_70_48_75 Single-core non-sheathed \(LHSF\) insulated cables Type B](#)
7. Circuit protective conductors: Cable armour and auxiliary.
8. Earth terminal type: [Pr_65_70_46_24 Earth bars](#) and Distribution Network Operators earth terminal block.
9. Accessories: [Pr_65_70_12_04 Anti-vandal cable guards](#);
[Pr_65_70_46_29 Earthing clamps](#);
and [Pr_65_70_46_80 Soil conditioning conductive agents](#).
10. Electrical identification: [Pr_40_10_27_27 Electrical shock treatment signs](#);
[Pr_40_10_27_24 Electrical diagrams](#);
and [Pr_40_10_57_29 Equipment labels and warning notices type B](#).

11. Execution: [Ss_70_30_25/630 General installation](#);
[Ss_70_30_25/640 Installing earth conductor joints and connections](#)
[Ss_70_30_25/650 Installing surface barriers around earth rods](#)
[Ss_70_30_25/660 Installing earthing conductor](#);
[Ss_70_30_25/670 Installing main protective bonding conductors](#)
[Ss_70_30_25/680 Installing supplementary bonding conductors](#)
[Ss_70_30_25/690 Dissimilar metals](#);
[Ss_70_30_25/720 Notices and labels](#);
[Ss_70_30_25/730 Installing functional earthing conductors](#);
12. System completion: [Ss_70_30_25/810 Inspection and testing](#) and [Ss_70_30_25/820 Documentation](#).

Products

[Pr_40_10_27_24](#) Electrical diagrams

Shared by: [Ss_70_30_80_35 Hardwired voltage small power systems](#) and [Ss_70_30_45_45 Low-voltage distribution systems](#)

1. Description:
2. Material: Paper print, encapsulated.
3. Format: Single line engineering drawings to BS EN 61082-1.
4. Information to be included: Supply characteristics;
Maximum demand;
Cable types and sizes;
Switchgear ratings;
Protective device types, ratings and function;
Prospective fault current values at each item of switchgear;
Earth fault loop impedance values at each item of switchgear;
and Circuits containing equipment vulnerable to testing.
5. Size: A1.

[Pr_40_10_27_27](#) Electrical shock treatment signs

Shared by: [Ss_70_30_80_35 Hardwired voltage small power systems](#) , [Ss_70_30_45_45 Low-voltage distribution systems](#) and [Ss_70_80_33_35 Hardwired general lighting systems](#)

1. Description:
2. Manufacturer: Contractor's choice and they shall submit proposals to the contract administrator for review.
3. Format: Plastics encapsulated.
4. Content: Text and images.
5. Size: Submit proposals .
6. Geometric shape: Submit proposals .
7. Colours: Full colour.

[Pr_40_10_57_29](#) Equipment labels and warning notices type B

Shared by: [Ss_70_30_80_35 Hardwired voltage small power systems](#) , [Ss_70_30_45_45 Low-voltage distribution systems](#) , [Ss_70_80_33_35 Hardwired general lighting systems](#) and [Ss_75_50_45_45 Lightning protection systems](#)

1. Description:
2. Manufacturer:
3. Material: Face engraved rigid plastic laminate.
4. Label size: To suit the specific label and warning notice requirements and in accordance with British Standards.
5. Colour
 - 5.1. Background: White.
 - 5.2. Lettering: Black.
6. Typography
 - 6.1. Font: Font shall be fully legible.
 - 6.2. Size: Size of lettering shall be appropriate so that the label is fully legible.

7. Notice wording: All notice wording shall be carried out by the contractor in accordance with the project requirements. Include equipment reference and name.

Pr_65_70_12_04 Anti-vandal cable guards

Shared by: [Ss_75_50_45_45 Lightning protection systems](#)

1. Description:
2. Manufacturer: Furse or equal and approved.
3. Material: Galvanized steel. Suitable corrosion protection shall be provided.
4. Diameter: The anti-vandal capping shall be off suitable size to protect the system.
5. Colour: To match the building material
6. Execution: [Pr_65_70_12/745 Installing anti-vandal capping.](#)

Pr_65_70_46_24 Earth bars

1. Description:
2. Manufacturer: Furse or equal and approved.
3. Material
 - 3.1. Bar type: Hard drawn copper to BS EN 13601.
 - 3.2. Finish: Bare.
 - 3.3. Support: PVC-U.
4. Size
 - 4.1. Profile: 50 mm x 6 mm.
 - 4.2. Length: To suit the project requirements plus minimum 25% spare capacity.
5. Predrilled connections (minimum): To suit the project requirements plus minimum 25% spare capacity.
6. Disconnecting links: To suit the requirements and a minimum of one shall be provided.
7. Execution: [Pr_65_70_46/610 Installing earth bars.](#)

Pr_65_70_46_29 Earthing clamps

1. Description:
2. Manufacturer: Furse or equal and approved.
3. Standard: To BS 951.
4. Material: Metallic dry conditions and Metallic non-corrosive.
5. Pipe diameter (minimum): 30 mm.
6. Cable capacity (minimum): 2 x 16 mm² conductors.

Pr_65_70_46_80 Soil conditioning conductive agents

Shared by: [Ss_75_50_45_45 Lightning protection systems](#)

1. Description:
2. Manufacturer: The contractor shall supply the soil conditioning agent in accordance with the lightning protection / earthing specialist recommendations.
3. Standard: To BS EN IEC 62561-7
4. Material: Bentonite and Marconite TM.
5. Format: Granules;
Native aggregate;
Powder;
and Premixed with cement.
6. Execution: [Pr_65_70_46/670 Installing soil conditioning agents.](#)

Pr_65_70_48_75 Single-core non-sheathed (LHSF) insulated cables Type A

1. Standards: To BS EN 50525-1 and BS EN 50525-3-41.
2. Execution:

Pr_65_70_48_75 Single-core non-sheathed (LHSF) insulated cables Type B

1. Standards: To BS EN 50525-1 and BS EN 50525-3-41.

2. Execution:

Execution

Pr_65_70_12/745 Installing anti-vandal capping

1. Position: Provide between finished ground level and 3 m high.

Pr_65_70_46/610 Installing earth bars

1. Standards: In accordance with BS 7671 and BS 7430 and To BS EN 50522 and in accordance with BS 7430.
2. Main earth bar location: Next to the incoming electricity point of supply and Next to the main switchboard.
3. Multiple earth bars: Connect with a conductor ring.
4. Mounting
 - 4.1. Orientation: Horizontal.
 - 4.2. Spacers: Ceramic.
 - 4.3. Support spacing (maximum): 300 mm for 25 mm bar, and 450 mm for 50 mm bar.
 - 4.4. Clearance between wall and earth bar (minimum): 30 mm.

Pr_65_70_46/670 Installing soil conditioning agents

1. Position: As per contractors installation information.

Ss_70_30_25/630 General installation

1. Standards: In accordance with BS 7430 and BS 7671.

Ss_70_30_25/640 Installing earth conductor joints and connections

1. Number of joints: Minimize.
2. Contact surfaces: Clean. Coat with corrosion inhibitor.
3. Bimetallic joints: Do not cross-contaminate.
4. Protection to joints and connections: Apply heat shrink clear sheathing.
5. Connections to test points: Clamp.
6. Copper tape jointing
 - 6.1. Type: Phosphor bronze clamps, nuts, bolts and washers and Exothermic weld.
 - 6.2. Copper tape overlap (minimum): 100 mm.
7. Protective cable terminations: Compression lugs with phosphor bronze nuts, bolts and washers.

Ss_70_30_25/650 Installing surface barriers around earth rods

1. Non-conducting barriers: Install to prevent personnel or livestock contact with the ground within 2 m of earth rods.
2. Location and design: As per contractors installation drawings.

Ss_70_30_25/660 Installing earthing conductor

1. Conductor location: Install between the main incoming earth and the main earthing terminal in one continuous length.
2. Connection: Make with compression lugs and phosphor bronze nuts and bolts and spring washers.
3. Earthing conductor route: The contractor shall Submit proposals as part of the installation design.
4. Connection to earth electrodes: Heavy duty copper alloy mechanical clamps.
5. Protection to earthing conductor: Rigid conduit.

Ss_70_30_25/670 Installing main protective bonding conductors

1. Separate and continuous connections: Install between each service and the main earth terminal.
2. Bonding conductor routes: The contractor shall Submit proposals as part of the installation design.
3. Bonding connections at main earth terminal: Connect with compression lugs and phosphor bronze nuts and bolts and spring washers.

Ss_70_30_25/680 Installing supplementary bonding conductors

1. Earth connections: Connect with compression lugs.

Ss_70_30_25/690 Dissimilar metals

1. Connecting dissimilar metals: Prevent electrolytic action.

Ss_70_30_25/720 Notices and labels

1. Earth bars: Describe each connection and label with 'SAFETY ELECTRICAL CONNECTION – DO NOT REMOVE'.
2. Earthing and main protective bonding connections: Describe each connection and label with 'SAFETY ELECTRICAL CONNECTION – DO NOT REMOVE'.
3. Supplementary bonding connections: Describe each connection and label with 'SAFETY ELECTRICAL CONNECTION – DO NOT REMOVE'.
4. Telecommunications functional earth connections: Label with 'TELECOMMS EARTH – DO NOT REMOVE'.
5. Earth free locations: For areas utilizing protection by earth-free local equipotential bonding label with 'THE PROTECTIVE BONDING CONDUCTORS ASSOCIATED WITH THE ELECTRICAL INSTALLATION IN THIS LOCATION MUST NOT BE CONNECTED TO EARTH – EQUIPMENT HAVING EXPOSED-CONDUCTIVE-PARTS CONNECTED TO EARTH MUST NOT BE BROUGHT INTO THIS LOCATION'.

Ss_70_30_25/730 Installing functional earthing conductors

1. Standards: To BS 6701 and in accordance with BS 7671.
2. Labelling: Cable sheath continuously marked with the words 'TELECOMS FUNCTIONAL EARTH' with a label at the CMET connection stating 'TELECOMMS EARTH – DO NOT REMOVE' and Cable sheath green/yellow with a label at all connection points stating 'SAFETY/ TELECOMMS EARTH – DO NOT REMOVE'.

System completion

Ss_70_30_25/810 Inspection and testing

1. Standards: In accordance with BS 7430 and BS 7671.
2. Notice before commencing tests (minimum): 24 h.
3. Continuity of protective conductors
 - 3.1. Parallel earth paths: Isolate before testing.
 - 3.2. Equipment: Continuity tester with short circuit current not less than 200 mA, and a no load d.c. or a.c. voltage between 4 V and 24 V.
4. External earth fault loop impedance (Z_e): Direct measurement.
5. Earth fault loop impedance (Z_s): Calculate from measurement of the sum of the resistance of the phase conductor and the resistance of the circuit protective conductor and Direct measurement.

Ss_70_30_25/820 Documentation

1. Operating and maintenance instructions
 - 1.1. Scope: The contractor shall provide a complete operation & maintenance manual and instructions for all systems and equipment within the project. The information shall be collated in a user friendly format.
 - 1.2. Product information: Include product description, date of purchase, performance characteristics, application (suitability for use), method of operation and control, and cleaning and maintenance requirements.
 - 1.3. Format: Electronic and Paper copy.
 - 1.4. Number of copies: Two.
2. Record drawings
 - 2.1. Content: Location and arrangement of plant in plant rooms; Location, size and route of earth electrodes; and Location of earth terminals.
 - 2.2. Format: Full size paper print drawing and Electronic drawing.
 - 2.3. Number of copies: Two.
3. Submittal date: Four weeks before handover.

Ω End of System

Ss_70_30_45_40

Low-voltage site connection systems

Systems

Ss_70_30_45_40 Low-voltage site connection systems

1. Description: **Contractor's Responsibilities:**

The Contractor shall develop the tender design to completion, supply, install, co-ordinate with other contractors, test, commission and set to work the complete Incoming LV supply system. This shall include all necessary tools, labour, materials and equipment required to provide a complete working installation that fully meets the functional and performance criteria specified within this specification.

The Contractor shall include for provision of maintenance to the system, commissioning activities and rectification as required by the Contract and the Mechanical & Electrical Specification.

Function/Objectives:

To provide an incoming LV supply, as indicated on the LV schematic and the electrical layout drawings.

Applicable Standards:

In addition to this specification, the LV supply installation shall comply with the following standards and guidelines current at the time of tender:

- Building Regulations
- British Standards
- The requirements of the local Building Control Authority
- Relevant HSE Guidance
- Relevant DNO Guidance and requirement documentation
- BSRIA Standards & Guidance notes
- CIBSE Guides & Notes
- The IET Guidance Notes & On Site Guide
- Client specific standards and documentation

Any discrepancies identified by the contractor between the specification and the above documents shall be brought to the attention of the CA immediately.

System Description:

The incoming electrical supply to the building, shall be provided by an IDNO (Independent Distribution Network Operator) via a new on-site substation which shall be provided under the contract. A quotation has been produced by Ameen Utilities Engineering for a new transformer to be installed at ground level on Marsden street, adjacent to the existing car park entry ramp.

Three number supplies have been quoted:

- Office Block; 1700kVA, terminated in to a new switch board located at basement level.
- Pavilion (restaurant); 300kVA, terminated in to a heavy duty cut-out in the same room as the office block supply.
- Pall Mall Medical; 122kVA, which is an independent connection from the local LV network, to supply the existing tenant independently of the larger building. The new supply will be terminated in to a new 200A cut-out located within the existing tenants switch room.

The incoming electrical supply for the office block shall consist of an LV cabling connection with the point of connection being at the outgoing terminals of the circuit protection within the IDNO substation.

The IDNO shall supply, install and commission a new transformer with the capacity of 2000kVA on Marsden St.

Supply and installation of the LV supply cables from the IDNO substation to the LV switch board shall be undertaken by the Contractor.

The LV cabling shall be routed from the IDNO sub-station to the new LV switch board on cable ladder located on the upper car park level as indicated on the layout drawings. This cable route shall be fully protected with a Dura steel removable enclose to provide fire protection, this is because these cable's provide power for life safety loads throughout the building.

The contractor shall verify the proposed LV supply cable configuration and cable terminations with the IDNO prior to procurement. The contractor shall liaise with the IDNO project engineer.

The electrical meter shall be located in the LV switchroom located within the basement level.

The electrical supply meter shall be provided by the energy provider and the contractor shall coordinate the installation of the meter by the energy provider. The details of the energy provider shall be confirmed by the client.

The Main Contractor shall be responsible for the procurement of a low voltage electricity supply in order to serve the development.

This shall be generally as per quotes which have been provided, however, the Main Contractor may choose to appoint a specialist approved Contractor to carry out the 'contestable' elements of the works.

Works by IDNO:

The IDNO will detail design, supply, install and test a HV supply for the development. The supply point shall be as indicated on the site services layouts.

Works by Contractor:

The Contractor shall be responsible for the following works that relate to the LV supply and associated equipment:

- a) Liaison with the IDNO to determine the size and type of protection and earthing arrangement proposed as well as the expected prospective fault current.
- b) Supply, design, installation and testing of the LV cabling from the circuit protection within the IDNO substation to the Clients installation within the LV switchroom.
- c) Supply, installation and testing of all electrical services required in IDNO sub-station to IDNO requirements/specification.
- d) The Contractor shall carry out a load assessment for the site which shall be based on the most up to date information available at the time. The results of the assessment shall be used to determine the ASC (Authorised Supply Capacity) used in the application to the IDNO. The load assessment shall be reviewed and if necessary revised once the detailed design has been completed.
- e) Contractor shall also request the electrical characteristics from the IDNO. When this information becomes available the calculations will need to be reviewed by the contractor, this might mean that the cable sizes and protective devices will need to be modified. This will be the contractors responsibility to check and re-design if applicable.

Works by Main Contractor:

The Main Contractor shall liaise with the IDNO to obtain details of the required builder's work, structural requirements, fabric and envelope requirements, access requirements and earthing requirements.

The Main Contractor shall liaise with the Contractor to obtain details of the required builder's work in order to install the LV main distribution cables.

The Main Contractor shall arrange a detailed application with the IDNO and arrange supply and installation of LV meters with Clients preferred supplier.

The order and commencement of this element of works shall be undertaken, by the Contractor, as early as possible. The Contractor shall ensure that the "power on date" is included within the construction program.

Refer to the General Conditions specification for provision of temporary services and supplies.

Drawings:

See all relevant drawings in the drawing issue sheet.

Schematics:

See all relevant drawings in the drawing issue sheet.

2. System performance: [Ss_70_30_45/210 Design of incoming low voltage electricity supply](#)
3. Nature of current: Alternating.
4. Phase: Three phase 4 wire.
5. Voltage: 400 V.
6. Electricity distributor: Electricity North West.
7. Electricity supplier:
8. Metering: Seperate Landlord / Tenant
9. Execution: [Ss_70_30_45/610 Removing and permanent isolation](#); [Ss_70_30_45/620 Temporary isolation of existing supply](#); [Ss_70_30_45/630 Management of electricity distributor Type A](#); [Ss_70_30_45/640 Location of incoming point of supply Type A](#); [Ss_70_30_45/660 Earthing arrangement Type A](#)
10. System completion:

System performance

[Ss_70_30_45/210](#) Design of incoming low voltage electricity supply

1. Standards: In accordance with BS 7671 and the Electricity Distributor's guidelines.
2. Design: Complete the design of the low voltage supply.
3. Requirement:
4. Evidence of agreement with Electricity Distributor: Submit.

Execution

[Ss_70_30_45/610](#) Removing and permanent isolation

1. Scope: Remove complete installation including service cut out, metering equipment and service cable, to site boundary.
2. Existing low voltage supply: Engage the Electricity Distributor to isolate and disconnect.
3. Point of isolation:
4. Written evidence of isolation:

[Ss_70_30_45/620](#) Temporary isolation of existing supply

1. Existing low voltage supply: Engage the Electricity Distributor to isolate and disconnect.
2. Point of isolation:
3. Written evidence of isolation:
4. Reinstatement: Submit proposals.

[Ss_70_30_45/630](#) Management of electricity distributor Type A

1. Establishing the supply: Manage and liaise with the Electricity Distributor to establish an incoming electricity supply.
2. Evidence of liaison: Submit.

[Ss_70_30_45/640](#) Location of incoming point of supply Type A

1. Incoming point of supply: Coordinate the location and establish the spatial requirements for the Electricity Distributor's equipment and metering.
2. Location and colour coding of equipment: In accordance with NJUG guidelines on the positioning of underground apparatus for new development sites. Volume 2.

[Ss_70_30_45/660](#) Earthing arrangement Type A

1. Incoming earthing arrangement: Establish with the Electricity Distributor.

Ω End of System

Ss_70_30_45_45

Low-voltage distribution systems

Systems

Ss_70_30_45_45 Low-voltage distribution systems

1. Description:

Contractors Responsibilities:

The Contractor shall develop the tender design to completion, supply, install, co-ordinate with other contractors, test, commission and set to work the complete low voltage distribution system. This shall include all necessary tools, labour, materials and equipment required to provide a complete working installation that fully meets the functional and performance criteria specified within this specification.

The Contractor shall include for provision of maintenance to the system, seasonal commissioning activities and rectification as required by the Contract and the Mechanical & Electrical Specification.

Function / Objectives:

A complete and fully operational low voltage distribution system installation shall be provided.

Applicable Standards:

In addition to this specification, the low voltage distribution installation shall comply with the following standards and guidelines current at the time of tender :

- Building Regulations
- British Standards
- CIBSE Guides & Notes
- Electricity Safety, Quality and Continuity Regulations
- Electrical Supply Regulations
- Requirements of the health and safety executive under the health and safety at work act
- Electricity at Work Regulations
- Health Technical Memoranda

Any discrepancies identified by the contractor between the specification and the above documents shall be brought to the attention of the CA immediately.

Part L Building Regulation Compliance:

The Contractor shall ensure that prior to the final selection and order of any mechanical or electrical equipment they refer to the "As Designed" Part L2 modelling report to ensure that the minimum equipment efficiencies as listed are achieved or bettered. As a bare minimum these will be as defined within the current edition of the Non Domestic Compliance guide, but will typically exceed these values so must be checked.

Where variations or value engineering recognises equipment efficiency or control strategy changes that are potentially detrimental to the anticipated Part L2 compliance outcome, the Contractor must review and make the necessary enhancements to other areas of the proposed design in order to maintain a compliant project with respect to Part L at completion.

System Description

The contractor shall supply, install, test, commission and set to work the complete Low Voltage distribution system.

The contractor shall confirm the above electrical characteristics with the network operator and undertake any on-site electrical testing, as required. Where the finalised values vary from the above the contractor shall confirm the design proposals via cable calculation which might mean the cable sizes and protective devices will need to be modified. The contractor shall include for all costs as necessary within this tender for any modifications required in order to provide a compliant installation.

The main LV supply cabling shall be provided by the contractor and routed from the point of connection and terminate within the main LV switchboard MDB/1.

MDB/1

The main LV switchboard (MDB/1) shall be provided as BS EN 61439 Form 4b Type 6 board.

This type of switchboard is arranged so that cable connections can be made whilst the panel is energised.

The short circuit current of the LV switchgear shall be 65kA for 1 second.

The main incoming device to MDB/1 shall be an ACB (Air Circuit Breaker). This shall be of the withdraw-able type units which allow for quick replacement without the need for any wiring modifications in the event of failure. Outgoing devices will be a mix of ACB's and MCCB's (Moulded Case Circuit Breaker). As shown on the LV schematic.

The contractor shall coordinate with the IDNO to obtain the IDNO's protection settings and shall ensure discrimination is achieved between the IDNO ACB and the whole building distribution system.

LV switchboard MDB/2 shall be supplied from MDB/1 via a 5 core aluminium power busbar (Eaton XPS2).

MDB/2

MDB/2 is the retained existing BS88 switchboard located in the existing switch room in the basement of the building. The existing switchboard is to be serviced, tested, re-commissioned and warranted by Eaton. There is an existing 2000A bus-coupler, which is to be removed and the bus-bar connection linked out.

Existing outgoing ways are to be re-used as shown on the LV schematic.

Additional and spare ways are to be created as part of the works by Eaton as shown on the LV schematic.

New metering devices have been shown on the LV schematic, the preference is for these new meters to be installed within the cubicle door of the devices they are associated with. If this is not possible the contractor shall provide a proposal for a workable alternative.

The contractor shall provide 9No. spare fuses of every size and type of fuse installed within the switchboard, these shall be located in a new powder coated steel wall mounted enclosure within the switchroom.

MDB/R1

LV switchboard MDB/R1 shall be supplied from MDB/1 and shall be provided as BS EN 61439 Form 4b Type 6 board.

LV switchboard MDB/R1 shall be supplied from MDB/1 via a 5 core aluminium power busbar (Eaton XPS2).

This switchboard shall house 6No. 250A rated panel assemblies, this is to provide approximately 36No. 32A TPN and 63A TPN supplies for mechanical equipment located on the roof of the tower.

LSMDB/1, LSMDB/2, LSMDB/R1 & LSMDB/R2

LV life safety switchboards supplied from MDB/1 and the life safety generator shall be provided as BS EN 61439 Form 4b Type 6 board, as shown on the LV schematic.

LSMDB/1 & LSMDB/R1, are the primary life safety switchboards located in LV switch room at basement and roof level of the building.

LSMDB/2 & LSMDB/R2, are the secondary life safety switchboards located in LV switch room at basement and roof level of the building.

Both primary and secondary switchboards shall be separated by 2hr fire rated enclosures as detailed by BS 8519.

The outgoing circuit protective devices on the LV switchboards (except for MDB/2) shall be Moulded Case Circuit Breakers (MCCB) complete with electronic trip units. The electronic trips shall be complete with adjustable trip settings. Refer to the LV schematic.

The overall height of switchboards, cubicles and enclosures for electrical apparatus shall be determined by the individual switchroom and the termination requirements of the incoming and outgoing ways. Operating handles shall be located so that the limits of operation shall be within the limits of 0.6 m and 1.8 m above floor level. Relays, instruments, indications, locking devices and door handles shall be placed not higher than 1.8 m and not less than 0.45 m above floor level.

All new switchboards shall be located on 100mm high (minimum) house keeping pads. Please note switchboard plinths will not be accepted in lieu of house keeping pads.

Building services LV sub-main cables will emanate from the above switchboards to a series of strategically positioned miniature circuit breaker distribution boards and final fixed equipment e.g. lifts, fire alarm panel and mechanical equipment etc. Refer to the LV schematics and layout drawings for further details.

Provision within the switchboards has been made for the future installation of power quality equipment such as Power Factor Correction/Active Harmonic Filtration. The contractor shall ensure that all required CT's are installed complete with shorting links to enable future fit out of power quality equipment.

Labelling

Label each section of the switchboard using multilayer engraved labels with a white face and black lettering. Text shall be 6mm high uppercase text. Affix the labels to the switchboard sections using Allen headed bolts with suitable ni-lock nuts at the rear complete with washer. The contractor shall ensure that these bolts do not affect the clearances required within the boards.

Labels shall be provided to identify the functions of the main components.

General

Generally, LV sub-main cable installations for non-life safety systems will be Multicore armoured cables XLPE/SWA/LS0H.

Where indicated on the cable schedule large supplies will utilize single core Alu armoured Cu core cables arranged in a trefoil arrangement. Cables shall be fixed to cable ladder or cable tray with all round metal bands to maintain a constant trefoil arrangement for the full route of the cable.

The outer sheath insulation materials shall be low smoke zero Halogen which shall be provided as the environment dictates. Specific cabling types are provided on the drawings and distribution board schedules.

Cables supplying life safety systems will where required by code be PH120 fire rated and typically FP600S type armoured cables will be utilized.

All circuit protective devices have been sized to accommodate the anticipated loads and fault currents.

The main and sub mains distribution equipment shall be as manufactured by an approved supplier and shall be consistent within the building.

Cable and cable support systems will be secured to the building fabric in a manner that shall allow easy access for the installation of additional future cables.

Wiring systems in all areas shall be supported such that they will not be liable to premature collapse in the event of fire, as detailed in BS 8519.

Switchboards

All cabinet enclosed switchgear, measurement, control and signalling equipment shall be suitable for continuous operation under the climatic conditions prevailing at the installation site. On completion of commissioning, the cubicles shall contain at least 25% of fully fitted spare terminal capacity and 25% spare useable space for future installation. It shall be possible to replace indicating lamps on the front panels of cubicle feeders and motor supply outlets without isolating the equipment concerned. Furthermore, the control system shall be designed in such a way that the lamps shall be operated at less than their rated voltage in order to prevent overheating.

The Contractor shall ensure maximum dimensions of each transportable section of switchboard does

not exceed values which are limited by the access to the LV switchroom, and in accordance with the typical general arrangements shown on the drawings.

The switchboard shall be provided with: -

- Provide each section with at least 4 removable lifting eyes.
- Fit lifting handles to each bolted access cover.
- Provide anchoring studs on switchboard to support covers.
- Ensure doors are removable and have corrosion resistant hinges.
- Restrict equipment mounted on doors to: instruments, control switches and switch operating handles.

The switchboard shall be constructed to allow each section to be divided into compartments on a modular basis, to ensure future alterations and/or additions of equipment within the switchboard can be accomplished without difficulty.

Paint finish of the switchboard shall be generally as the manufacturer's normal standard, with the exception of the fire alarm supply device which shall be coloured red.

Constructed of extruded welded side frames and bolted panels.

Cover = 1.0mm thick Zintec steel.

Sides = 1.5mm thick Zintec steel.

Final Distribution boards

The Contractor shall, supply and install at various locations throughout the building distribution boards.

Single / Three phase and neutral miniature circuit breaker boards of the size and type to suit the design loads. All miniature circuit breaker boards are to be equipped with on load isolation switches, hinged lockable lid and the MCB's detailed in the distribution board schedules. 6 No. spare keys shall be provided for each lock. These shall be handed to the contract administrator and a signature obtained.

The distribution board circuit reference chart shall be typed and contained within a plastic protective wallet. The Contractor shall allow for securely fixing these charts on the inside of the hinged lockable front cover to the distribution board.

A traffolyte label is to be fitted to the distribution board giving the distribution board reference, the earth loop impedance reading and short circuit fault current rating. A sample of the label is to be submitted to the contract administrator for approval prior to fixing.

All labelling, circuit references shall be in accordance with the Client's requirements and a full schedule of proposed labels issued for comment prior to manufacture.

Life Safety Generator

The Contractor shall be responsible for the supply, works testing, wiring and transportation to site in position to the design drawings, carriage / craneage on-site to final locations, installation, testing, commissioning and setting to work of the Generator Installation to support the emergency and standby capability.

The scope of works relating to the generator is summarised as:

The generator shall be installed with a removable acoustic enclosure to limit generator noise level to a maximum of 85dBA.

The Generator shall have a day tank accommodated within the generator plant room.

The engine shall have an electric starting system, complete with a starter motor, heavy-duty engine starting batteries and a charging system. The starter batteries shall be provided with local ON load isolator within the Generator plant room.

The generator engine lube oil system shall be designed to store, pump and control the pressure, temperature and cleanliness of the oil, which provides lubrication to all moving parts of the engine. The system shall have sufficient capacity to allow continuous / unlimited operation for a period of no less than 8 hours.

The engine shall be located on a concrete house keeping pad with anti-vibration isolators.

Local control panel, for the engine located within the plantroom, CPU for control of all local engine functions.

Interface with the Energy Management System.

The Generator is to be provided with a Day Tank sized to allow 8 hours operation + 6 months of fuel for maintenance testing.

Fuel will be delivered in to the service yard at the rear of the building, the contractor shall provide a remove fill point at this location.

The generator exhaust shall be sized by the generator specialist and shall consist of a dual wall stainless steel exhaust from the generator room to the roof termination.

A residential rated silencer shall be provided to limit the engine noise.

Generator systems full factory acceptance testing with allowance for attendance by four Client / Consultant Engineers – to include all accommodation, travel and subsistence.

Full on-site commissioning and load tests using temporary load banks at site for testing.

Full black building testing shall be carried out at the commissioning stage which will be witness tested by the client, engineer and building control / fire officer.

As part of the Tender the Contractor shall provide full details of consumable spare parts and recommended on-site spares holding for a twenty four month period.

Sub Meters

Multi-function energy meters shall also be provided to meet the requirements of Part L of the Building Regulations.

Energy sub metering will be provided to facilitate effective monitoring of energy consumption as part of an overall site energy management strategy in accordance with the requirements within The Building Regulations Part L and in accordance with TM39.

It is proposed that multi-functional digital type sub-meters are provided which can monitor and record kWh, kVA, Volts, Amps, PF and max demand, as a minimum.

Sub-meters will be linked to the BMS system using a protocol in compliance with IEC 61580 to facilitate data collection and remote monitoring on and off site.

A sub-metered supply shall be provided for the lettable units. These meters shall be MID approved to enable billing to the tenant by the landlord.

This system will assist the facilities management staff to advise on areas where power consumption appears excessive, assist in fault monitoring, manage power quality, and control the power network efficiently.

Sub-meters will generally be mounted within individual switchboards and distribution boards. Meters will be of the Smart Meter type with Modbus output and kWh information shall be transmitted to the BMS.

Final circuits supplying mechanical loads in both landlord and tenancy areas, shall have an addition of a wireless energy sensor rated at 63A, it shall monitor the following parameters, active energy, total and partial (kWh), ph/ph and ph/n Voltage (V), current per phase (A), total active power and active power per phase (W) and power factor with Class 1 measurement accuracy of energy and current, and class 0.5 of voltage. The output of this system will be Modbus TCP/IP.

Surge Suppression

Surge protection will be provided as an integral component on the main switchboard in accordance with the type stipulated with the BS EN 62305 Lightning Protection Risk Assessment.

Electronic Surge Protection shall be provided within the main switchboard and be protected by an outgoing MCCB within the board. The surge protection devices shall be provided with status indication lamps which are to be placed in a position visible without removing covers.

The transient over-voltage protection must: -

Protect all modes (i.e. phase(s) to neutral, phases(s) to phase and neutral to earth). Have a full status indication with lights to show full protection, pre-failure and failure. The unit shall be modular and withdrawable for ease of replacement should the need arise. The Contractor shall provide a complete and functioning system, complete with full documentation, full warranty and client training/instruction upon completion of the project.

Combined Type 1, 2 and 3 surge protection shall be provided on individual circuit cabling and control cabling when routed externally i.e. fire alarm network cabling, CCTV camera power/control cabling and external lighting.

Sub Main Cable Distribution

Cables shall generally be routed via the main containment routes. Care shall be taken to install cables on all tray and ladder work in a neat and orderly manner and to minimise the number of crossovers.

Care shall be taken to ensure that all sub-mains cables are supported along their entire length. Cables dropping from tray to switchboards(s) below shall be supported over their entire length by uni-strut or similar framing system.

The Contractor shall allow for the removal of gland plates on all switchboards, motor control centres etc. and any other package plant for the drilling of such plates to accept cable glands.

Cable cleats should be of the correct diameter/size of the cables being fixed. All cables shall be terminated using brass compression glands.

When terminating on to distribution boards, gland plates etc the Contractor shall bond from an earthing stud to the cable gland and earthing ring to the distribution board casing and also cross bond onto the distribution board earth bar using LSZH/CU conductors of at least half of the CSA of the cable phase conductors. All cables shall be terminated using cable glands of the correct type and size.

Single core aluminium armoured cables shall be glanded in to an aluminium gland plate.

All cable cores shall be ferruled before connection. All cables shall be marked at each end using universal carrier strip (e.g. Critchley). The cable markers description shall be agreed in schedule form with the contract administrator prior to installations.

Containment

The Contractor shall supply and install a system of containment through the buildings, adopting suitable routes to suit the final cabling design arrangement.

A network of galvanised steel cable ladders, trays, baskets and trunking / conduit shall be supplied and installed throughout the building to separately support cables for LV power, general lighting and power, fire alarm and emergency lighting, security, communications and mechanical plant controls.

Cable containment will NOT be accepted if installed upside down.

Where cables are run vertically, they shall be fixed to the cable ladder or cable tray with metal cleats and shall snake there way up the building, long lengths of straight vertical cables will not be accepted.

Stainless steel 316L grade containment shall be provided in external areas. This shall include all components of the containment system including the uni-strut bracketry and threaded rods.

Cable ladder shall be heavy duty.

Cable tray shall be medium duty return flange.

Fire alarm cabling shall be contained on a dedicated cable tray system.

The cable containment will generally be routed horizontally suspended from the soffit, suspended within ceiling voids and vertically within designated service risers.

All cable containment shall be supported by galvanized steel screwed rod and Unistrut, with Unistrut and rod end caps fitted. Please note gripple wire will NOT be accepted to support cable containment systems.

Care shall be taken to provide supports for the tray at intervals that do not exceed 1200mm and a maximum deflection of 25mm between supports and fully co-ordinate with the building structure,

pipes, accessories and fixings/supports and will accommodate for loads from future additional cabling.

The containment heights will be shown to minimise bending radii on cables where dropping to equipment yet not compromising other services or structural building elements.

All non-sheathed cables along their entire length shall be installed to an IP4X degree of protection in accordance with BS EN 60529, BS7671 Section 521.10.1.

In general, each element of containment shall accommodate 20% spare capacity.

All containment shall be fixed securely to the building fabric, steel work and secondary steelwork shall be provided by the contractor. All steelwork connections shall be by clamped connections only.

Service penetrations shall be co-ordinated to avoid primary structural elements. All penetrations shall be sealed to meet the required fire rating requirements where applicable.

Fire stopping shall be provided where services pass through fire-rated walls or partitions, as determined by the fire strategy. The fire stopping provided shall be equal to the rating of the partition in which it occurs. In addition, to enhance property protection and to minimise noise transference, fire stopping shall be provided all round services where they pass through floor plates.

The cable containment system shall be continuous throughout and cabling shall be mechanically protected to the final equipment termination point.

All conduit boxes shall be complete with rubber gaskets.

Conduits shall be finished galvanised class 3, except in positions exposed to water (other than water in construction), steam condensation or the action of weather, where hot dipped galvanised conduits to class 4 shall be used. Insulated conduits, where required, shall be heavy gauge and high impact. All conduit boxes and couplings draw-in boxes shall be of the same manufacture and quality as the conduit.

PVC coated steel flexible conduits shall be used for the final connection from a rigid conduit installation, to the terminal boxes of all equipment provided with a means of positional adjustment and/or where vibration may reasonably be expected to occur.

All conduit runs and routes are not shown on the drawings and it shall be the Contractors responsibility to supply and install all the conduit networks as necessary to connect from trunkings, baskets, distribution boards, equipment cabinets etc, to provide a fully enclosed wiring system to all accessories, luminaires and outlets etc. this shall include conduit systems for specialist contractors e.g. BMS.

All metalwork, cable trays, cable ladders, cable trunking and equipment shall be equipotential bonded. The cable trays, cable ladders and cable trunking shall be jointed in a manner so that electrical continuity is maintained, (copper bonding links or earth straps are the preferred method) and connected to the earthing system.

It will be noted that the positions of all points and equipment shown on the tender drawings are approximate only and are for the guidance in the preparation of this tender.

The Contractor will include for the determination on site of the finalised position of all points and equipment.

The Contractor must obtain from site all information available that is likely to affect the installations of any section of the works. Any points installed before such consultation become the Contractor's responsibly and the cost of any subsequent alteration will be borne by the Contractor.

Bus-Bar Systems

Distribution

Two new distribution bus-bar system shall be provided to supply switchboards MDB/2 and MDB/R1 from MDB/1.

Each bus-bar shall be aluminium frame, c/w 5 aluminium 100% sized cores.

Each bus-bar shall be terminated directly in to the switchboard with a flange connection, the height and arrangement of each switchboard will be determined with this connection in mind.

There shall be no tap-off's in distribution bus-bars.

Fire barriers sections shall be provided for each fire wall / structure identified on the fire engineering drawings.

Rising Bus-Bars

The existing Eaton (MEM) rising bus-bars located in the 3N. vertical risers shall be retained. The contractor shall employ the manufacturer to service, make any necessary repairs, test, re-commission and warranty the retained bus-bars.

New sub-main cables to supply each bus-bar shall be provided as shown on the LV schematic.

New tap-off units shall be provided for every tap-off shown on the LV schematic.

Sub-main cables connected to tap-off units shall be independently supported, the weight of the sub-main cable shall not be taken by the tap-off unit.

Underfloor Bus-Bars

In office areas 63A clean earth power track bus-bar systems shall be provided as shown on the low level LV System drawings.

Each length of power track shall be supplied from a 63A type C MCB, within the local distribution board.

Tap-off units shall be un-fused and supplied with a suitable length cable to supply the relevant floor box.

Each floor box shall incorporate a 32A RCBO to provide protection for the 2No. twin sockets in each floor box.

Commissioning

The contractor shall allow within their tendered costs the full commissioning of all the LV switchgear and electrical installation in accordance with this specification.

The Client representative shall be given due opportunity and notice to witness this commissioning. The contractor shall inform the engineer of the commencement of commissioning at least two weeks in advance.

Drawings:

See all relevant drawings in the drawing issue sheet

2. System performance: [Ss_70_30_45/211 Design of low voltage distribution systems](#)
[Ss_70_30_45/215 Low voltage distribution circuit cables generally](#)
[Ss_70_30_45/221 Selection of conduit, trunking and ducting;](#)
[Ss_70_30_45/231 Input power supply characteristics;](#)
3. Connection to low-voltage supply: Refer to LV Schematic for the proposed point of connection. The contractor shall coordinate the connection of the low voltage supply with the service provider.
4. Switchgear: [Pr_60_70_22_22 Distribution boards;](#)
[Pr_60_70_22_19 Cubicle switchboards;](#)
[Pr_60_70_48_44 Low-voltage fuse-switch disconnectors;](#)
[Pr_60_70_48_47 Low-voltage switch disconnectors type A;](#)
[Pr_60_70_22_11 Cable distribution cabinets and](#)
[Pr_75_51_52_15 Control and protective switching devices](#)
5. Protective devices : MCCBs with electronic trip units
6. Distribution circuit cabling: [Pr_60_70_48_66 Power busbar trunking;](#)
[Pr_65_70_48_90 Thermosetting insulated and thermoplastic sheathed \(LSHF\) armoured cables;](#)
[Pr_65_70_48_88 Thermosetting insulated armoured fire-resistant \(LSHF\) cables.](#)
[Pr_65_70_48_29 Fire-resistant screened \(LSHF\) cables](#)
7. Cable accessories: [Pr_65_70_11_13 Cable cleats;](#)
[Pr_65_70_11_15 Cable ties;](#)
[90-55-10/320 Cable bands;](#)
8. Containment: [Pr_65_70_11_19 Channel cable supports;](#)
[Pr_65_70_11_12 Cable baskets;](#)
[Pr_65_70_11_17 Cable trays;](#)

- Pr_65_70_11_71 Rigid conduit;
- Pr_65_70_11_14 Cable ladders;
- Pr_65_70_11_30 Flexible conduit and
- Pr_65_70_11_63 Pliable conduit
- 9. Containment accessories: Pr_20_29_03_83 Stainless steel chemical anchor rods;
Pr_20_29_03_84 Stainless steel chemical anchor sockets;
Pr_65_70_11_20 Conduit fittings;
Pr_25_80_81_42 Intumescent linear gap seals
- 10. Rewireable installation: Required.
- 11. Concealed installation: Required.
- 12. Monitoring and metering: Pr_80_51_51_19 Current transformers;
Pr_80_51_51_22 Digital metering equipment;
and Pr_65_72_27_74 Residual current monitors.
- 13. Power conditioning equipment: Pr_65_72_27_50 Mains power supply transient overvoltage suppression devices.
- 14. Accessories: Pr_60_70_48_07 Busbar trunking feed units;
Pr_60_70_48_08 Busbar trunking fire barrier units;
- 15. Electrical identification: Pr_40_10_27_27 Electrical shock treatment signs;
Pr_40_10_27_24 Electrical diagrams;
and Pr_40_10_57_29 Equipment labels and warning notices type B.
- 16. Execution: Ss_70_30_45/650 Connection to the incoming supply and Ss_70_30_45/625 Installing low voltage distribution systems. Ss_70_30_45/605 Factory inspections
- 17. System completion: Ss_70_30_45/811 Inspecting, testing and commissioning of switchgear generally;
Ss_70_30_45/831 Spares and consumables;
Ss_70_30_45/821 Documentation;
Ss_70_30_45/813 Inspecting, testing and commissioning harmonic filters;
and Ss_70_30_45/840 Maintenance.

System performance

Ss_70_30_45/211 Design of low voltage distribution systems

1. System designer: The contractor shall be responsible to develop the design of the system to the installation stage level of detail.
2. Design: Complete the design of the low voltage distribution system.
3. Standard: In accordance with BS 7671.
4. Provision of low-voltage distribution: Provide electrical supplies to equipment requiring power.
5. Spare capacity throughout the low-voltage distribution system: 20% of current carrying capacity.
6. Requirement: Submit proposals including detailed design drawings, technical information, calculations and manufacturers' literature.

Ss_70_30_45/215 Low voltage distribution circuit cables generally

1. Proposed selection of low-voltage distribution cables: Submit drawings, technical information, calculations and manufacturers' literature.
2. Conductor sizes (minimum): Refer to the LV Schematic.
3. Cable sizes not stated: Submit proposals including technical information, calculations and manufacturers' literature.
4. Format: Amtech.

Ss_70_30_45/221 Selection of conduit, trunking and ducting

1. Standard: In accordance with BS 7671.
2. Requirement: Submit proposals including technical information, calculations and manufacturers' literature.
3. Conduit, trunking and ducting sizes not stated: Submit.

Ss_70_30_45/231 Input power supply characteristics

1. Supply impedance: The contractor shall confirm the impedance during the construction stage. The contractor shall undertake their own calculation using proprietary software if the actual values vary from the impedance assumptions used at design stage. The contractor shall include all alteration works to achieve a compliant installation.

2. Supply Fault Current: The contractor shall confirm the fault current during the construction stage. The contractor shall undertake their own calculation using proprietary software if the actual values vary from the fault current assumptions used at design stage. The contractor shall include all alteration works to achieve a compliant installation.
3. Earthing type: To be confirmed by the installation contractor and in accordance with utility service provider.
4. Nominal voltage: Single phase 230 V a.c. +10%, -6% and Three phase 400 V a.c. +10%, -6%.
5. Nominal frequency: 50 Hz.
6. Type of protective device in the input supply circuit: The contractor shall confirm the circuit protective device with the service provider during the construction stage. The contractor shall undertake their own calculation using proprietary software if the actual values vary from the fault current assumptions used at design stage. The contractor shall include all alteration works to achieve a compliant installation.

Products

90-55-10/320 Cable bands

1. Manufacturer: Thorsman or equal and approved.
2. Material: Perforated steel bands.
3. Protective covering: LSHF.

90-75-75/310 Padlocks and keys

1. Manufacturer: ABUS or equal and approved.
2. Locking mechanism: Five lever
3. Material: Steel
4. Padlock identification: Stamp padlock describing its function.
5. Execution: .

Pr_20_29_03_83 Stainless steel chemical anchor rods

Shared by: [Ss_75_50_28_29 Fire detection and alarm systems](#) , [Ss_70_30_80_35 Hardwired voltage small power systems](#) , [Ss_70_80_33_35 Hardwired general lighting systems](#) , [Ss_75_10_21_21 Data distribution systems](#) and [Ss_75_40_02_11 Card access control systems](#)

1. Description:
2. Manufacturer: To be provided by cable channel support manufacturer
3. Certification: Where a European Assessment Document (EAD) or European Technical Assessment Guideline (ETAG) is available, provide a European Technical Assessment (ETA) with CE marking and a Declaration of Performance (DoP). Otherwise provide third party certification by a United Kingdom Accreditation Service (UKAS)-approved independent laboratory.
4. Head arrangement: Nut and washer.
5. End arrangement: Flat.
6. Steel grade: A2 to BS EN ISO 3506-1 and A4 to BS EN ISO 3506-1.
7. Size
 - 7.1. Thread diameter: To suit the fixing requirements.
 - 7.2. Length: To suit the fixing requirements.
8. Execution: [Pr_20_29_03/611 Fixing anchors using cartridge-applied adhesive](#) and [Pr_20_29_03/620 Fixing anchors using chemical anchor capsules](#).

Pr_20_29_03_84 Stainless steel chemical anchor sockets

Shared by: [Ss_75_10_21_21 Data distribution systems](#) and [Ss_75_40_02_11 Card access control systems](#)

1. Description:
2. Manufacturer: To be provided by cable channel support manufacturer
3. Certification: Where a European Assessment Document (EAD) or European Technical Assessment Guideline (ETAG) is available, provide a European Technical Assessment (ETA) with CE marking and a Declaration of Performance (DoP). Otherwise provide third party certification by a United Kingdom Accreditation Service (UKAS)-approved independent laboratory.
4. Steel grade: A2 to BS EN ISO 3506-1 and A4 to BS EN ISO 3506-1.
5. Size

- 5.1. Thread diameter: To suit the fixing requirements.
- 5.2. Length: To suit the fixing requirements.
6. Safe working load (minimum): To suit the fixing requirements.
7. Accessories: Threaded lifting loop and Threaded swivel lifting eye.
8. Execution: [Pr_20_29_03/611 Fixing anchors using cartridge-applied adhesive](#) and [Pr_20_29_03/620 Fixing anchors using chemical anchor capsules](#).

Pr_25_80_81_42 Intumescent linear gap seals

Shared by: [Ss_75_10_21_21 Data distribution systems](#) and [Ss_75_40_02_11 Card access control systems](#)

1. Description:
2. Manufacturer: Envirograf or equal and approved.
3. Standard: In accordance with BS 476-22 and BS EN 1363-1. Fire rating duration shall meet the same fire rating of the compartment.
4. Third party certification: LPCB approved.
5. Size: To suit size of fire rated opening.
6. Fixing: Self-adhesive.
7. Execution: [Pr_65_70_11/700 Installing conduit, trunking and ducting](#).

See [Pr_40_10_27_24 Electrical diagrams](#) in [Ss_70_30_25_25 Earthing and bonding systems](#)

See [Pr_40_10_27_27 Electrical shock treatment signs](#) in [Ss_70_30_25_25 Earthing and bonding systems](#)

See [Pr_40_10_57_29 Equipment labels and warning notices type B](#) in [Ss_70_30_25_25 Earthing and bonding systems](#)

Pr_60_70_22_11 Cable distribution cabinets

1. Description:
2. Manufacturer: Lucy Zodion or equal and approved.
3. Standards: To BS EN 61439-1 and BS EN 61439-5.
4. Third-party certification: ASTA Type test certification.
5. Rated operational voltage (Ue): 250 V and 415 V a.c.
6. Rated operational frequency: 50 Hz.
7. Number of phases: Single and Three.
8. Incoming device: [Pr_60_70_48_47 Low-voltage switch disconnectors type A](#);
As circuit schedules;
and [Pr_60_70_48_47 Low-voltage switch disconnectors type B](#).
9. Outgoing devices
 - 9.1. Type: Refer to distribution board schedules.

Miniature circuit breakers and Residual current circuit breakers with integral overcurrent protection.
 - 9.2. Quantity: Refer to distribution board schedules.
10. Busbars and connections
 - 10.1. Type: Fully shrouded.
 - 10.2. Rated operational current (Ie): 125A and 250A generally. Refer to distribution board schedules.
 - 10.3. Rated short-time withstand current (Icw) for 1 s: Rated short-time withstand current of up to 35kA
11. Neutral and earth bars: Individual terminal for each outgoing circuit.
12. Spare ways: Refer to distribution board schedules. At least 25% spare capacity shall be provided.
13. Identification: Label L, N and E cable terminations with push on plastic markers identifying circuit reference.
14. Spare outgoing devices: Two of each size and rating used mounted within cabinet.
15. Enclosure
 - 15.1. Ingress protection (minimum): To BS EN 60529, IP65.
 - 15.2. Impact protection (minimum): To BS EN 62262, IK10.

- 15.3. Dimensions: The feeder pillar shall be capable of housing all proposed equipment and cabling. Full access shall be provided to allow for easy maintenance.
- 15.4. Material: Glass reinforced plastics and Stainless steel.
- 15.5. Finish: Externally polyester powder coated.
- 15.6. Colour: Colour to be agreed with contract administrator and architect.
- 15.7. Doors: Double;
Single;
Flexible earthing conductor between main earth terminal and pillar door;
Internally hinged with padlock loop;
and Two tri-head locks.
- 15.8. Backboard: A wooden backboard shall be provided.
16. Accessories: Anti-condensation heater and thermostat and Internal lighting.
17. Execution: [Pr_60_70_22/665 Installing switchgear generally](#).

[Pr_60_70_22_19](#) Cubicle switchboards

1. Description: Sb-15
2. Manufacturer: Schneider or equal and approved.
3. Standards: To BS EN 60439-1.
4. Third-party certification: Full manufacturer type tests IEC 60439-1 / IEC 61439-2. Provide certificates of verification.
5. External design type: Cubicle.
6. Rated operational voltage (Ue): 415 V a.c.
7. Incoming device: [Pr_65_72_27_53 Moulded case circuit breakers](#) and [Pr_65_72_27_02 Air circuit breakers](#).
8. Outgoing devices
 - 8.1. Type: [Pr_65_72_27_53 Moulded case circuit breakers](#).
 - 8.2. Quantity: As LV Schematic
9. Busbar and connections
 - 9.1. Rated operational current (Ie): Refer to the LV Schematic.
 - 9.2. Rated short-time withstand current (Icw) for 1 s: 50 kA.
10. Terminals: Suitable for the connection of copper and aluminium conductors.
11. Full length internal copper earth bar: Required.
12. Spare ways: Fit with blank plates. 20%, subject to a minimum of 3 spare ways
13. Enclosure
 - 13.1. Dimensions:
 - 13.2. Ingress protection (minimum): To suit the location and environmental conditions in accordance with BS EN 60529.
 - 13.3. Impact protection (minimum): To suit the location and environmental conditions in accordance with BS EN 60529.
 - 13.4. Material: Steel.
 - 13.5. Finish: Externally polyester powder coated.
Internal partitions, zinc coated.
 - 13.6. Colour: Grey.
 - 13.7. Locking mechanism: Door-interlocked operating handles.
 - 13.8. Hardware: Corrosion-resistant lever type handles with latching mechanism.
 - 13.9. Locks: Cylinder. Standardize key type.
 - 13.10. Fixing of removable panels: Captive, corrosion resistant knurled thumb screws.
 - 13.11. Lifting bolts: Integral within reinforced top frame.
14. Internal separation: Refer to the form of separation on the LV schematic and specification system description. The minimum form of separation shall be Form 4b type 6 unless stated otherwise.
15. Cable entry: Refer to layout drawings but the proposed switchboard shall be capable to be produced for the following:
 - Suitable for front access cabling;
 - Entry via gland plates facilitating either top and/or bottom entry;

- Suitable for front or rear access cabling entry via top gland plates; and Bottom gland plate.
- 16. Mounting arrangement for Electricity Distributor's metering equipment: Separate.
- 17. Accessories: Refer to the LV schematic for further details of the required equipment that shall be integrated within the cubicle switchboard.
- 18. Execution:

Pr_60_70_22_22 Distribution boards

1. Description:
2. Manufacturer: Schneider or equal and approved.
3. Standards: To BS EN 61439-1 and BS EN 61439-3.
4. Third party certification: Full manufacturer type tests to IEC 60439-3.
5. Rated operational voltage (Ue): 250 V and 415 V.
6. Incoming device: [Pr_60_70_48_47 Low-voltage switch disconnectors type A](#).
7. Outgoing devices
 - 7.1. Type: Refer to distribution board schedules.
 - [Pr_65_72_27_52 Miniature circuit breakers](#);
 - and [Pr_65_72_27_73 Residual current circuit breakers with integral overcurrent protection](#).
 - 7.2. Quantity: Refer to distribution board schedules.
8. Busbars and connections
 - 8.1. Type: Fully shrouded.
 - 8.2. Rated operational current (Ie): 125 A and 250 A.
 - 8.3. Rated short-time withstand current (Icw) for 1 s: 25 kA.
9. Neutral and earth bars: Individual terminal for each outgoing circuit.
10. Neutral terminations: Match current carrying capacity of phase conductor.
11. Spare ways: Fit with blank plates. Minimum 20% spare capacity shall provided.
12. Enclosure
 - 12.1. Ingress protection (minimum): To suit the location and the environmental conditions in accordance with BS EN 60529.
 - 12.2. Material: Steel.
 - 12.3. Finish: Polyester powder coated.
 - 12.4. Colour: Manufacturer's standard .
 - 12.5. Locking mechanism: Cylinder locks with a standard key type.
13. Accessories: [Pr_80_51_51_19 Current transformers](#);
- [Pr_80_51_51_22 Digital metering equipment](#);
- [Pr_65_72_27_74 Residual current monitors](#);
- and [90-75-75/310 Padlocks and keys](#).
14. Execution: [Pr_60_70_22/665 Installing switchgear generally](#).

Pr_60_70_48_07 Busbar trunking feed units Distribution

1. Description: Flange connections in to switch boards
2. Manufacturer: Eaton Power Xpert XP2
3. Standards: To BS EN 61439-1 and BS EN 61439-6.
4. Unit type: Switchboard feed.
5. Rated current: Refer to layout drawings and LV schematic.
6. **Enclosure**
 - 6.1. Ingress protection (minimum): To suit the location and environmental conditions in accordance with BS EN 60529.
 - 6.2. Material: Aluminium.
 - 6.3. Finish: Corrosion-resistant paint.
 - 6.4. Colour: Manufacturers standard
7. Configuration: 5 pole.

8. Protective device: Moulded case circuit breaker;
Air circuit breaker
9. Execution: [Pr_60_70_48/645 Installing feed units.](#)

Pr_60_70_48_07 Busbar trunking feed units Risers

1. Description: Retained vertical busbars
2. Manufacturer: Eaton (MEM) MP
3. Standards: To BS EN 61439-1 and BS EN 61439-6.
4. Unit type: Centre feed;
End feed;
5. Rated current: Refer to layout drawings and LV schematic.
6. **Enclosure**
 - 6.1. Ingress protection (minimum): To suit the location and environmental conditions in accordance with BS EN 60529.
 - 6.2. Material: Steel.
 - 6.3. Finish: Corrosion-resistant paint.
 - 6.4. Colour: Manufacturers standard
7. Configuration: To match busbar trunking.
8. Protective device: HRC fuses;
9. Execution: [Pr_60_70_48/645 Installing feed units Type A.](#)
10. Service conditions: Normal.

Pr_60_70_48_07 Busbar trunking feed units Under floor

1. Description: Feeder unit
2. Manufacturer: As Power busbar trunking.
3. Standards: To BS EN 61439-1 and BS EN 61439-6.
4. Unit type: End feed;
5. Rated current: 63 A.
6. **Enclosure**
 - 6.1. Ingress protection (minimum): To suit the location and environmental conditions in accordance with BS EN 60529.
 - 6.2. Material: Nylon
 - 6.3. Finish: Manufacturers standard
 - 6.4. Colour: Manufacturers standard
7. Configuration: To match busbar trunking.
8. Protective device: N/A
9. Execution: [Pr_60_70_48/645 Installing feed units Type B.](#)

Pr_60_70_48_08 Busbar trunking fire barrier units Distribution

1. Description: Install as busbar
2. Manufacturer: Eaton Power Expert XP2
3. Standards: To BS EN 61439-1 and BS EN 61439-6.
4. Fire resistance: 60 minutes and 120 minutes. Refer to the fire strategy information for fire resistance duration.
5. Service conditions: Normal.
6. Execution: [Pr_60_70_48/650 Installing fire barrier units.](#)

Pr_60_70_48_09 Busbar trunking tap-off units Risers

1. Description: New 100A Tap-off's
2. Manufacturer: Eaton (MEM) MP
3. Standards: To BS EN 61439-1 and BS EN 61439-6.
4. Unit type: Plug-in.

5. Rated current: Refer to layout drawings and LV schematic.
6. **Enclosure**
 - 6.1. Ingress protection (minimum): To suit the location and environmental conditions in accordance with BS EN 60529.
 - 6.2. Material: Steel. Aluminium.
 - 6.3. Finish: Corrosion-resistant paint.
 - 6.4. Colour: Manufacturers standard
7. Configuration: To match busbar trunking.
8. Protective device: HRC fuses;
Moulded case circuit breaker;
9. Service conditions: Normal.
10. Execution: [Pr_60_70_48/640 Installing tap-off units Type A.](#)

Pr_60_70_48_09 Busbar trunking tap-off units Under floor

1. Description: Clean earth tap -off's
2. Manufacturer: As As Power busbar trunking.
3. Standards: To BS EN 61439-1 and BS EN 61439-6.
4. Unit type: Plug-in.
5. Rated current: 63 A.
6. **Enclosure**
 - 6.1. Ingress protection (minimum): To suit the location and environmental conditions in accordance with BS EN 60529.
 - 6.2. Material: Nylon
 - 6.3. Finish: Manufacturers standard
 - 6.4. Colour: Manufacturers standard
7. Configuration: To match busbar trunking.
8. Protective device: N/A
9. Execution: [Pr_60_70_48/640 Installing tap-off units.](#)

Pr_60_70_48_66 Power busbar trunking Distribution

1. Description: New distribution bus-bar text
2. Manufacturer: Eaton Power Expert XP2
3. Standards: To BS EN 61439-1 and BS EN 61439-6.
4. Third party certification: ASTA Type test certification.
5. Nominal voltage: 230 V a.c and 400 V a.c.
6. Rated current: Refer to layout drawings and LV schematic.
7. Configuration: 100% earth;
5 pole.
8. Tap-off points: None
9. Place of installation: Indoor and Outdoor.
10. Mounting orientation: Horizontal and Vertical.
11. Rated peak withstand current: The busbar trunking shall easily withstand the maximum fault current at the point within the electrical installation.
12. Rated short-time withstand current (1 s): The power busbar shall be capable of easily withstanding the rated short circuit current when installed within the proposed electrical distribution system.
13. **Enclosure**
 - 13.1. Ingress protection (minimum): To suit the location and environmental conditions in accordance with BS EN 60529.
 - 13.2. Impact protection (minimum): To suit the location and environmental conditions in accordance with BS EN 60529.
 - 13.3. Mechanical loads: Normal.
 - 13.4. Material: Sheet Steel. Aluminium.
 - 13.5. Finish: Corrosion-resistant paint.
 - 13.6. Colour: Manufacturers standard

14. Conductors: Aluminium.
15. Supports: Ceiling bracket;
Clamp for channel;
Suspension clamp;
Suspension ring;
and Wall brackets.
16. Accessories: Elbows;
End covers;
Fire barrier units;
Joint covers;
and Thrust units.
17. Service conditions: Normal.
18. Execution: [Pr_65_70_11/660 Testing and commissioning of site-assembled busbar trunking Distribution](#) and [90-50-45/635 Installing power busbar trunking Distribution](#).

Pr_60_70_48_66 Power busbar trunking Risers

1. Description: Existing rising bus-bars to be retained, with new tap-off's
2. Manufacturer: Eaton (MEM) MP
3. Standards: To BS EN 61439-1 and BS EN 61439-6.
4. Third party certification: ASTA Type test certification.
5. Nominal voltage: 230 V a.c and 400 V a.c.
6. Rated current: Refer to layout drawings and LV schematic.
7. Configuration: 5 pole.
8. Tap-off points: To suit the required connections refer to the LV schematic and layout drawings. Tap off points shall be coordinated with all other services and the building structure.
9. Place of installation: Indoor in risers
10. Mounting orientation: Vertical.
11. Rated peak withstand current: The busbar trunking shall easily withstand the maximum fault current at the point within the electrical installation.
12. Rated short-time withstand current (1 s): The power busbar shall be capable of easily withstanding the rated short circuit current when installed within the proposed electrical distribution system.
13. **Enclosure**
 - 13.1. Ingress protection (minimum): To suit the location and environmental conditions in accordance with BS EN 60529.
 - 13.2. Impact protection (minimum): To suit the location and environmental conditions in accordance with BS EN 60529.
 - 13.3. Mechanical loads: Normal.
 - 13.4. Material: Existing
 - 13.5. Finish: Corrosion-resistant paint.
 - 13.6. Colour: Manufacturers standard
14. Conductors: Copper
15. Supports: Wall brackets.
16. Accessories: End covers;
Fire barrier units;
Joint covers;
Tap-off unit covers;
17. Service conditions: Normal.
18. Execution: [Pr_65_70_11/660 Testing and commissioning of site-assembled busbar trunking Risers](#) and [90-50-45/635 Installing power busbar trunking Risers](#).

Pr_60_70_48_66 Power busbar trunking Under floor

1. Description: Clean earth track
2. Manufacturer: Legrand or equal and approved.
3. Standards: To BS EN 61439-1 and BS EN 61439-6.
4. Third party certification: ASTA Type test certification.
5. Nominal voltage: 230 V a.c
6. Rated current: 63 A.

7. Configuration: 5 pole;
Clean earth;
100% earth;
8. Tap-off points: At 300mm intervals
9. Place of installation: Indoor and Underfloor.
10. Mounting orientation: Vertical.
11. Rated peak withstand current: The busbar trunking shall easily withstand the maximum fault current at the point within the electrical installation.
12. Rated short-time withstand current (1 s): The power busbar shall be capable of easily withstanding the rated short circuit current when installed within the proposed electrical distribution system.
13. **Enclosure**
 - 13.1. Ingress protection (minimum): To suit the location and environmental conditions in accordance with BS EN 60529.
 - 13.2. Impact protection (minimum): To suit the location and environmental conditions in accordance with BS EN 60529.
 - 13.3. Mechanical loads: Normal.
 - 13.4. Material: Galvanized Steel.
 - 13.5. Finish: Hot dipped galvanized.
 - 13.6. Colour: Galvanized Steel.
14. Conductors: Copper
15. Supports: Hold down clamps.
16. Accessories: End covers;
Joint covers;
Tap-off unit covers;
17. Service conditions: Normal.
18. Execution: [Pr_65_70_11/660 Testing and commissioning of site-assembled busbar trunking Under floor](#) and [90-50-45/635 Installing power busbar trunking Under floor](#).

Pr_60_70_48_44 Low-voltage fuse-switch disconnectors

1. Description:
2. Manufacturer: Schneider or equal and approved.
3. Standards: To BS EN 60947-1 and BS EN 60947-3.
4. Third-party certification: ASTA Type test certification.
5. Rated operational voltage (Ue): 415 V and 600 V.
6. Rated operational current (In): To suit the maximum load requirements including 25% spare capacity.
7. Rated operational frequency: 50 Hz.
8. Switch arrangement: DP;
SPSN;
TPN;
and TPSN.
9. Rated short-time withstand current (Icw) for 1 s: Icw shall not be less than 12 times the maximum rated operational current in accordance with BS EN 60947-3.
10. Utilization category: AC-23A.
11. Terminals: Suitable for the connection of copper and aluminium conductors.
12. Mechanical interlocking: Rotary handle capable of accepting up to three padlocks.
13. Enclosure
 - 13.1. Ingress protection (minimum): To suit the location and the environmental conditions in accordance with BS EN 60529.
 - 13.2. Impact protection (minimum): To suit the location and the environmental conditions in accordance with BS EN 60529.
 - 13.3. Material: Polycarbonate and Sheet steel.
 - 13.4. Finish: Powder coated.
 - 13.5. Colour: Grey
 - 13.6. Gland plates: Fully removable to top and bottom faces and Pre-drilled cable knock-outs.
14. Fuses: [Pr_65_72_27_47 Low-voltage fuse links](#).

15. Execution: [Pr_60_70_22/665 Installing switchgear generally.](#)

Pr_60_70_48_47 Low-voltage switch disconnectors type A

1. Description:
2. Manufacturer: Schneider or equal and approved.
3. Standards: To BS EN 60947-3.
4. Third-party certification: ASTA Type test certification.
5. Rated operational voltage (Ue): 250 V and 415 V.
6. Rated operational current (In): To suit the maximum load requirements including 25% spare capacity.
7. Rated operational frequency: 50 Hz.
8. Switch arrangement: DP;
SPSN;
and TPN.
9. Rated short-time withstand current (Icw) for 1 s: Icw shall not be less than 12 times the maximum rated operational current in accordance with BS EN 60947-3.
10. Utilization category: Utilisation category shall be confirmed by contractor to suit the intended application of the equipment.

The following shall be applied by the contractor to determine the utilisation category to suit the device and equipment to be switched:

1. The suffix AC or DC, which indicates the nature of the current.
2. The two digit number, which indicates the type of application the unit is suitable for:
 - 20 Connecting and disconnecting under no-load.
 - 21 Switching of resistive loads.
 - 22 Switching of mixed resistive and inductive loads.
 - 23 Switching of highly inductive loads.
3. The suffix A or B, which indicates whether the unit is suitable for frequent or infrequent operation:
 - A Frequent operation
 - B infrequent operation.
11. Terminals: Suitable for the connection of copper and aluminium conductors.
12. Mechanical interlocking: Rotary handle.
13. Enclosure
 - 13.1. Ingress protection (minimum): To suit the location and the environmental conditions in accordance with BS EN 60529.
 - 13.2. Impact protection (minimum): To suit the location and the environmental conditions in accordance with BS EN 60529.
 - 13.3. Material: Sheet steel.
 - 13.4. Finish: Powder coated.
 - 13.5. Gland plates: Fully removable to top and bottom faces and Pre-drilled cable knock-outs.
14. Execution: and [Pr_60_70_22/665 Installing switchgear generally.](#)

Pr_60_70_48_47 Low-voltage switch disconnectors type B

1. Description:
2. Manufacturer: Schneider or equal and approved.
3. Standards: To BS EN 60947-1 and BS EN 60947-3.
4. Third-party certification: ASTA Type test certification.
5. Rated operational voltage (Ue): 415 V.
6. Rated operational current (In): As circuit schedules.
7. Rated operational frequency: 50 Hz.
8. Switch arrangement: SPSN and TPN.
9. Rated short-time withstand current (Icw) for 1 s: Manufacturer's standard .
10. Utilization category: Submit proposals .
11. Terminals: Suitable for the connection of copper and aluminium conductors.
12. Mechanical interlocking: Rotary handle capable of accepting up to three padlocks.

13. Enclosure

- 13.1. Ingress protection (minimum): To BS EN 60529, IP41.
- 13.2. Impact protection (minimum): Submit proposals .
- 13.3. Material: Polycarbonate.
- 13.4. Finish: Submit proposals .
- 13.5. Colour: Submit proposals .
- 13.6. Gland plates: Pre-drilled cable knock-outs.

14. Execution: [Pr_60_70_22/665 Installing switchgear generally.](#)

[Pr_60_70_48_66](#) Power busbar trunking

- 1. Description: 63A Cast resin copper busbar
- 2. Manufacturer: E+I or equal and approved.
- 3. Standards: To BS EN 61439-1 and BS EN 61439-6.
- 4. Third party certification: ASTA Type test certification.
- 5. Nominal voltage: 230 V a.c and 400 V a.c.
- 6. Rated current: 3200A
- 7. Configuration: 4 pole;
Clean earth;
100% earth;
Double sided;
and Single sided.
- 8. Tap-off points: To suit the required connections refer to the LV schematic and layout drawings. Tap off points shall be coordinated with all other services and the building structure.
- 9. Place of installation: Indoor and Underfloor.
- 10. Mounting orientation: Horizontal and Vertical.
- 11. Rated peak withstand current: The busbar trunking shall easily withstand the maximum fault current at the point within the electrical installation.
- 12. Rated short-time withstand current (1 s): The power busbar shall be capable of easily withstanding the rated short circuit current when installed within the proposed electrical distribution system.
- 13. Enclosure
 - 13.1. Ingress protection (minimum): To suit the location and environmental conditions in accordance with BS EN 60529.
 - 13.2. Impact protection (minimum): To suit the location and environmental conditions in accordance with BS EN 60529.
 - 13.3. Mechanical loads: Normal.
 - 13.4. Material: Sheet Steel.
 - 13.5. Finish: Hot dipped galvanized.
 - 13.6. Colour: White lacquered sheet steel
- 14. Conductors: Copper
- 15. Supports: Ceiling bracket;
Clamp for channel;
Suspension clamp;
Suspension ring;
and Wall brackets.
- 16. Accessories: Elbows;
End covers;
Fire barrier units;
Flexible connections;
Joint covers;
Tap-off unit covers;
Tees;
and Thrust units.
- 17. Service conditions: Normal.
- 18. Execution: [Pr_65_70_11/660 Testing and commissioning of site-assembled busbar trunking type B and 90-50-45/635 Installing power busbar trunking.](#)

Pr_60_70_65_34 Generator sets

1. Description: 250kVA Life Safety Generator
2. Manufacturer: FG Wilson or equal and approved.
3. Standard: To BS ISO 8528-5.
4. Internal combustion engine
 - 4.1. Standards
 - 4.1.1. Generally: To BS ISO 8528-2.
 - 4.1.2. Overspeed protection: To BS 5514-6.
 - 4.2. Engine type: Compression-ignition.
 - 4.3. Air and fuel intake
 - 4.3.1. Type: Turbocharged.
 - 4.3.2. Air filters: Dry replaceable element
 - 4.3.3. Fuel filters: Replaceable spin-on
 - 4.4. Lubrication
 - 4.4.1. Oil filters: Replaceable spin-on and full flow
 - 4.4.2. Crankcase oil heater: Required where ambient temperature is below 0 degrees Celsius.
 - 4.4.3. Drain valve: Oil drain line with isolation valves.
 - 4.4.4. Oil reservoir tank: Provide with adequate capacity; include oil level monitoring and a drain valve located to facilitate gravity oil removal.
 - 4.5. Cooling system
 - 4.5.1. Cooling medium: Closed-circuit pressurized water-based.
 - 4.5.2. Radiator: The generator set shall be provided with an apparent power rating to reliably support the project electrical loads including 25% spare capacity.
 - 4.5.3. Fan: Engine driven and mounted. A remote mounted radiator shall be provided where required.
 - 4.5.4. Coolant heater: Coolant heaters shall be provided to aid engine starting where the location dictates low ambient temperatures (<2°C).
 - 4.5.5. Drain valve: This shall be provided and located to provide easy maintenance.
 - 4.6. Engine starting method: Electric starter motor.
5. Alternator
 - 5.1. Standards: To BS 5000-3, and BS ISO 8528-3 or BS EN 60034-22.
 - 5.2. Rated power output: The generator set shall be provided with a power rating to reliably support the project electrical loads including 25% spare capacity.
 - 5.3. Format: Synchronous.
 - 5.4. Excitation: Self.
 - 5.5. Short-circuit withstand capability (minimum): 2.5 times full load, short-circuit current for 10 s.
 - 5.6. Protection: Electronic circuit protection shall be provided and consist of a MCCB c/w a electronic trip unit as minimum. Refer to the electrical schematic for further information.
 - 5.7. Overspeed withstand: 120% rated speed
 - 5.8. Thermal classification: In accordance with BS EN 60085 and suit the project requirements.
 - 5.9. Ingress protection (minimum): To suit the location of the equipment and the environmental conditions.
 - 5.10. Anti-condensation heaters: Required.
 - 5.11. Output cable terminal boxes
 - 5.11.1. Configuration: Removable lid and side covers shall be provided.
 - 5.11.2. Outgoing cable entry: Top exit.
6. Control systems
 - 6.1. Standards
 - 6.1.1. Generally: To BS ISO 8528-4 and EREC G59/3.
 - 6.1.2. Speed governing: To BS ISO 8528-5 and BS ISO 3046-4.
 - 6.1.3. Voltage regulation: To BS ISO 8528-5 and BS 4999-140.
 - 6.2. Enclosure

- 6.2.1. Mounting position: Integral to the generating set.
- 6.2.2. Ingress protection (minimum): To suit the location of the equipment and the environmental conditions.
- 6.2.3. Material: Standard generating set material shall be provided.
- 6.2.4. Finish: Standard generating set finish shall be provided.
- 6.2.5. Colour: Standard generating set colour shall be provided.
- 6.3. User interface: LCD alphanumeric display with integrated operation keys and LED indication.
- 6.4. Control functions: Alphanumeric display with navigation buttons;
 - Automatic/ manual selection;
 - Emergency stop;
 - Fault reset;
 - Manual start/ stop;
 - and Voltage and frequency adjust $\pm 5\%$.
- 6.5. Measurement and indication
 - 6.5.1. Engine: Engine coolant temperature;
 - Engine speed;
 - Hours run;
 - Lubricating oil pressure;
 - Lubricating oil temperature;
 - and Starting system battery voltage.
 - 6.5.2. Alternator: Alternating current for each phase;
 - Frequency;
 - Power factor total and each phase indicating lead or lag condition;
 - Total load (active power kW);
 - Total load (apparent power kV A);
 - Voltage (L-L & 3x L-N);
 - and Voltage (L-N).
 - 6.5.3. Status: Coolant heater on;
 - Emergency stop activated;
 - Generator in use;
 - Generator ready;
 - Generator off-load;
 - Generator on-load;
 - Mains available;
 - Mains failure;
 - Not in automatic;
 - and Oil heater on.
- 6.6. Protection
 - 6.6.1. Engine: Battery charger malfunction alarm;
 - Battery low voltage alarm;
 - Emergency stop, immediate shutdown and prevention of operation;
 - Engine coolant over temperature alarm and load disconnection;
 - Engine coolant low temperature alarm;
 - Failure to crank shutdown;
 - Fail to start alarm;
 - Low fuel level alarm;
 - Low oil pressure shutdown;
 - and Overspeed shutdown.
 - 6.6.2. Alternator: Earth fault shutdown;
 - Over and under frequency shutdown;
 - Over and under voltage shutdown;
 - Over current and short circuit shutdown;
 - and Over current warning.
- 6.7. Alarms: Audible and visual with common audible reset. The generator shall be connected to the BMS system where provided.
- 6.8. Communications interface: Auxiliary output relays;
 - Modbus;
 - and USB port.
- 6.9. Features: Generator set model data held within controller.
- 7. Sub-base fuel tank
 - 7.1. Capacity (minimum): Minimum of 8 hours at full load + 6 months for maintenance testing
 - 7.2. Tank type: Steel double skinned, mounted integral to the generator base frame.

8. Accessories: Air intake manifold heaters;
Control cabinet heater;
Glow plugs;
and Used oil container.

Pr_80_77_28_33 Generator enclosures

1. Description: Removable acoustic enclosure rated to 85dBA @ 1m
 2. Manufacturer: Provided by the generator manufacturer.
 3. Format: The enclosure shall be compatible with the proposed equipment.
 4. Material: Aluminium construction with minimum thickness of 2mm.
 5. Finish: Epoxy powder coated.
 6. Colour: Manufacturers standard
 7. Size (l x w x d): Sized to suit generator requirements and enable full access for easy maintenance.
 8. Personnel access doors: Required.
 9. Removable side panels: Required.
 10. Louvres
 - 10.1. Type: Louvres shall be provided to suit air flow and weatherproof requirements. Screens shall also be provided to prevent bird and rodent access.
 - 10.2. Dampers: Automatic.
 11. Anti-condensation heaters: Thermostatically controlled to provide internal air temperature of 10 °C.
- Acoustic performance (maximum under full load): Attenuation shall be provided to limit the noise emissions to 80 dBA at 1 m from generator enclosure as a minimum (unless indicated otherwise in the specification system description or layout drawings).

Pr_65_70_11_12 Cable baskets

Shared by: [Ss_75_50_28_29 Fire detection and alarm systems](#) , [Ss_70_30_80_35 Hardwired voltage small power systems](#) , [Ss_70_80_33_35 Hardwired general lighting systems](#) , [Ss_75_10_21_21 Data distribution systems](#) , [Ss_75_40_02_11 Card access control systems](#) and [Ss_75_50_11_27 Emergency voice communication systems](#)

1. Description:
2. Manufacturer: Legrand or equal and approved.
3. Standard: To BS EN 61537.
4. Material: Metallic - Refer to specification system description and electrical equipment schedules for cable basket duty requirements (medium duty shall be the minimum duty unless noted otherwise). The cable basket material shall be suitable for the installed environment and shall be able to withstand any corrosion effects caused by the environment.
5. Coating material: Hot dip galvanized and stainless steel in corrosive environments.
6. Resistance against flame propagation: Non-flame propagating
7. Electrical Properties: The cable basket containment system shall be electrically continuous.
8. Sizes
 - 8.1. Width: As per the layout drawings.
 - 8.2. Side height: 54 mm.
9. Features
 - 9.1. Segregation: Cable dividers shall be provided where services such as fire alarm cabling share the same cable basket for example.
 - 9.2. Protective cover: Not required.
10. Execution: [Pr_65_70_11/661 Cable support zones](#);
[Pr_65_70_11/630 Installing cable basket](#);
and [Pr_65_70_11/650 Multiple cable runs](#).

Pr_65_70_11_13 Cable cleats

1. Description:
2. Manufacturer: CMP or equal and approved.
3. Standard: To BS EN 61914.
4. Format: To suit cable type and cable manufacturers instructions.

5. Material: Metallic throughout all areas including escape routes and non escape routes. Non-metallic cable cleats may be used in external locations.
6. Temperatures for permanent installation
 - 6.1. Maximum: In accordance with BS EN 61914 and to suit project requirements and environmental conditions.
 - 6.2. Minimum: In accordance with BS EN 61914 and to suit project requirements and environmental conditions.
7. Resistance to impact: Heavy.
8. Type of retention or resistance to electromechanical forces: Resistant to electromechanical forces, withstanding one short circuit.
9. Environmental influences
 - 9.1. Non-metallic and composite components: Resistant to ultraviolet light.
 - 9.2. Metallic and composite components: High resistance to corrosion.

Pr_65_70_11_14 Cable ladders

1. Description:
2. Manufacturer: Legrand or equal and approved.
3. Standard: To BS EN 61537.
4. Material: Carbon steel. Stainless steel in external environments. The cable tray material shall be suitable for the installed environment and shall be able to withstand any corrosion effects caused by the environment.
5. Duty: Heavy duty shall be the minimum duty unless noted otherwise.
6. Resistance against flame propagation: Non-flame propagating.
7. Electrical properties
 - 7.1. Continuity characteristics: With electrical continuity.
 - 7.2. Conductivity characteristics: With electrical conductive system component.
8. Coating material: Hot dip galvanized.
9. Temperature properties for transport, storage, installation and application
 - 9.1. Minimum: -20°C.
 - 9.2. Maximum: +90°C.
10. Mechanical properties
 - 10.1. Cable ladder free base area: Class X - up to 80% perforation in the cable tray free base area.
 - 10.2. Resistance to impact: Up to 50 J.
11. Width: Refer to layout drawings.
12. Features
 - 12.1. Segregation: Cable dividers.
 - 12.2. Protective cover: Required where additional mechanical impact protection is required. In addition, cable tray covers are required in external areas to protect cables from vermin or the effects of UV rays for example.
13. Execution: [Pr_65_70_11/621 Installing cable tray and cable ladder](#);
[Pr_65_70_11/640 Installing cable supports on roofs](#);
[Pr_65_70_11/650 Multiple cable runs](#);
 and [Pr_65_70_11/661 Cable support zones](#).

Pr_65_70_11_15 Cable ties

Shared by: [Ss_75_50_28_29 Fire detection and alarm systems](#) , [Ss_70_30_80_35 Hardwired voltage small power systems](#) and [Ss_70_80_33_35 Hardwired general lighting systems](#)

1. Description:
2. Manufacturer: Thorsman or equal and approved.
3. Standard: To BS EN 62275.
4. Format: Wrap around self-locking releasable.
5. Material: Metal.
6. Loop tensile strength (minimum): Manufacturer's standard .
7. Temperatures for permanent installation

- 7.1. Maximum: To suit the location and environmental conditions.
- 7.2. Minimum: To suit the location and environmental conditions.
- 8. Contribution to fire : Non-flame propagating.
- 9. Environmental influences
 - 9.1. Non-metallic and composite components: Resistant to ultraviolet light.
 - 9.2. Metallic and composite components: Resistant to corrosion.

Pr_65_70_11_17 Cable trays

Shared by: [Ss_75_50_28_29 Fire detection and alarm systems](#)

- 1. Description:
- 2. Manufacturer: Legrand or equal and approved.
- 3. Standard: To BS EN 61537.
- 4. Material: Metallic (perforated) - The cable tray material shall be suitable for the installed environment and shall be able to withstand any corrosion effects caused by the environment.
- 5. Duty: Heavy duty shall be the minimum duty unless noted otherwise.
- 6. Resistance against flame propagation: Non-flame propagating.
- 7. Electrical properties
 - 7.1. Continuity characteristics: With electrical continuity.
 - 7.2. Conductivity characteristics: With electrical conductive system component.
- 8. Coating material: Hot dip galvanized and stainless steel in corrosive environments.
- 9. Temperature properties for transport, storage, installation and application
 - 9.1. Minimum: In accordance with BS EN 61537 and to suit project requirements and environmental conditions.
 - 9.2. Maximum: In accordance with BS EN 61537 and to suit project requirements and environmental conditions.
- 10. Mechanical properties
 - 10.1. Cable tray free base area: Class X - up to 80% perforation in the cable tray free base area.
 - 10.2. Resistance to impact: In accordance with BS EN 61537 and to suit project requirements and environmental conditions.
- 11. Width: As per the layout drawings.
- 12. Features
 - 12.1. Flange type: Return Flange.
 - 12.2. Segregation: Cable dividers shall be provided where services such as fire alarm cabling share the same cable basket for example.
 - 12.3. Protective cover: Required where additional mechanical impact protection is required. In addition, cable tray covers are required in external areas to protect cables from vermin or the effects of UV rays for example.
- 13. Execution: [Pr_65_70_11/621 Installing cable tray and cable ladder](#).

Pr_65_70_11_19 Channel cable supports

Shared by: [Ss_75_50_28_29 Fire detection and alarm systems](#) , [Ss_70_30_80_35 Hardwired voltage small power systems](#) and [Ss_70_80_33_35 Hardwired general lighting systems](#)

- 1. Description:
- 2. Manufacturer: Legrand or equal and approved.
- 3. Standard: To BS 6946.
- 4. Format: Plain and Slotted.
- 5. Dimensions: To suit the containment support requirements.
- 6. Material: Carbon steel. Stainless steel in external type environments.
- 7. Finish: Hot dip galvanized.
- 8. Accessories
 - 8.1. Manufacturer: As channel cable support.
 - 8.2. Type: 90° brackets;
Base plates;

Beam clamps;
Channel type cantilever arms;
End caps;
Internal connectors;
Threaded rod;
Threaded rod connectors;
Trapeze hangers;
U bolt type beam clamps;
and Window type beam clamps.

9. Execution: Installing channel cable supports;
[Pr_65_70_11/640 Installing cable supports on roofs](#);
[Pr_65_70_11/650 Multiple cable runs](#);
and [Pr_65_70_11/661 Cable support zones](#).

Pr_65_70_11_20 Conduit fittings

Shared by: [Ss_75_50_28_29 Fire detection and alarm systems](#) , [Ss_70_30_80_35 Hardwired voltage small power systems](#) , [Ss_70_80_33_35 Hardwired general lighting systems](#) , [Ss_75_10_21_21 Data distribution systems](#) and [Ss_75_40_02_11 Card access control systems](#)

1. Description:
2. Manufacturer: Shall be provided to match manufacturer of conduit.
3. Standards: To BS EN 61386-1 and to BS EN 61386-21, BS EN 61386-22, or BS EN 61386-23 as appropriate; or to BS 4607-1.
4. Material
 - 4.1. Type: Stainless steel and PVC-U. Metallic conduit or metallic cable supports must be provided in ceilings throughout all areas where in the event of fire the unsupported cabling could impede fire fighting activities.
 - 4.2. Finish: Match conduit.
5. Conduit boxes: Fit covers of same material and finish as boxes. Include brass earthing terminals in PVC-U boxes.
6. Plugs
 - 6.1. For metallic boxes: Hexagonal malleable iron and Slotted brass.
 - 6.2. For non-metallic boxes: Solvent PVC-U and Hexagon screwed PVC-U.
7. Locknuts
 - 7.1. For metallic boxes: Hexagonal malleable iron and Hexagonal carbon steel.
 - 7.2. For non-metallic boxes: Hexagonal PVC-U and Knurled circular PVC-U.
8. Execution: [Pr_65_70_11/700 Installing conduit, trunking and ducting](#).

Pr_65_70_11_30 Flexible conduit

Shared by: [Ss_70_30_80_35 Hardwired voltage small power systems](#) and [Ss_70_80_33_35 Hardwired general lighting systems](#)

1. Description:
2. Manufacturer: Legrand or equal and approved.
3. Standards: To BS EN 61386-1 and BS EN 61386-23.
4. Mechanical properties
 - 4.1. Resistance to compression: Medium.
 - 4.2. Resistance to impact: Medium.
5. Transport, installation and application
 - 5.1. Lower temperature (minimum): In accordance with BS EN 61386 and to suit project requirements and environmental conditions.
 - 5.2. Upper temperature (maximum): In accordance with BS EN 61386 and to suit project requirements and environmental conditions.
6. Resistance to bending: Flexible.
7. Electrical characteristics: With electrical continuity and insulating characteristics.
8. Resistance to external influences
 - 8.1. Protection against ingress of solid objects (minimum): To BS EN 60529, IP4X.
 - 8.2. Protection against ingress of water (minimum): To BS EN 60529, IPX0.

9. Resistance to corrosion: High protection inside and out. To BS EN 61386-1, Class 4.
10. Tensile strength: Medium.
11. Resistance to flame propagation: Non-flame propagating.
12. Suspended load capacity: Medium.
13. Sizes (OD): Minimum of 25mm overall diameter.
14. Execution: Installing conduit connections to equipment;
[Pr_65_70_11/765 Conduit, trunking and ducting zones](#);
 and Installing pliable and flexible conduit.

Pr_65_70_11_63 Pliable conduit

Shared by: [Ss_70_30_80_35 Hardwired voltage small power systems](#) and [Ss_70_80_33_35 Hardwired general lighting systems](#)

1. Description:
2. Manufacturer: Legrand or equal and approved.
3. Standards: To BS EN 61386-1 and BS EN 61386-22.
4. Mechanical properties
 - 4.1. Resistance to compression: Medium.
 - 4.2. Resistance to impact: Medium.
5. Transport, installation and application
 - 5.1. Lower temperature (minimum): In accordance with BS EN 61386 and to suit project requirements and environmental conditions.
 - 5.2. Upper temperature (maximum): In accordance with BS EN 61386 and to suit project requirements and environmental conditions.
6. Resistance to bending: Pliable, self-recovering.
7. Electrical characteristics: With electrical continuity and insulating characteristics.
8. Resistance to external influences
 - 8.1. Protection against ingress of solid objects (minimum): To BS EN 60529, IP4X.
 - 8.2. Protection against ingress of water (minimum): To BS EN 60529, IPX0.
9. Resistance to corrosion: High protection, inside and outside.
10. Tensile strength: Medium.
11. Resistance to flame propagation: Non-flame propagating.
12. Suspended load capacity: Medium.
13. Sizes (OD): Minimum of 25mm overall diameter.
14. Execution: Installing pliable and flexible conduit;
 Installing conduit connections to equipment;
 and [Pr_65_70_11/765 Conduit, trunking and ducting zones](#).

Pr_65_70_11_71 Rigid conduit

Shared by: [Ss_75_50_28_29 Fire detection and alarm systems](#) , [Ss_70_30_80_35 Hardwired voltage small power systems](#) , [Ss_70_80_33_35 Hardwired general lighting systems](#) , [Ss_75_10_21_21 Data distribution systems](#) and [Ss_75_50_11_27 Emergency voice communication systems](#)

1. Description:
2. Manufacturer: Legrand or equal and approved.
3. Standards: To BS EN 61386-1 and BS EN 61386-21.
4. Mechanical properties
 - 4.1. Resistance to compression: Heavy.
 - 4.2. Resistance to impact: Heavy.
5. Transport, installation and application
 - 5.1. Lower temperature (minimum): In accordance with BS EN 61386 and to suit project requirements and environmental conditions.
 - 5.2. Upper temperature (maximum): In accordance with BS EN 61386 and to suit project requirements and environmental conditions.
6. Resistance to bending: Rigid.
7. Electrical characteristics: With electrical continuity properties.

8. Resistance to external influences
 - 8.1. Protection against ingress of solid objects (minimum): To BS EN 60529, IP4X.
 - 8.2. Protection against ingress of water (minimum): To BS EN 60529, IPX0.
9. Resistance to corrosion: High protection, inside and outside.
10. Tensile strength: Heavy.
11. Resistance to flame propagation: Non-flame propagating.
12. Suspended load capacity: Heavy.
13. Colour: To match main containment
14. Sizes (OD): Minimum 25 mm overall diameter. Minimum 1.2mm tubing thickness.
15. Execution: [Pr_65_70_11/720 Installing rigid metallic conduit](#);
[Pr_65_70_11/725 Installing rigid non metallic conduit](#);
 Installing conduit connections to equipment;
 and [Pr_65_70_11/765 Conduit, trunking and ducting zones](#).

Pr_65_70_48_29 Fire-resistant screened (LSHF) cables

Shared by: [Ss_75_50_28_29 Fire detection and alarm systems](#) , [Ss_70_30_80_35 Hardwired voltage small power systems](#) , [Ss_70_80_33_35 Hardwired general lighting systems](#) and [Ss_75_50_11_27 Emergency voice communication systems](#)

1. Description:
2. Manufacturer: Prysmian or equal and approved.
3. Standard: To BS 7629-1.
4. Third-party certification: British Approvals Service for Cables (BASEC) certified and Loss Prevention Certification Board (LPCB) certified.
5. Size: Refer to distribution board schedule and schematics.
6. Insulation: Standard or enhanced fire rated cabling shall be provided to suit the project requirements in accordance with the fire strategy, BS999, BS5839, BS5266 and BS8519.
7. Fire resistance category: Standard or enhanced fire rated cabling shall be provided to suit the project requirements in accordance with the fire strategy, BS999, BS5839, BS5266 and BS8519.
8. Screen: Copper tape.
9. Execution: [Pr_65_70_48/635 Installing low voltage cables](#);
[Pr_65_70_48/660 Installing low voltage cables in conduit and trunking](#);
[Pr_65_70_48/735 Cable installation on channel cable supports, cable tray, cable ladder and cable basket](#);
[90-55-15/640 Extra low and low voltage cable routes](#);
[90-55-15/645 Low voltage cables concealed in walls and partitions](#);
 and [90-55-15/655 Extra low and low voltage surface mounted cables](#).

Pr_65_70_48_88 Thermosetting insulated armoured fire-resistant (LSHF) cables

1. Description:
2. Manufacturer: Prysmian or equal and approved.
3. Standard: To BS 7846.
4. Third-party certification: British Approvals Service for Cables (BASEC) certified.
5. Size: Refer to LV Schematic, Layout drawings and distribution board schedules.
6. Insulation: In accordance with BS6724 to suit project requirements.
7. Fire resistance category: Standard or enhanced fire rated cabling and shall be in accordance with the requirements of the fire strategy, BS5839, BS9999, BS5266 and BS8519.
8. Voltage rating category:
9. Oversheath colour: Black.
10. Execution: [Pr_65_70_48/680 Installing low voltage armoured cables](#);
[Pr_65_70_48/720 Cables in ducts](#);
[Pr_65_70_48/730 Installing warning devices for underground cables](#);
 and [Pr_65_70_48/735 Cable installation on channel cable supports, cable tray, cable ladder and cable basket](#).

Pr_65_70_48_90 Thermosetting insulated and thermoplastic sheathed (LSHF) armoured cables

1. Description:
2. Manufacturer: Prysmian or equal and approved.

3. Standard: To BS 6724.
4. Third-party certification: British Approvals Service for Cables (BASEC) certified.
5. Size: Refer to the LV schematic and distribution board schedules.
6. Insulation: In accordance with BS 6724.
7. Sheath colour: Black.
8. Reaction to fire class
 - 8.1. Fire behaviour: In accordance with BS EN 50575 and BS EN 13501-6.
 - 8.2. Additional classification for smoke production: In accordance with BS EN 50575 and BS EN 13501-6.
 - 8.3. Additional classification for flaming droplets and/ or particles: In accordance with BS EN 50575 and BS EN 13501-6.
 - 8.4. Additional classification for acidity: In accordance with BS EN 50575 and BS EN 13501-6.
9. Execution: [Pr_65_70_48/680 Installing low voltage armoured cables](#);
[Pr_65_70_48/720 Cables in ducts](#);
[Pr_65_70_48/730 Installing warning devices for underground cables](#);
 and [Pr_65_70_48/735 Cable installation on channel cable supports, cable tray, cable ladder and cable basket](#).

Pr_65_72_27_02 Air circuit breakers

1. Description:
2. Manufacturer: Schneider or equal and approved.
3. Standards: To BS EN 60947-1 and BS EN 60947-2.
4. Third party certification: ASTA Type test certification.
5. Rated operational current (In): Refer to LV Schematic.
6. Number of poles: Three and Four. Refer to LV and Earthing Schematic.
7. Rated operational voltage (Ue): 400 V. a.c.
8. Rated insulation voltage (Ui): 1000V a.c
9. Rated impulse withstand voltage (Uimp) : 12 kV.
10. Rated frequency: 50 Hz.
11. Rated ultimate short-circuit breaking capacity (Icu): The unit shall be able to withstand the maximum short-circuit breaking capacity at installation point of the electrical distribution system.
12. Rated service short-circuit breaking capacity (Ics): The unit shall be able to withstand the maximum service short-circuit breaking capacity at installation point of the electrical distribution system.
13. Utilization category: Category A - comprises circuit-breakers not specifically intended for selectivity under short-circuit conditions with respect to other short-circuit protective devices in series on the load side, i.e. without an intentional time delay, or one which is not in accordance with the requirements of BS EN 60947-2, Table 3.
14. Protection
 - 14.1. Type: Microprocessor.
 - 14.2. Characteristics: Interchangeable with fixed range of settings and adjustable parameters.
 - 14.3. Settings: Earth leakage;
Instantaneous trip;
N-phase protection;
and Overload protection.
 - 14.4. Parameters: Earth leakage sensitivity;
Earth leakage time delay;
Long-time delay;
Instantaneous trip level;
N-phase trip current;
Overload pick-up current;
and Short-time delay.
 - 14.5. Special features: - Phase-failure sensing.
- Phase rotation protection.
- Contact temperature monitoring.
- Reverse power trip.
15. Measurement: Active, apparent and reactive powers;
Frequency;
Instantaneous and maximum demand;
Leakage current;

- Number of operations;
- Power factor;
- RMS values of current and voltage;
- and Total harmonic distortion (THD).
- 16. Visual indication: LED indication of alarms and trip functions.
- 17. Adjustment: Rotary dials.
- 18. Communications
 - 18.1. Remote monitoring: Bluetooth™.
 - 18.2. Displays: Bluetooth™.
- 19. Charge mechanism: Manual.
- 20. Mechanical interlocking: Captive key exchange type with square faced key and alphabetical or numerical coded operating face.
- 21. Suitable for isolation: Required.
- 22. Provision for maintenance: Maintainable.
- 23. Method of installation: Withdrawable.
- 24. Ingress protection (minimum): In accordance with BS EN 61386 and to suit project requirements and environmental conditions.
- 25. Connections
 - 25.1. Position: Rear - to enable withdraw of the unit.
 - 25.2. Configuration: Suitable for outgoing cable connection; Suitable for a single busbar connection on each pole; and Suitable for a twin busbar connection on each pole.
 - 25.3. Orientation: Horizontal.
- 26. Accessories: The following accessories shall be provided where required:
 - Auxiliary contacts to BS EN 60947-5-1;
 - Interphase barriers;
 - Over current alarm;
 - Remote communications connection;
 - Shunt trip release;
 - Undervoltage release.

Pr_65_72_27_47 Low-voltage fuse links

1. Description:
2. Manufacturer: Schneider or equal and approved.
3. Standards: To BS EN 60269-1 and BS HD 60269-2;
To BS EN 60269-1 and BS EN 60269-4;
and To BS EN 60269-1 and BS EN 60269-6.
4. Third party certification: ASTA Type test certification.
5. Fuse type: System E and System G.
6. Breaking range and utilization categories: Low voltage fuses that comply with general purpose gG characteristics
7. Rated operational current (In): Refer to the LV schematic and schedules.
8. Rated operational voltage (Ue): 230 V a.c and 400 V a.c.
9. Rated breaking capacity: 80 kA.

Pr_65_72_27_50 Mains power supply transient overvoltage suppression devices

Shared by: **Ss_75_50_45_45** Lightning protection systems

1. Description:
2. Manufacturer: Furse or equal and approved.
3. Standard: To BS EN 61643-11, type 1;
To BS EN 61643-11, type 2;
and To BS EN 61643-11, type 3.
4. Operating voltage and frequency (nominal): 230 V at 50 Hz and 400 V at 50 Hz.
5. Number of poles: Single and three phase.
6. Maximum continuous operating voltage (Uc): 275 V and 500 V.
7. Mode of protection: Lines to earth, lines to neutral, neutral to earth.

8. Lightning impulse current (Iimp): In accordance with the project requirements and BS EN 61643-11.
9. Nominal discharge current (In): In accordance with the project requirements and BS EN 61643-11.
10. Maximum discharge current 8/20 μ s (Imax): In accordance with the project requirements and BS EN 61643-11.
11. Minimum short-circuit current rating (Iscrr): In accordance with the project requirements and BS EN 61643-11.
12. Voltage protection level (Up): In accordance with the project requirements and BS EN 61643-11 and BS EN 60664-1.
13. Open circuit voltage (Uoc): In accordance with the project requirements and BS EN 61643-11.
14. Thermal overload protection: Required.
15. Protection status indicators: Full protection status.
16. Remote monitoring: Required – via one NO, NC 230 V, 0.2 A changeover contact. System shall be connected to the BMS system where indicated in the BMS specification.
17. Ingress protection (minimum): To suit the location and environmental conditions.
18. Mounting method: Suitable for 35 mm DIN rail.
19. Enclosure: Generally the equipment shall be provided within switchboards and distribution boards but the contractor shall provide enclosure for the surge protection equipment where required.
20. Execution: [Pr_65_72_27/610 Installing surge protective devices for low voltage power supplies](#) and [Pr_70_75_88/620 Installing surge protective devices for telecommunications and signalling networks](#).

Pr_65_72_27_52 Miniature circuit breakers

1. Description:
2. Manufacturer: Schneider or equal and approved.
3. Standards: To BS EN 60898-1 and To BS EN 60898-2.
4. Third party certification: ASTA Type test certification.
5. Rated operational current (In): Refer to distribution board schedules.
6. Rated operational voltage (Ue): 230 V a.c and 400 V a.c.
7. Rated impulse withstand voltage (Uimp) : The circuit breaker shall be able to withstand the levels of impulse voltage expected at the points in the installation at which the MCBs are to be installed.
8. Rated frequency: 50 Hz.
9. Number of poles: Single;
Double;
Triple;
and Four.
10. Rated short-circuit capacity (Icn): The circuit breaker shall have a rated short-circuit current capacity to be able to easily withstand the short-circuit fault current expected at the points in the installation at which the MCBs are to be installed.

Refer to the distribution board schedules for information.

11. Tripping characteristic: B;
C;
and D.
12. Pollution degree category: In accordance with BS EN 60947-1 to suit the project requirements.
13. Features: Supply connection either side.
14. Mounting method: DIN rail.
15. Accessories: Locking kit;
Phase barriers;
and Terminal covers.

Pr_65_72_27_53 Moulded case circuit breakers

1. Description:
2. Manufacturer: Schneider or equal and approved.
3. Standards: To BS EN 60947-1 and BS EN 60947-2.
4. Third party certification: ASTA Type test certification.
5. Rated operational current (In): Refer to LV Schematic.
6. Number of poles: Refer to LV schematic and schedules:
Double;

- Triple;
and Four.
7. Rated operational voltage (Ue): 230 V a.c and 400 V a.c.
 8. Rated insulation voltage (Ui): 800 V a.c.
 9. Rated impulse withstand voltage (Uimp) : 8 kV.
 10. Rated frequency: 50 Hz.
 11. Rated ultimate short-circuit breaking capacity (Icu): The unit shall be able to withstand the maximum short-circuit breaking capacity at installation point of the electrical distribution system.
 12. Rated service short-circuit breaking capacity (Ics): The unit shall be able to withstand the maximum short-circuit breaking capacity at installation point of the electrical distribution system.
 13. Utilization category: Category A - comprises circuit-breakers not specifically intended for selectivity under short-circuit conditions with respect to other short-circuit protective devices in series on the load side, i.e. without an intentional time delay; or one which is not in accordance with the requirements of BS EN 60947-2 British Standards link, Table 3.
 14. Protection
 - 14.1. Type: Adjustable.
Electronic.
Thermal/ magnetic.
 - 14.2. Characteristics: Interchangeable and Integral.
 - 14.3. Settings: The following settings shall be provided where required:
 - Adjustable thermal and fixed magnetic;
 - Adjustable thermal, and magnetic;
 - Adjustable magnetic;
 - Earth leakage;
 - Fixed magnetic;
 - Fixed thermal and magnetic;
 - Fully adjustable.
 - 14.4. Parameters: The following parameters may be adjusted where required:
 - Earth leakage sensitivity;
 - Earth leakage time delay;
 - Long-time delay;
 - Magnetic adjustment;
 - Short-time delay;
 - Thermal adjustment.
 - 14.5. Special features: The following special features shall be provided where required:
 - Earth leakage function test/ self-test.
 - Phase-failure sensing.
 - Locked rotor (used for magnetic MCCBs protecting electric motors).
 - Protection of the neutral conductor (frequently available as a % setting of the phase currents).
 - Circuit breaker position (racked in or out).
 15. Measurement: Not required.
 16. Visual indication: LED indication of earth leakage levels and LED indication of overload conditions.
 17. Adjustment: Rotary dials.
 18. Communications
 - 18.1. Remote monitoring: Not required.
 - 18.2. Displays: Not required.
 19. Suitable for isolation: Required.
 20. Operating handle
 - 20.1. Manual: Rotary direct.
 - 20.2. Electrical: Remote control not required.
 21. Mechanical interlocking: Captive key exchange type with square faced key and alphabetical or numerical coded operating face.
 22. Method of installation: Fixed and Withdrawable.
 23. Ingress protection (minimum): In accordance with BS EN 61386 and to suit project requirements and environmental conditions.
 24. Connections
 - 24.1. Position: Front and Rear.

24.2. Configuration: Screw-type.

25. Accessories: Not required.

Pr_65_72_27_73 Residual current circuit breakers with integral overcurrent protection

1. Description:
2. Manufacturer: Schneider or equal and approved.
3. Standards: To BS EN 61009-1
4. Operating characteristic: RCBOs to BS EN 61009-1 with an 'A' characteristic that are sensitive to both sinusoidal a.c. and pulsating d.c. currents.
5. Tripping characteristic: Type B;
Type C;
and Type D.
6. Rated operational current (In): Refer to distribution board schedules.
7. Rated operational voltage (Ue): 230 V a.c and 400 V a.c.
8. Rated impulse withstand voltage (Uimp) : 4 kV.
9. Rated frequency: 50 Hz.
10. Number of poles: Double;
Triple;
and Four.
11. Rated short-circuit capacity (Icn): The circuit breaker shall have a rated short-circuit current capacity to be able to easily withstand the short-circuit fault current expected at the points in the installation at which the MCBs are to be installed.

Refer to the distribution board schedules for information.

12. Rated residual operating current: 30 mA.
13. Time delay:
14. Pollution degree category: In accordance with BS EN 60947-1 to suit the project requirements.
15. Features: Supply connection either side.
16. Mounting method: DIN rail.
17. Accessories: Locking kit;
Phase barriers;
and Terminal covers.

Pr_65_72_27_74 Residual current monitors

1. Description:
2. Manufacturer: Schneider or equal and approved.
3. Standard: To BS EN 62020.
4. Enclosure
 - 4.1. Ingress protection (minimum): To suit the location and environmental conditions and in accordance with BS EN 60529.
 - 4.2. Material: Polycarbonate and Steel.
 - 4.3. Finish: Powder coated.
 - 4.4. Colour: To match main equipment.
5. Mounting: DIN rail mounted.
6. Rated operational voltage (Ue): 230 V a.c.
7. Nominal frequency: 50 Hz.
8. Response differential current: 30 mA.
9. Discrimination threshold
 - 9.1. Main alarm: 80% of set differential current.
 - 9.2. Pre-alarm: Adjustable between 10–90% of main alarm threshold.
10. Response time: Adjustable between 0.1s–1s.
11. Output: Integral audible alarm and Integral visual indicator.
12. Execution: [Pr_80_51_51/620 Installing electrical monitoring and metering equipment.](#)

Pr_75_51_52_15 Control and protective switching devices

1. Description:
2. Manufacturer: Schneider or equal and approved.
3. Standards: To BS EN 60947-6-2.
4. Number of poles: Double;
Triple;
and Four.
5. Method of operation: Electromagnetic.
6. Method of control: Automatic.
7. Reset after overload: Local manual resetting.
8. Rearming after short-circuit: Manual via a circuit breaker.
9. Rated operational voltage (Ue): 400 V.
10. Rated operational current (Ie): Submit proposals .
11. Rated operational frequency: 50 Hz.
12. Rated service breaking capacity (Ics): 50kA
13. Utilization category: AC-40.
14. Tripping class: Submit proposals .
15. Communication protocol: Submit proposals .
16. Control functions: Manufacturer's standard .
17. Enclosure
 - 17.1. Ingress protection (minimum): To BS EN 60529, IP31.
 - 17.2. Material: Polycarbonate.
 - 17.3. Finish: Submit proposals .
18. Execution: [Pr_60_70_22/665 Installing switchgear generally.](#)

Pr_80_51_51_19 Current transformers

1. Description:
2. Manufacturer: In accordance with the LV Switchgear and metering manufacturers instructions.
3. Standard: To BS EN 61869-2.
4. Accuracy classification
 - 4.1. For use with protective equipment: Provide separate current transformers for each protection device and instrumentation. Ensure current transformers provide appropriate accuracy and are compatible with over current factors, characteristics, performance and VA rating required for satisfactory operation of protection devices, instruments and meters indicated.
 - 4.2. For use with measuring equipment: As above
5. Format: Cast resin encapsulated solid ring.
6. Size:
7. Primary rating: In accordance with the LV Switchgear and metering manufacturers instructions and to suit project requirements.
8. Secondary rating: In accordance with the LV Switchgear and metering manufacturers instructions and to suit project requirements.
9. Rated short time current: Match the rating of the circuit in which the current transformer is installed.
10. Test links: Provide for connection of calibration instruments and meters.
11. Mounting arrangement: Busbar;
DIN rail;
and In-built mounting feet.
12. Execution: [Pr_80_51_51/610 Installing current transformers.](#)

Pr_80_51_51_22 Digital metering equipment

1. Description:
2. Manufacturer: As switchboard and distribution board manufacturer
3. Standard: To BS EN 50470-1.
4. Third party certification: Measuring Instruments Directive approved when used for billing purposes.
5. Display: LCD.

6. Rated voltage: 230 V a.c and 400 V a.c.
7. Phase arrangement: Single phase, two-wire;
Three phase, three-wire;
and Three phase, four-wire.
8. Current measuring range: To suit the requirements of either the direct connected or CT meter and in accordance with the project requirements.
9. Rated frequency: 50 Hz.
10. Metering functions: Voltage between phases (V);
Voltage between phases and neutral (V);
Phase currents (A);
Frequency (Hz);
Power factor $\cos \phi$;
Active power (kW);
Reactive power (kVA(r));
Active energy (kWh);
and Reactive energy (kVA(r)h).
11. Mounting: DIN rail mounted and Recessed into switchgear assembly.
12. Ingress protection (minimum): To suit the location and environmental conditions and in accordance with BS EN 60529.
13. Outputs: RS232/485;
Ethernet;
and Pulse output module.
14. Execution: [Pr_80_51_51/620 Installing electrical monitoring and metering equipment.](#)

Execution

[90-50-45/635](#) Installing power busbar trunking

1. Generally: In accordance with BS 7671.
2. Position: As per contractors installation drawings
3. Expansion joint interval (maximum): 30m.
4. Supports and fixings:
 - 4.1. Supports: Suspension rods and steel channels.
 - 4.2. Finish and colour: Match trunking.
 - 4.3. Locations where moisture may occur: Corrosion resistant, selected to prevent deterioration by electrolytic action.
5. Trunking: Clean immediately before handover.

[90-55-15/640](#) Extra low and low voltage cable routes

1. Cables generally:
 - 1.1. Concealed cable runs to wall accessories: Run vertically from the accessory.
 - 1.2. Exposed cable runs: The contractor shall contain cabling within rigid conduit where cable runs are exposed. Final connection to containment shall be within flexible conduit.
2. Distance from other services running parallel (minimum): 150 mm. Position cables below heating pipes.

[90-55-15/645](#) Low voltage cables concealed in walls and partitions

1. Position: In a zone within 150 mm of wall perimeter (except at the floor); and run vertically or horizontally from these zones, or from floor level, to switches, accessories, etc and At least 50 mm from the surface.
2. Protection: [Pr_65_70_11_71 Rigid conduit](#) and Cover with galvanized steel channel nailed to substrate.

[90-55-15/655](#) Extra low and low voltage surface mounted cables

1. Fastening: Direct to surface.
2. Orientation: Dress cables flat, free from twists, kinks and strain.
3. Terminating cables when not using glands: Take sheathing of cables into accessory boxes and equipment and protect against abrasion with grommets.

[Pr_20_29_03/611](#) Fixing anchors using cartridge-applied adhesive

1. Position: In accordance with contractors installation information.

2. Preparation of surface, hole into which chemical is applied: Drill hole to correct diameter and depth. Clean drill hole and remove all dust, water and debris.
3. Installation: Dispense to waste until an even colour and then pump into hole. Insert stud or socket with a twisting action.
4. Curing: Allow to cure prior to attaching fixture.

Pr_20_29_03/620 Fixing anchors using chemical anchor capsules

1. Position: In accordance with contractors installation information.
2. Preparation of surface, hole into which chemical is applied: Drill hole to correct diameter and depth. Clean drill hole and remove all dust, water and debris.
3. Installation: Place capsule in drill hole. Drive stud through capsule until stud reaches the base of the hole or the depth marker on the stud is reached.
4. Curing: Allow to cure prior to attaching fixture.

Pr_60_70_22/665 Installing switchgear generally

1. General requirements: In accordance with the contractors installation information.
2. Switchgear cubicles: Arrange in modular form to facilitate future extension.
3. Clearance (minimum)
 - 3.1. Front access switchgear: 1000 mm in front of switchgear.
 - 3.2. Rear access switchgear: 1000 mm in front of and behind switchgear.
4. Fixing equipment
 - 4.1. Generally: Fix independently of wiring installation with zinc electroplated fasteners.
 - 4.2. Indoor equipment: Fix using internal lugs.
 - 4.3. Outdoor equipment: Fix using external lugs.
5. Orientation: Accurate and square to vertical and horizontal axes. Align adjacent items of switchgear on the same horizontal axis.
6. Extension boxes: Provide where necessary.
7. Gland plates: Non-ferrous for single core cables.
8. Interconnection of close coupled switchgear
 - 8.1. Cable type: Copper busbar links.
 - 8.2. Containment: Manufacturer's enclosure.
9. Identification
 - 9.1. Neutral and earth bar terminals: Label with the outgoing circuit reference.
 - 9.2. Cable terminations: Label with circuit reference, with push-on plastics markers.

Pr_60_70_48/640 Installing tap-off units

1. Generally: In accordance with BS 7671.
 2. Position: As per contractors installation drawings
- Tap-off point intervals: To suit the equipment being connected.

Pr_60_70_48/645 Installing feed units

1. Generally: In accordance with BS 7671.
2. Position: As per contractors installation drawings

Pr_60_70_48/650 Installing fire barrier units

1. Generally: In accordance with BS 7671.
2. Position: At each location where the busbar trunking passes through a fire compartment.

Pr_65_70_11/621 Installing cable tray and cable ladder

1. Standards: In accordance with BS 7671 and IET Guidance Note 1.
2. Preparation
 - 2.1. Burrs and sharp edges: Make smooth.
 - 2.2. Cutting: Minimize and make good edges. Cuts to cable tray to be square along an unperforated line.

- 2.3. Treatment of cut surface: Extend 25 mm beyond the cut. Match finish of cable supports.
3. Access: Provide space around cable ladder and tray to permit access for installing and maintaining cables.
4. Joints and expansion couplers
 - 4.1. Joints and expansion couplers: Locate between the bracket support and the quarter point.
 - 4.2. Position:
 - 4.3. Number of joints: Minimize.
 - 4.4. Lengths of cable ladder and tray: Maximize.
 - 4.5. Ends: Blank with end plates.
5. Changes of size and direction: Manufacturer's accessories of the same material type, pattern, finish and thickness as cable supports.
6. Fire barriers: Provide where required to maintain fire performance of fabric.
7. Protective covers: Provide to cables requiring mechanical protection.
8. Support
 - 8.1. Fixing arrangement: Independently fix and support from building structure using threaded rod fixed to channel cable support with shake proof washers and hex nuts;
Independently fix and support from building structure using threaded rod fixed into expanding anchors;
and Independently fix and support from building structure using threaded rod fixed into resin injection anchors.
 - 8.2. Clearance from building fabric (minimum): 20 mm.
9. Components: Avoid contact between dissimilar metals. Contact between dissimilar materials shall not occur in external environments. Where un-avoidable a suitable insulator shall be provided between the metals to prevent any corrosion occurring.
10. Routing of cable ladder and tray: The contractor shall submit installation drawings showing the proposed routes of cable ladder and cable tray.

Pr_65_70_11/630 Installing cable basket

1. Standards: In accordance with BS 7671 and IET Guidance Note 1.
2. Joints: Cut adjacent cross basket wires. Make smooth any burrs or edges.
3. Accessories: Form on site and connect with basket manufacturer's coupling components.
4. Fire barriers: Provide where required to maintain fire performance of fabric.
5. Support
 - 5.1. Fixing arrangement: Independently fix and support from building structure using threaded rod fixed to channel cable support with shake proof washers and hex nuts;
Independently fix and support from building structure using threaded rod fixed into expanding anchors;
and Independently fix and support from building structure using threaded rod fixed into resin injection anchors.
 - 5.2. Clearance from building fabric (minimum): 20 mm.
6. Components: Avoid contact between dissimilar metals.
7. Routing of cable basket: The contractor shall submit installation drawings showing the proposed routes of cable basket.

Pr_65_70_11/640 Installing cable supports on roofs

1. Position: Elevate above roof.
2. Mounting: Load spreading supports.

Pr_65_70_11/650 Multiple cable runs

1. Requirement: Use cable basket when three or more cables are run in parallel;
Use cable ladder when two or more cables run in parallel;
Use cable tray when three or more cables are run in parallel;
and Use cable trunking when three or more conduits are run in parallel.

Pr_65_70_11/660 Testing and commissioning of site-assembled busbar trunking type B

1. Notice before testing and commissioning: 7 days.
2. Routine testing and commissioning: Submit results.

3. Additional inspection and testing: Check and adjust tightness of busbar connections and supports.
Check tightness of bolted connections.
Check busbar joints using ductor resistance measurements.
Check earth connections.
Check clearance of live parts from direct contact.
Carry out earth fault protection simulation tests.
4. Inspection and test results: Submit.

Pr_65_70_11/661 Cable support zones

1. Ceiling voids: Provide clear distance of 150 mm (minimum) between underside of any cable supports and brackets and the topside of ceiling.

Pr_65_70_11/700 Installing conduit, trunking and ducting

1. Standards: In accordance with BS 7671 and IET Guidance Note 1.
2. Preparation: Cut square. Remove burrs and sharp edges to make smooth.
3. Protection of metallic conduit, trunking and ducting
 - 3.1. Joints and ends: Remove grease, oil, dirt and rust before applying protective paint. Paint immediately following installation.
 - 3.2. Protective paint
 - 3.2.1. Generally: Compatible with conduit, trunking and ducting finish.
 - 3.2.2. Type: Match factory finish.
4. Cross-sectional area: Maintain throughout the conduit, trunking and ducting length.
5. Arrangement: Position vertically and horizontally in line with equipment served, and parallel with building lines.
6. Spare containment: Install one spare 25 mm diameter conduit from each distribution board to the nearest accessible void space, terminating in a conduit box with lid.
7. Draw wires: Install galvanized soft iron wires within spare conduit, trunking and ducting.
8. Distance from other services running parallel (minimum)
 - 8.1. Generally: 150 mm.
 - 8.2. Above radiators: 1000 mm.
 - 8.3. Steam services: 600 mm.
9. Drainage of conduit, trunking and ducting: Locate drainage outlets at lowest points in conduit, trunking and ducting installed externally, and where condensation may occur.
10. Fire barriers: Provide to maintain integrity of fire compartments.
11. Rewireable installations: Enable rewiring from accessible boxes or accessories only.
12. Support: Independently fix and support conduit, trunking and ducting from building structure.
13. Cleaning: Clean insides of conduit, trunking and ducting before installing cables.
14. Cabling: Install when conduit, trunking and ducting enclosure is complete.
15. Submittals: Submit manufacturer's technical information. Submit drawings showing the proposed routes of conduit, trunking and ducting and the location of service outlets.

Pr_65_70_11/710 Installing conduit generally

1. Fixing: Fix securely. Fix boxes independently of conduit.
2. Changes of direction: Conduit boxes or bends site formed by machine. Do not use elbows, tees or inspection bends.
3. Joints
 - 3.1. Generally: Manufacturer's jointing fittings shall be provided.
 - 3.2. Number of joints: Minimize.
 - 3.3. Lengths of conduit: Maximize.
 - 3.4. Open ends: Plug.
 - 3.5. At movement joints in structure: Manufactured expansion coupling. Install adaptable boxes on both sides of joint at a maximum distance of 300 mm.
4. Connections to boxes, trunking, equipment and accessories: Screwed couplings with rubber bushes at open ends.
5. Conduit boxes
 - 5.1. Generally: Install flush with finished surfaces. Provide extension rings if required.

- 5.2. Fixing screws: Countersunk, or round-headed screws.
- 5.3. Number of fixings (minimum): Two.
- 5.4. Lids: Fasten with brass slot pan head screws.
- 6. Rear outlet boxes: Locate where surface conduits pass through walls to external equipment.
- 7. Draw-in boxes
 - 7.1. Spacing (maximum): 10 m.
 - 7.2. Number of bends between draw-in boxes (maximum): Two.
 - 7.3. Floors: Do not install draw-in boxes in floors.
- 8. Conduit in walls: Avoid concealed horizontal runs.
- 9. Suspended ceiling installations: Fasten outlet boxes to structure above ceiling.

Pr_65_70_11/720 Installing rigid metallic conduit

- 1. General requirements: [Pr_65_70_11/710 Installing conduit generally](#) and [Pr_65_70_11/700 Installing conduit, trunking and ducting](#).
- 2. Fixings: Distance saddle; Saddle; and Spacer bar saddle.
- 3. Joints: Plain and Screwed.
- 4. Threaded conduits: Tightly screw to ensure electrical continuity, with no thread showing.
- 5. Conduit connections to boxes and items of equipment, other than those with threaded entries: Earthing coupling with male brass bush and protective conductor.

Pr_65_70_11/725 Installing rigid non metallic conduit

- 1. General requirements: [Pr_65_70_11/710 Installing conduit generally](#) and [Pr_65_70_11/700 Installing conduit, trunking and ducting](#).
- 2. Fixings: Distance saddle; Saddle; and Spacer bar saddle.
- 3. Joints: Compression and Threaded.
- 4. Conduit connections to boxes and items of equipment: Threaded bushed entries.

Pr_65_70_11/765 Conduit, trunking and ducting zones

- 1. General requirements: [Pr_65_70_11/700 Installing conduit, trunking and ducting](#).
- 2. Ceiling voids: Provide clear distance of 150 mm (minimum) between underside of any conduit, trunking or trunking and the topside of ceiling.

Pr_65_70_48/635 Installing low voltage cables

- 1. Standard: In accordance with BS 7671.
- 2. Timing: Do not start internal cabling until building enclosure provides permanently dry conditions.
- 3. Preparation: Store cables above 5°C for 24 hours before installation. Clear cable path of debris.
- 4. Installation temperature (minimum): 5°C.
- 5. Cables: Install in one length. Dress cables flat, free from twists, kinks and strain.
- 6. Cable pulling: Do not overstress. Prevent kinks and twisting of the cable.
- 7. Cable protection: Cables passing through walls and floors to be sleeved with conduit or pipeduct to a minimum of 300 mm. Bush at both ends. Ensure that appropriate fire stopping materials are used to maintain the original fire integrity of the wall or floor around the penetration.
- 8. Concealed cable runs to wall accessories: Run vertically from the accessory.
- 9. Exposed cable runs: Minimum 25 mm between cable face and structure.
- 10. Distance from other services running parallel (minimum): 150 mm. Position cables below heating pipes.
- 11. Jointing and termination
 - 11.1. Final circuit cables: At electrical accessories only.
 - 11.2. Core connections: Using compression lugs to equipment without integral clamping terminals.
 - 11.3. Terminating cables when not using glands: Take sheathing of cables into accessory boxes and equipment and protect against abrasion with grommets.

Pr_65_70_48/660 Installing low voltage cables in conduit and trunking

1. Cable installation: Orderly and capable of being withdrawn.
2. Single core wiring: Arrange using the loop-in method.
3. Cables within trunking: Tie at 2 m intervals for cables of the same circuit reference. Label ties with circuit reference number at 10 m intervals.
4. Cables in vertical conduit: Provide cable clamps in accessible conduit boxes at 5 m intervals.
5. Extra low voltage cables: Install within a separate partition from low voltage cables where installed in multi compartment trunking.

Pr_65_70_48/680 Installing low voltage armoured cables

1. General requirements: [Pr_65_70_48/635 Installing low voltage cables](#) .
2. Earthing: Bond the sheaths and armour of low voltage cables solidly to earth:

- Multicore cables, at both ends.
- Single core cables, at both ends.

The contractor shall ensure that the connected equipment terminals are suitable rated for any circulating currents that may occur.

3. Connections to apparatus: Moisture proof, sealed glands and shrouds.

Pr_65_70_48/720 Cables in ducts

1. Cable installation from cable drums: Submit method statement.
2. Single core trefoil cable groups and protective conductors: Install within a single duct and bind at 1 m intervals.

Pr_65_70_48/730 Installing warning devices for underground cables

1. Installation: Warning devices to be laid 100 mm above top of cable or duct.

Pr_65_70_48/735 Cable installation on channel cable supports, cable tray, cable ladder and cable basket

1. Cabling: Install when cable supports are complete.
2. Position: Place single and multicore cables side by side.
3. Fastening
 - 3.1. Fastenings generally: Secure cables, do not indent sheaths. Position to enable any submain cable to be individually removed.
 - 3.2. Submain cables <95 mm²: [Pr_65_70_11_13 Cable cleats](#).
 - 3.3. Submain cables >95 mm²: [Pr_65_70_11_13 Cable cleats](#) and [90-55-10/320 Cable bands](#).
 - 3.4. Final circuit cabling: Cable ties at 250 mm (maximum) spacing.
 - 3.5. Extra low voltage, communications and fibre optic cabling: Cable ties at 250 mm (maximum) spacing.

Pr_65_72_27/610 Installing surge protective devices for low voltage power supplies

1. Standards: In accordance with BS 7671 and DD CLC/TS 61643-12.
2. Point of installation: As per contractors installation information.
3. Mounting arrangement: Separate enclosure.
4. Connection arrangement: In parallel with the main circuit current carrying path and in series with the main circuit current carrying path.
5. Interconnecting cable
 - 5.1. Cable type: In accordance with the manufacturers instructions.
 - 5.2. Cable size: In accordance with the manufacturers instructions.
 - 5.3. Cable length (maximum): 500 mm.
 - 5.4. Cable installation: Tightly bind connecting leads together.

Pr_70_75_88/620 Installing surge protective devices for telecommunications and signalling networks

1. General requirements: [Pr_65_72_27/610 Installing surge protective devices for low voltage power supplies](#) .
2. Standards: In accordance with BS 7671 and PD CLC/TS 61643-22.

3. Point of installation: As per contractors installation information.
4. Mounting arrangement: Separate enclosure.

Pr_80_51_51/610 Installing current transformers

1. Standard: In accordance with BS 7671.
2. Identification details: Mount current transformers so that polarity markings and name plate details are easily viewed in situ.

Pr_80_51_51/620 Installing electrical monitoring and metering equipment

1. Standard: In accordance with BS 7671.
2. Digital metering equipment: Connect to building management system.

Ss_70_30_45/605 Factory inspections

1. Notice before inspection and testing:
2. Equipment for inspection and testing:
3. Factory inspections
 - 3.1. Custom made products:
 - 3.2. Assembly completed, busbars exposed and functional units assembled:
 - 3.3. Factory testing of assembly:

Ss_70_30_45/625 Installing low voltage distribution systems

1. Standard: In accordance with BS 7671.
2. Layout: Position cabling and equipment to provide safe and easy access for operation and maintenance.

Ss_70_30_45/650 Connection to the incoming supply

1. Customer's installation: Connect to the incoming point of supply.

90-50-45/635 Installing power busbar trunking Distribution

1. Generally: In accordance with BS 7671.
2. Position: As per contractors installation drawings
3. Expansion joint interval (maximum): 30m.
4. Supports and fixings: Unistrut
 - 4.1. Supports: Suspension rods and steel channels.
 - 4.2. Finish and colour: Manufacturers standard
 - 4.3. Locations where moisture may occur: Corrosion resistant, selected to prevent deterioration by electrolytic action.
5. Trunking: Clean immediately before handover.

90-50-45/635 Installing power busbar trunking Risers

1. Generally: In accordance with BS 7671.
2. Position: As per contractors installation drawings
3. Expansion joint interval (maximum): 30m.
4. Supports and fixings: Vertical wall brackets
 - 4.1. Supports: Steel channels.
 - 4.2. Finish and colour: Match trunking.
 - 4.3. Locations where moisture may occur: Corrosion resistant, selected to prevent deterioration by electrolytic action.
5. Trunking: Clean immediately before handover.

90-50-45/635 Installing power busbar trunking Under floor

1. Generally: In accordance with BS 7671.
2. Position: As per contractors installation drawings
3. Expansion joint interval (maximum): 30m.
4. Supports and fixings: Hold down clamps

- 4.1. Supports: Hold down clamps
- 4.2. Finish and colour: Manufacturers standard.
- 4.3. Locations where moisture may occur: Corrosion resistant, selected to prevent deterioration by electrolytic action.
5. Trunking: Clean immediately before handover.

Pr_65_70_11/660 Testing and commissioning of site-assembled busbar trunking Distribution

1. Notice before testing and commissioning: Seven days.
2. Protective devices settings: As Stage 4 calculations
3. Routine testing and commissioning: Submit results.
4. Additional inspection and testing: Check and adjust tightness of busbar connections and supports.
Check tightness of bolted connections.
Check busbar joints using ductor resistance measurements.
Check earth connections.
Check clearance of live parts from direct contact.
Carry out earth fault protection simulation tests.
5. Inspection and test results: Submit.

Pr_65_70_11/660 Testing and commissioning of site-assembled busbar trunking Risers

1. Notice before testing and commissioning: Seven days.
2. Protective devices settings: Fuse
3. Routine testing and commissioning: Submit results.
4. Additional inspection and testing: Check and adjust tightness of busbar connections and supports.
Check tightness of bolted connections.
Check busbar joints using ductor resistance measurements.
Check earth connections.
Check clearance of live parts from direct contact.
Carry out earth fault protection simulation tests.
5. Inspection and test results: Submit.

Pr_65_70_11/660 Testing and commissioning of site-assembled busbar trunking Under floor

1. Notice before testing and commissioning: Seven days.
2. Protective devices settings: MCB
3. Routine testing and commissioning: Submit results.
4. Additional inspection and testing: Check and adjust tightness of busbar connections and supports.
Check tightness of bolted connections.
Check busbar joints using ductor resistance measurements.
Check earth connections.
Check clearance of live parts from direct contact.
Carry out earth fault protection simulation tests.

Inspection and test results: Submit

System completion

Ss_70_30_45/811 Inspecting, testing and commissioning of switchgear generally

1. Standard: In accordance with BS 7671.
2. Notice before testing and commissioning: 7 days.
3. Switches and circuit breakers: Clean to remove all visible traces of dust.
4. Protective devices settings: To be confirmed by the contractor.
5. Switchboard monitoring: Continuous for 30 minutes following first energizing.
6. Additional inspecting and testing: Check levelling and alignment of assembly;
Check operation of instruments and metering devices;
Check and adjust tightness of busbar connections and supports;
Check tightness of bolted connections;
Check busbar joints with duct or resistance measurements;
Check earth connections at compartments, switches and earth electrodes;
Check clearance of live parts from direct contact;
Check polarity and phase sequence of protective devices;
Check operation of protective devices using secondary and primary current injection;

Manually operate protective devices;
 Carry out earth fault protection simulation tests;
 Check functional operation of circuit breakers;
 and Check operation of switch tripping devices.

7. Testing and commissioning results: Submit three copies.
8. Certificates of calibration for meters and instruments: Submit.

Ss_70_30_45/813 Inspecting, testing and commissioning harmonic filters

1. Standard: In accordance with BS 7671.
2. Commissioning of filters: By manufacturer.
3. Notice before testing and commissioning: 7 days.
4. Operation of instruments and displays: Check and confirm correct display of:;
 Supply current (rms) L1, L2, L3 and neutral current;
 Load current (rms) L1, L2, L3 and neutral current;
 Supply THD % L1, L2, L3;
 Load THD % L1, L2, L3;
 Supply voltage;
 Load on the filter expressed as a percentage for L1, L2, L3;
 Detailed load current spectrum including individual measurement of the fundamental, and each harmonic up to and including 25th expressed as a percentage, and the TDHI of the current absorbed by the load;
 Detailed supply current spectrum including individual measurement of the fundamental, and each harmonic up to and including 25th expressed as a percentage, and the TDHI of the current supplied by the Electricity Distributor;
 Check and confirm correct operation of:;
 Reactive compensation;
 Selection of harmonic orders for mitigation;
 Number of parallel connected filters;
 Alarm functions;
 Communication port function;
 and Identification function.
5. Controls: Commission and adjust for optimum harmonic mitigation and reactive power compensation.
6. Inspecting, testing and commissioning results: Submit three copies.

Ss_70_30_45/821 Documentation

1. Operating and maintenance instructions
 - 1.1. Scope: Submit for the system giving optimum settings for controls.
 - 1.2. Product information: Include product description, date of purchase, performance characteristics, application (suitability for use), method of operation and control, and cleaning and maintenance requirements.
 - 1.3. Format: Electronic and Paper copy.
 - 1.4. Number of copies: Two.
2. Record drawings
 - 2.1. Content: Location, route and depth of underground cables;
 Location of LV switchgear including distribution boards;
 Routes of trunking, conduit, cable tray and cable ladders;
 and Schematic drawings showing all low voltage distribution circuits: the cable origin, circuit designation, cable type, size, number of cores, size and type of overcurrent protective device.
 - 2.2. Drawing format: Full size paper print drawing and Electronic drawing.
 - 2.3. Number of copies: Two.
3. Submittal date: Four weeks before handover.

Ss_70_30_45/831 Spares and consumables

1. Supply the following spares
 - 1.1. Fuses: 5% of each type and rating used. e.g. MCB, MCCB, RCBO
 - 1.2. Operating handles for circuit breakers and switches: One per device.

Ss_70_30_45/840 Maintenance

1. Servicing and maintenance: Undertake.
2. Duration: Until 12 months after Practical Completion.

Ω End of System

Ss_70_30_80_35

Hardwired voltage small power systems

Systems

Ss_70_30_80_35 Hardwired voltage small power systems

1. Description: **Contractors Responsibilities**

The Contractor shall develop the tender design to completion, supply, install, co-ordinate with other contractors, test, commission and set to work the complete hard wired low voltage small power system. This shall include all necessary tools, labour, materials and equipment required to provide a complete working installation that fully meets the functional and performance criteria specified within this specification.

The Contractor shall include for provision of maintenance to the system, seasonal commissioning activities and rectification as required by the Contract and the Mechanical & Electrical Specification.

Function/Objectives

A complete and fully operational small power installation shall be provided.

Applicable Standards

In addition to this specification, the small power installation shall comply with the following standards and guidelines current at the time of tender:

- Building Regulations
- British Standards
- The requirements of the local Building Control Authority
- Relevant HSE Guidance
- BSRIA Standards & Guidance notes
- CIBSE Guides & Notes.
- MoD Specifications, Design and Maintenance Guides and Technical Bulletins.
- Client Specific Requirements.
- Manufacturers' guidelines.

Any discrepancies identified by the contractor between the specification and the above documents shall be brought to the attention of the CA immediately.

System Descriptions

The contractor shall supply, install, test and commission a complete small power installation.

The small power circuits shall be provided as necessary and shall be supplied from the relevant local distribution board. The wiring shall generally be LS0H single core cables in trunking and conduit and shall be fully re-wireable.

All socket outlets and distribution boards are to be provided with earth terminals/bars to comply with regulation BS7671. High quality white accessories in a high grade thermoset material will be provided for general areas. For areas where the accessories are likely to sustain either high usage or mechanical impact (plantroom etc) metalclad types shall be provided. All socket outlets will contain double pole switches and include double earth connections internally.

Power to desks will be provided via underfloor power track systems. Each individual track will be rated at 63A and will be located under the raised floor. Each track will be fed by a multi-core armoured cable from the distribution board serving the space. Tap-off units will plug into the power track and each tap-off will be wired into a floor-box housing 13A sockets and data outlets. Each floor box will be equipped with an integral RCBO rated at 20A to protect the switchgear within the floor box and any items downstream. The contractor shall design the final arrangement to suit the architects FF&E layouts.

Dedicated switched cleaners socket outlets shall be provided within each area as indicated on the layouts. These outlets shall be labelled as 'Cleaners' and shall be RCD protected.

Small power circuits shall be provided with RCD protection in accordance with BS7671.

All remaining minor items of fixed equipment shall be supplied via double pole, fused connection units, appropriately switched and provided with neon indication and flexible outlets as required.

Individual items requiring power supplies are as identified below (this list is not exhaustive):

- Fire alarm equipment.
- Lifts.
- Data cabinets.
- Hand dryers.
- Automatic opening doors.
- Electronic door access equipment.
- Mechanical services power supplies as required.
- CCTV Equipment.
- BMS outstation / equipment supplies
- Mechanical Plant i.e. AHU's, VRF indoor/outdoor units
- Socket outlets and fused connection units within the HV switch room, substations, plant rooms and energy centre
- Fire Curtians
- MFSDs

Socket outlets in external locations shall be housed in minimum IP66 weatherproof enclosures.

Where high level connection units are specified, include for connecting these to the controlled units by means of 25mm conduits and cable outlet boxes installed within the walls. Connection shall be made using conduit couplers and smooth bore brass bushes.

Surface installations shall only be used in the storage, cleaners rooms and plant areas and all remaining areas shall have a flush installation unless agreed prior to installation with the client and architect.

Include for providing and installing 13 amp fused connection units for controlling the various ancillary services as indicated and correctly fuse to the manufacturers specification

Mechanical Supplies

Provide supplies to mechanical control panels and condenser supplies as shown on the drawings.

Also liaise with the BMS and mechanical contractor during the tender period to ensure all required supplies are included in the tender.

Liaise with the BMS and Mechanical contractor during the tender period to ensure all power and control cabling, and all containment required, is included within the tender by either the Contractor or the BMS contractor.

Electrical supplies will be provided to all mechanical plant items. Large items of plant such as Heat Pumps will be supplied directly from the main LV switchboard as required. Electrical supplies to mechanical plant items shall generally utilise multi-core armoured cables with XLPE/LSOH insulation installed on medium duty cable trays. Provision shall be made for local isolation to each individual piece of equipment.

Electrical supplies to items of equipment such as condensing units and other ancillary equipment will be from either switched fused connection units or suitably rated isolators as appropriate. Supplies to items of equipment such as these shall utilise single core XLPE/LSOH insulated cable installed in trunking and conduit supplied from the respective local distribution board.

Labelling

The contractor shall provide a complete labelling installation to all small power equipment and accessories.

Commissioning

The contractor shall allow within their tendered costs the full commissioning of the complete small power system in accordance with this specification.

The Client representative shall be given due opportunity and notice to witness this commissioning. The contractor shall inform the engineer of the commencement of commissioning at least two weeks in advance.

Drawings:

See all relevant drawings in the drawing issue sheet.

2. System performance: [Ss_70_30_80/220 Selection of conduit, trunking and ducting generally](#) and [Ss_70_30_80/230 Multi-gang power outlets](#). [Ss_70_30_80/215 Low voltage small power cables generally](#); [Ss_70_30_80/210 Design of low voltage small power systems](#)
3. Connection to low voltage supply: Low voltage distribution system
4. Final circuit cabling: [Pr_65_70_48_75 Single core non-sheathed \(LHSF\) insulated cables](#); and [Pr_65_70_48_29 Fire-resistant screened \(LHSF\) cables](#).
5. Cable accessories: [Pr_65_70_11_15 Cable ties](#).
6. Containment: [Pr_65_70_11_12 Cable baskets](#); [Pr_65_70_11_30 Flexible conduit](#); [Pr_65_70_11_63 Pliable conduit](#); [Pr_65_70_11_71 Rigid conduit](#); [Pr_65_70_11_18 Cable trunking](#);
7. Containment accessories: [Pr_20_29_03_83 Stainless steel chemical anchor rods](#); [Pr_20_29_63_50 Masonry plugs Type A](#); [Pr_65_70_11_75 Service outlet boxes](#); [Pr_65_70_11_76 Service outlet poles](#); [Pr_65_70_11_20 Conduit fittings](#); and [Pr_65_70_11_19 Channel cable supports](#).
8. Rewireable installation: Required.
9. Concealed installation: Required.
10. Partial installation: Required.
11. Final connections: [Pr_65_70_48_58 Ordinary-duty heat-resistant PVC-insulated and sheathed flexible cables](#).
12. Power conditioning equipment:
13. Electrical accessories and outlets: [Pr_65_72_97_11 Cable couplers](#); [Pr_65_72_97_12 Cable outlet plates](#); [Pr_65_72_97_17 Ceiling power switches](#); [Pr_65_72_97_82 Specialist socket outlets](#); [Pr_65_72_97_23 Double pole switches](#); [Pr_65_72_97_30 Fan isolators](#); [Pr_65_72_97_31 Fused connection units](#); [Pr_60_70_48_11 Changeover switches](#); [Pr_65_72_97_52 Multi-gang power outlets](#); [Pr_65_72_97_41 Industrial socket outlets](#); [Pr_65_72_97_83 Surface and concealed wiring enclosures](#); and [Pr_65_72_97_84 Standard socket outlets](#).
14. Controls and starters: [Pr_75_51_52_26 Electromechanical contactors](#); [90-65-25/360 Electromechanical control circuit devices](#); [Pr_75_51_17_27 Emergency stop buttons](#); and [Pr_75_51_52_22 Direct-on-line starters](#).
15. Accessories:
16. Electrical identification: [Pr_40_10_57_29 Equipment labels and warning notices type B](#); [Pr_40_10_27_24 Electrical diagrams](#); and [Pr_40_10_27_27 Electrical shock treatment signs](#).
17. Execution: [Ss_70_30_80/620 Small power installation](#) and [Ss_70_30_80/630 Installing cabling to socket outlets](#).
18. System completion: [Ss_70_30_80/820 Documentation](#); [Ss_70_30_80/830 Spares](#); and [Ss_70_30_80/840 Maintenance](#). [Ss_70_30_80/812 Inspection, testing and commissioning of harmonic filters](#)

System performance

[Ss_70_30_80/210 Design of low voltage small power systems](#)

1. Provision of small power: For fixed and portable equipment requiring power.
2. Design: Complete for the low voltage small power systems.
3. Standards:
4. Diversity: In accordance with IET Guidance Note 1.
5. Spare capacity throughout the small power system:

6. Requirement: Submit proposals including detailed design drawings, technical information, calculations and manufacturers' literature.

Ss_70_30_80/215 Low voltage small power cables generally

1. Standard: In accordance with BS 7671.
2. Proposed selection of low voltage cables: Submit drawings, technical information, calculations and manufacturers' literature.
3. Conductor sizes (minimum):
4. Cable sizes not stated: Submit.
5. Format:

Ss_70_30_80/220 Selection of conduit, trunking and ducting generally

1. Standard: In accordance with BS 7671.
2. Requirement: Submit proposals including detailed design drawings, technical information, calculations and manufacturers' literature.
3. Conduit, trunking and ducting sizes not stated: Submit proposals including detailed design drawings, technical information, calculations and manufacturers' literature.

Ss_70_30_80/230 Multi-gang power outlets

1. Quantity: Refer to layout drawings

Products

See [90-55-10/320 Cable bands](#) in [Ss_70_30_45_45 Low-voltage distribution systems](#)

90-65-25/360 Electromechanical control circuit devices

1. Manufacturer: Eaton or equal and approved
2. Standard: To BS EN 60947-5-1.
3. Format: Indicator lights;
Push button;
and Rotary switch.
4. Number of poles: 2;
3;
and 4.
5. Interrupting medium: Air.
6. Operating method: Electromagnetic.
7. Control method: Automatic c/w a manual override facility.
8. Utilization category: In accordance with equipment connected manufacturers instructions.
9. Form: Single gap make-contact element
10. Features: Latch in actuating position;
Lock in open position;
and Position indicator.
11. Enclosure:
 - 11.1. Material: Polycarbonate.
 - 11.2. Ingress protection (minimum): To suit the location and environmental conditions in accordance with BS EN 60529.

See [Pr_20_29_03_83 Stainless steel chemical anchor rods](#) in [Ss_70_30_45_45 Low-voltage distribution systems](#)

Pr_20_29_63_50 Masonry plugs Type A

Shared by: [Ss_70_80_33_35 Hardwired general lighting systems](#)

1. Description:
2. Manufacturer: Rawplug or equal and approved.
3. Format: To suit substrate, loads to be supported and conditions expected in use. To be matched with the associated screw lengths.
4. Size: To suit the installation and weight of equipment to be fixed.

See [Pr_40_10_27_24 Electrical diagrams](#) in [Ss_70_30_25_25 Earthing and bonding systems](#)

See [Pr_40_10_27_27 Electrical shock treatment signs](#) in [Ss_70_30_25_25 Earthing and bonding systems](#)

See [Pr_40_10_57_29 Equipment labels and warning notices type B](#) in [Ss_70_30_25_25 Earthing and bonding systems](#)

Pr_60_70_48_11 Changeover switches

1. Description:
2. Manufacturer: Craig and Derricott or equal and approved
3. Standards: To BS EN 60947-1 and BS EN 60947-3.
4. Operating mechanism: Rotary handle with facility for padlock in the OFF position and door interlocked in either ON position.
5. Operating sequence: A manual operating sequence shall be provided with a open and close transition with a 'make before break' sequence (I-I+II-II)
6. Rated operational current (In): A fully rated operational current shall be provided to suit the installation requirements. Refer to the layout drawings and schematic for further information.
7. Rated operational voltage (Ue): 415 V;
500 V;
and 690 V.
8. Rated operational frequency: 50 Hz.
9. Number of poles: Triple and Four.
10. Rated short-time withstand current (Icw) for 1 s: In accordance with BS EN 60947-3 clause 4.3.6.1 so that the value of Icw is not less than 12 times the maximum rated operational current.
11. Rated short-circuit making capacity (Icm): The equipment shall have a suitable short-circuit making capacity current to suit the installation requirements.
12. Rated short-circuit breaking capacity (Icu): The equipment shall have a suitable short-circuit breaking capacity current to suit the installation requirements.
13. Utilization category: AC-23A.
14. Execution: [Pr_60_70_22/665 Installing switchgear generally](#).

See [Pr_65_70_11_12 Cable baskets](#) in [Ss_70_30_45_45 Low-voltage distribution systems](#)

See [Pr_65_70_11_13 Cable cleats](#) in [Ss_70_30_45_45 Low-voltage distribution systems](#)

See [Pr_65_70_11_15 Cable ties](#) in [Ss_70_30_45_45 Low-voltage distribution systems](#)

Pr_65_70_11_18 Cable trunking

Shared by: [Ss_75_50_28_29 Fire detection and alarm systems](#) and [Ss_75_50_11_27 Emergency voice communication systems](#)

1. Description:
2. Manufacturer: Legrand or equal and approved.
3. Standards: To BS EN 50085-1 and BS EN 50085-2-1.
4. Installation position: In accordance with the contractors installation information.
5. Format: Wall, ceiling and suspended mounted trunking.
6. Resistance to compression: Not applicable.
7. Resistance to impact: Minimum of 2 Joules.
8. Temperature properties
 - 8.1. Storage and transport temperature (minimum): In accordance with BS EN 50085 and to suit project requirements and environmental conditions.
 - 8.2. Installation and application temperature (minimum): In accordance with BS EN 50085 and to suit project requirements and environmental conditions.
 - 8.3. Application temperature (maximum): In accordance with BS EN 50085 and to suit project requirements and environmental conditions.
9. Resistance to flame propagation: Non-flame propagating.
10. Electrical properties: With electrical continuity characteristics.
11. Protection by enclosure
 - 11.1. Protection against ingress of solid objects (minimum): To BS EN 60529, IP4X.

- 11.2. Protection against ingress of water (minimum): To BS EN 60529, IPX1.
 - 11.3. Protection against access to hazardous parts (minimum): To BS EN 60529, IPXXD.
 - 12. Access method: With tools.
 - 13. Screening: Required.
 - 14. Sizes: As per the layout drawings
 - 15. Compartments: As per the layout drawings.
 - 16. Accessories and fittings
 - 16.1. Generally: Factory made of the same material type and finish as trunking or ducting.
 - 16.2. Types: Cable retainers,
Pin racks,
Earth Links,
Stirrup hangers,
Overhead hangers,
Loose partitions,
PVC edging strips,
Fasteners.
 - 17. Execution: [Pr_65_70_11/765 Conduit, trunking and ducting zones](#) and [Pr_65_70_11/740 Installing trunking generally](#).
- See [Pr_65_70_11_19 Channel cable supports](#) in [Ss_70_30_45_45 Low-voltage distribution systems](#)
- See [Pr_65_70_11_20 Conduit fittings](#) in [Ss_70_30_45_45 Low-voltage distribution systems](#)
- See [Pr_65_70_11_30 Flexible conduit](#) in [Ss_70_30_45_45 Low-voltage distribution systems](#)
- See [Pr_65_70_11_63 Pliable conduit](#) in [Ss_70_30_45_45 Low-voltage distribution systems](#)
- See [Pr_65_70_11_71 Rigid conduit](#) in [Ss_70_30_45_45 Low-voltage distribution systems](#)

Pr_65_70_11_75 Service outlet boxes

- 1. Description:
- 2. Manufacturer: Marshall Tufflex or equal and approved.
- 3. Standards: To BS EN 60670-1 and BS EN 60670-23.
- 4. Installation method: Flush, semi-flush or embedded in non-combustible floors and Suitable for installation into concrete during the casting process.
- 5. Dimensions: As required to house the total number of power and data points.
- 6. Frame material: Galvanized carbon steel.
- 7. Hinged lid
 - 7.1. Material: Galvanized carbon steel base with polyamide outer.
 - 7.2. Outer finish: Manufacturer's standard grey.
 - 7.3. Recess: To suit floor covering.
 - 7.4. Cable exits: Via lift up flap with grommet insert to allow cable exit whilst lid closed.
 - 7.5. Lockable: Facility for locking shall be provided.
- 8. Compartments
 - 8.1. Power: Refer to layout drawings for power requirements.
 - 8.2. Communications and signalling: Refer to layout drawings for data requirements.
- 9. Segregation of cabling: Maintain with bridges and dividers.
- 10. Execution: [Pr_65_70_11/770 Installing service outlets](#).

Pr_65_70_11_76 Service outlet poles

- 1. Description:
- 2. Manufacturer: MK or equal and approved.
- 3. Standard: To BS EN 50085-1 and BS EN 50085-2-4.
- 4. Arrangement: Floor to ceiling and Free standing.
- 5. Material: Extruded aluminium with PVC-U covers.
- 6. Profile: Square.
- 7. Colour: White

8. Single gang outlet boxes: Refer to layout drawing.
9. Outlet box arrangement: Single sided and Double sided. Outlets shall be colour contrasting where required to meet Part M of the building regulations.
10. Cover: Flush fitting.
11. Segregation of cabling: Maintain using bridges and dividers.

See [Pr_65_70_48_29 Fire-resistant screened \(LSHF\) cables](#) in [Ss_70_30_45_45 Low-voltage distribution systems](#)

Pr_65_70_48_58 Ordinary-duty heat-resistant PVC-insulated and sheathed flexible cables

1. Description:
2. Manufacturer: Prysmian or equal and approved.
3. Standards: To BS EN 50525-1 and BS EN 50525-2-11.
4. Third party certification: British Approvals Service for Cables (BASEC) certified.
5. Cable type: PVC insulated and sheathed flexible cable (H05V2V2-F)
6. Size: In accordance with the distribution board circuit schedules.
7. Sheath colour: White.
8. Reaction to fire class
 - 8.1. Fire behaviour: In accordance with BS EN 50575 and BS EN 13501-6.
 - 8.2. Additional classification for smoke production: In accordance with BS EN 50575 and BS EN 13501-6.
 - 8.3. Additional classification for flaming droplets and/ or particles: In accordance with BS EN 50575 and BS EN 13501-6.
 - 8.4. Additional classification for acidity: In accordance with BS EN 50575 and BS EN 13501-6.
9. Execution: Installing Flexible Cables

Pr_65_70_48_75 Single core non-sheathed (LHSF) insulated cables

Shared by: [Ss_70_80_33_35 Hardwired general lighting systems](#)

1. Description:
2. Manufacturer: Prysmian or equal and approved.
3. Standards: To BS EN 50525-1 and BS EN 50525-3-41.
4. Third-party certification: British Approvals Service for Cables (BASEC) certified.
5. Cable type: LS0H Single core cables c/w stranded conductors (H07Z-R).
6. Size: In accordance with the distribution board circuit schedules.
7. Reaction to fire class
 - 7.1. Fire behaviour: In accordance with BS EN 50575 and BS EN 13501-6.
 - 7.2. Additional classification for smoke production: In accordance with BS EN 50575 and BS EN 13501-6.
 - 7.3. Additional classification for flaming droplets and/ or particles: In accordance with BS EN 50575 and BS EN 13501-6.
 - 7.4. Additional classification for acidity: In accordance with BS EN 50575 and BS EN 13501-6.
8. Execution: [Pr_65_70_48/635 Installing low voltage cables](#) and [Pr_65_70_48/660 Installing low voltage cables in conduit and trunking](#).

Pr_65_72_97_11 Cable couplers

1. Description:
2. Manufacturer: MK or equal and approved.
3. Standards: To BS 5733 and BS 1363-1;
To BS 5733 and BS 546;
and To BS EN 60309-1 and BS EN 60309-2.
4. Material: Polycarbonate.
5. Impact protection (minimum): To suit the location and environmental conditions in accordance with BS EN 60529.
6. Ingress protection (minimum): To suit the location and environmental conditions in accordance with BS EN 60529.

7. Voltage rating: 200–250 V and 380–480 V.
8. Current rating: 16 A;
32 A;
and 63 A.
9. Frequency rating: 50–60 Hz.
10. Pin configuration: 2 pole;
3 pole;
2 pole and earth;
3 pole and earth;
and 3 pole, neutral and earth.
11. Cable termination: Insulation piercing for rigid (both solid and stranded) and flexible conductors and Screwed.
12. Execution: [Pr_65_72_97/610 Installing electrical accessories](#).

Pr_65_72_97_12 Cable outlet plates

1. Description:
2. Manufacturer: MK or equal and approved.
3. Standard: To BS 5733.
4. Current rating: Minimum of 20 A.
5. Mounting: Direct enclosure mounted;
Flush;
Grid;
and Surface.
6. Flex outlet: Base entry and Side entry.
7. Ingress protection (minimum): To suit the location and environmental conditions in accordance with BS EN 60529.
8. Cable termination: Screwed.
9. Plate
 - 9.1. Material: Plastics.
 - 9.2. Finish: Generally a white plastic finish.
10. Execution: [Pr_65_72_97/610 Installing electrical accessories](#).

Pr_65_72_97_17 Ceiling power switches

1. Description:
2. Manufacturer: MK or equal and approved.
3. Standards: To BS EN 60669-1 and BS EN 60669-2-4.
4. Current rating: To suit the equipment connected.
5. Poles: Double pole.
6. Neon indicator: Required.
7. Flag indicator: Mechanical on/ off indication.
8. Mounting: Flush.
9. Ingress protection (minimum): To suit the location and environmental conditions in accordance with BS EN 60529.
10. Cable termination: Screwed.
11. Material: Plastics.
12. Colour: White.
13. Execution: [Pr_65_72_97/610 Installing electrical accessories](#).

Pr_65_72_97_23 Double pole switches

1. Description:
2. Manufacturer: MK or equal and approved.
3. Standards: To BS EN 60669-1 and BS EN 60669-2-4.
4. Current rating: Minimum of 20 A.
5. Indicator lamp: Not required.
6. Mounting: Flush and Surface.

7. Ingress protection (minimum): To suit the location and environmental conditions in accordance with BS EN 60529.
8. Cable termination: Screwed.
9. Plate
 - 9.1. Material: Plastics.
 - 9.2. Finish: Generally white plastic
10. Insert colour: White. The switch shall be colour contrasting in accordance with Part M of the building regulations where applicable.
11. Execution: [Pr_65_72_97/610 Installing electrical accessories](#).

[Pr_65_72_97_30](#) Fan isolators

1. Description:
2. Manufacturer: MK or equal and approved.
3. Standards: To BS EN 60669-1 and BS EN 60669-2-4.
4. Current rating: 10 A.
5. Poles: Triple pole.
6. Mounting: Flush and Surface.
7. Ingress protection (minimum): To suit the location and environmental conditions in accordance with BS EN 60529.
8. Cable termination: Screwed.
9. Plate
 - 9.1. Material: Plastics.
 - 9.2. Finish: Generally white plastic
10. Insert colour: White.
11. Accessories: An in-line fuse shall be provided on the final connection to the fan unit for electrical protection of the fan.
12. Execution: [Pr_65_72_97/610 Installing electrical accessories](#).

[Pr_65_72_97_31](#) Fused connection units

1. Description:
2. Manufacturer: MK or equal and approved.
3. Standard: To BS 1363-4.
4. Control
 - 4.1. Type: Double pole, switched and Unswitched. Refer to layout drawing for further information.
 - 4.2. Indicator lamp: LED power 'On'.
5. Mounting: Flush and Surface.
6. Flex outlet: Base entry and Side entry.
7. Ingress protection (minimum): To suit the location and environmental conditions in accordance with BS EN 60529.
8. Cable termination: Screwed.
9. Fuse carrier access: Pull out.
10. Plate
 - 10.1. Material: Plastics.
 - 10.2. Finish: Generally a white plastic finish.
11. Insert colour: White.
12. Execution: [Pr_65_72_97/610 Installing electrical accessories](#).

[Pr_65_72_97_41](#) Industrial socket outlets

1. Description:
2. Manufacturer: MK or equal and approved.
3. Standards: To BS EN 60309-1 and BS EN 60309-2.
4. Material: Polycarbonate.

5. Impact protection (minimum): To suit the location and environmental conditions in accordance with BS EN 60529.
6. Ingress protection (minimum): To suit the location and environmental conditions in accordance with BS EN 60529.
7. Controls: Integral rotary switch with interlock.
8. Mounting: Surface angle mount.
9. Voltage rating: 200–250 V and 380–480 V.
10. Current rating: Refer to layout drawings.
11. Frequency rating: 50–60 Hz.
12. Pin configuration: 2 pole;
3 pole;
2 pole and earth;
3 pole and earth;
and 3 pole, neutral and earth.
13. Cable termination: Insulation piercing for rigid (both solid and stranded) and flexible conductors and Screwed.
14. Execution: [Pr_65_72_97/610 Installing electrical accessories](#).

[Pr_65_72_97_52](#) Multi-gang power outlets

1. Description:
2. Manufacturer: MK or equal and approved.
3. Standard: To BS 1363-2.
4. Current rating: 13 A.
5. Fuse protection: To BS 1362.
6. Outgoing ways
 - 6.1. Type: Unswitched socket outlets.
 - 6.2. Quantity: 4.
7. Cable length (minimum): 3 m.
8. Features: Main switch with integral neon indicating 'power on'.

[Pr_65_72_97_82](#) Specialist socket outlets

1. Description:
2. Manufacturer: Blakley or equal and approved.
3. Enclosure
 - 3.1. Material: Generally plastic but a suitable material to suit the particular application.
 - 3.2. Mounting: Surface.
 - 3.3. Impact protection (minimum): To suit the location and environmental conditions in accordance with BS EN 60529.
 - 3.4. Ingress protection (minimum): To suit the location and environmental conditions in accordance with BS EN 60529.
4. Socket outlets
 - 4.1. Standards: To BS EN 60309-1 and BS EN 60309-2.
 - 4.2. Arrangement: Refer to the layout drawings.
 - 4.3. Circuit protection: MCCBs, MCBs, RCBOs with 30mA protection as required.
 - 4.4. Control: Integral switch with interlock.
 - 4.5. Voltage rating: 100–130 V a.c;
200–250 V a.c;
and 380–415 V a.c.
 - 4.6. Current rating: 16 A;
32 A;
63 A;
and 125 A.
 - 4.7. Frequency rating: 50–60 Hz.
 - 4.8. Pin configuration: 2 pole;
3 pole;
2 pole and earth;

- 3 pole and earth;
and 3 pole, neutral and earth.
- 4.9. Cable termination: Insulation piercing for rigid (both solid and stranded) and flexible conductors and Screwed.
- 5. Execution: [Pr_65_72_97/610 Installing electrical accessories.](#)

[Pr_65_72_97_83](#) Surface and concealed wiring enclosures

- 1. Description:
- 2. Manufacturer: MK or equal and approved.
- 3. Standards
 - 3.1. Concealed enclosures: To BS 4662.
 - 3.2. Surface enclosures: To BS 5733.
- 4. Enclosure
 - 4.1. Material: Pressed steel. Stainless steel shall be provided in external type environments.
 - 4.2. Finish: Galvanized.
- 5. Enclosure depth (minimum): 25 mm.
- 6. Execution: [Pr_65_72_97/610 Installing electrical accessories.](#)

[Pr_65_72_97_84](#) Standard socket outlets

- 1. Description:
- 2. Manufacturer: MK or equal and approved.
- 3. Standard: To BS 1363-2.
- 4. Arrangement: Single gang and Twin gang.
- 5. Control
 - 5.1. Type: Switched
 - 5.2. Switch position: Outboard.
 - 5.3. Indicator lamp: Not required.
 - 5.4. Interlock: Three-pin equal pressure.
- 6. Mounting: Flush and Surface.
- 7. Features: Dual earth terminals.
- 8. Ingress protection (minimum): To suit the location and environmental conditions in accordance with BS EN 60529.
- 9. Cable termination: Screwed.
- 10. Plate
 - 10.1. Material: Plastics.
 - 10.2. Finish: Generally a white plastic finish.
- 11. Insert colour: White. The socket outlet shall be colour contrasting where required to comply with Part M of the building regulations.
- 12. Execution: [Pr_65_72_97/610 Installing electrical accessories.](#)

[Pr_75_51_17_27](#) Emergency stop buttons

- 1. Description:
- 2. Manufacturer: Craig and Derricott or equal and approved
- 3. Standard: To BS EN 60947-5-5.
- 4. Resetting method: Red 40 mm mushroom head, with twist release.
- 5. Shroud: Required.
- 6. Enclosure
 - 6.1. Material: Polycarbonate.
 - 6.2. Ingress protection (minimum): To suit the location and environmental conditions in accordance with BS EN 60529.
- 7. Execution: [Pr_75_51_17/610 Installing emergency stop buttons.](#)

Pr_75_51_52_22 Direct-on-line starters

1. Description:
2. Manufacturer: Schneider or equal and approved.
3. Standard: To BS EN 60947-4-1.
4. Rated operational voltage (Ue): 230 V a.c and 400 V a.c.
5. Rated power (kW): To suit equipment connected in accordance with the manufacturers instructions.
6. Rated operational frequency: 50 Hz.
7. Utilization category: In accordance with equipment connected manufacturers instructions.
8. Number of poles: 3.
9. Interrupting medium: Air.
10. Reverse mode: Not required.
11. Control coil: 24 V a.c;
48 V a.c;
110 V a.c;
230 V a.c;
and 400 V a.c.
12. Overload relay
 - 12.1. Type: Electronic and Thermal. In accordance with equipment connected manufacturers instructions.
 - 12.2. Rating: In accordance with equipment connected manufacturers instructions.
 - 12.3. Features: In accordance with equipment connected manufacturers instructions.
13. Enclosure
 - 13.1. Mounting arrangement: Surface and Panel (open frame).
 - 13.2. Material: Polycarbonate.
 - 13.3. Finish: Epoxy powder coated.
 - 13.4. Colour: Manufacturer's standard .
 - 13.5. Ingress protection (minimum): To suit the location and environmental conditions in accordance with BS EN 60529.
 - 13.6. Integral control buttons: Start and Stop.
 - 13.7. Motor control switch: To BS EN 60947-3.
14. Accessories: 2 pole auxiliary contact module, 10 A rated, with one normally open and one normally closed contact;
2 pole auxiliary contact module, 10 A rated, with two normally closed contacts;
4 pole auxiliary contact module, 10 A rated, with two normally open and two normally closed contacts;
and 4 pole auxiliary contact module, 10 A rated, with four normally open contacts.

Pr_75_51_52_26 Electromechanical contactors

1. Description:
2. Manufacturer: Eaton or equal and approved
3. Standard: To BS EN 60947-4-1.
4. Equipment type: a.c. contactor and d.c. contactor.
5. Rated operational voltage (Ue): 230 V a.c and 400 V a.c.
6. Rated operational current (In): To suit equipment connected.
7. Rated operational frequency: 50 Hz.
8. Utilization category: In accordance with equipment connected manufacturers instructions.
9. Number of poles: 2;
3;
and 4.
10. Interrupting medium: Air.
11. Control coil: 24 V a.c;
48 V a.c;
110 V a.c;
230 V a.c;
and 400 V a.c.
12. Enclosure

- 12.1. Material: Polycarbonate.
- 12.2. Finish: Epoxy powder coated.
- 12.3. Colour: Manufacturer's standard .
- 12.4. Ingress protection (minimum): To suit the location and environmental conditions in accordance with BS EN 60529.
- 12.5. Integral switch disconnector: To BS EN 60947-3.
- 13. Overload relay
 - 13.1. Type: Electronic.
 - 13.2. Rating: To suit equipment connected.
- 14. Accessories: 2 pole auxiliary contact module, 10 A rated, with one normally open and one normally closed contact;
 2 pole auxiliary contact module, 10 A rated, with two normally closed contacts;
 4 pole auxiliary contact module, 10 A rated, with two normally open and two normally closed contacts;
 and 4 pole auxiliary contact module, 10 A rated, with four normally open contacts.

Execution

See [90-55-15/640 Extra low and low voltage cable routes](#) in [Ss_70_30_45_45 Low-voltage distribution systems](#)

See [90-55-15/645 Low voltage cables concealed in walls and partitions](#) in [Ss_70_30_45_45 Low-voltage distribution systems](#)

See [90-55-15/655 Extra low and low voltage surface mounted cables](#) in [Ss_70_30_45_45 Low-voltage distribution systems](#)

See [Pr_20_29_03/611 Fixing anchors using cartridge-applied adhesive](#) in [Ss_70_30_45_45 Low-voltage distribution systems](#)

See [Pr_20_29_03/620 Fixing anchors using chemical anchor capsules](#) in [Ss_70_30_45_45 Low-voltage distribution systems](#)

See [Pr_60_70_22/665 Installing switchgear generally](#) in [Ss_70_30_45_45 Low-voltage distribution systems](#)

See [Pr_65_70_11/630 Installing cable basket](#) in [Ss_70_30_45_45 Low-voltage distribution systems](#)

See [Pr_65_70_11/640 Installing cable supports on roofs](#) in [Ss_70_30_45_45 Low-voltage distribution systems](#)

See [Pr_65_70_11/650 Multiple cable runs](#) in [Ss_70_30_45_45 Low-voltage distribution systems](#)

See [Pr_65_70_11/661 Cable support zones](#) in [Ss_70_30_45_45 Low-voltage distribution systems](#)

See [Pr_65_70_11/700 Installing conduit, trunking and ducting](#) in [Ss_70_30_45_45 Low-voltage distribution systems](#)

See [Pr_65_70_11/710 Installing conduit generally](#) in [Ss_70_30_45_45 Low-voltage distribution systems](#)

See [Pr_65_70_11/720 Installing rigid metallic conduit](#) in [Ss_70_30_45_45 Low-voltage distribution systems](#)

See [Pr_65_70_11/725 Installing rigid non metallic conduit](#) in [Ss_70_30_45_45 Low-voltage distribution systems](#)

[Pr_65_70_11/740](#) Installing trunking generally

- 1. Changes of direction: Manufacturer's bends and tees.
- 2. Joints
 - 2.1. Generally: Manufacturer's jointing fittings. Maintain rigidity of trunking across joint.
 - 2.2. Number of joints: Minimize.
 - 2.3. Lengths of trunking: Maximize.
 - 2.4. Open ends: Blank using manufacturer's removable end caps.
 - 2.5. Metal edging: Protect with PVC edging strip.
 - 2.6. Electrical continuity: Maintain at each joint with a copper link fitted on the outside of the trunking.

3. Connections to conduit, boxes, equipment and accessories: Screwed couplings, adaptors, connectors and glands, with rubber bushes at open ends.
4. Connections to trunking covers: Minimize.
5. Electrical continuity of covers: Electrically continuous with the trunking or provide protective conductors.
6. Access: Provide space around trunking to permit access for installing and maintaining cables. Set out access with covers on a continuous face to allow cabling to be laid in throughout its entire length.
7. Trunking passing through building fabric openings: Provide fixed trunking covers. Extend covers 50 mm from both sides of the opening.
8. Cable retaining straps: Required except when trunking cover is on top.

See [Pr_65_70_11/765 Conduit, trunking and ducting zones](#) in [Ss_70_30_45_45 Low-voltage distribution systems](#)

Pr_65_70_11/770 Installing service outlets

1. Setting out: As per the contractors installation information.
2. Complete installation: Clean and stable. Free from bounce and vibration.
3. Cable connections to raised access floor outlets: Provide flexible metal conduit.
4. Spare compartments: Install blank plates.

See [Pr_65_70_48/635 Installing low voltage cables](#) in [Ss_70_30_45_45 Low-voltage distribution systems](#)

See [Pr_65_70_48/660 Installing low voltage cables in conduit and trunking](#) in [Ss_70_30_45_45 Low-voltage distribution systems](#)

See [Pr_65_70_48/735 Cable installation on channel cable supports, cable tray, cable ladder and cable basket](#) in [Ss_70_30_45_45 Low-voltage distribution systems](#)

Pr_65_72_97/610 Installing electrical accessories

1. Standard: In accordance with BS 7671.
2. Accessory faceplates: Free from any traces of plaster, grout, paint or similar.
3. Positioning: Coordinate with other wall- or ceiling-mounted equipment.
4. Alignment: Align adjacent accessories on the same vertical or horizontal axis.
5. Fixing: Fix securely, plumb and level to vertical and horizontal axes.
6. Mounting heights
 - 6.1. Generally: Measure from finished floor level to centre line of accessory.
 - 6.2. Light switches: 1200 mm.
 - 6.3. Single voltage shaver outlets: 1200 mm.
 - 6.4. Shaver supply units: 1200 mm.
 - 6.5. Socket outlets: 450 mm.
 - 6.6. Fan isolators: Adjacent fan.
 - 6.7. Cooker control units: 200 mm above worktop.
 - 6.8. Cooker connection units: 600 mm.
 - 6.9. Telecommunications and data outlets: 450 mm where not mounted on trunking system.
7. Separation distance between adjacent accessories (minimum): 30 mm.

Pr_75_51_17/610 Installing emergency stop buttons

1. Standards: In accordance with BS 7671 and to BS EN 60204-1.
2. Mounting: Wall mounted in a fully accessible location.

Ss_70_30_80/620 Small power installation

1. Standard: In accordance with BS 7671.

Ss_70_30_80/630 Installing cabling to socket outlets

1. General: Wire socket outlets in ring final circuits without spurs where hard wiring is employed and Wire socket outlets in radial circuits where prefabricated cable is employed.

System completion

Ss_70_30_80/812 Inspection, testing and commissioning of harmonic filters

1. Standard: In accordance with BS 7671.
2. Commissioning of filters:
3. Notice before testing and commissioning:
4. Filters, CTs, wiring, components, connections and equipment installation: Inspect.
5. Operation of instruments and displays:
6. Controls: Commission and adjust for optimum harmonic mitigation and reactive power compensation.
7. Inspection, testing and commissioning results:

Ss_70_30_80/820 Documentation

1. Operating and maintenance instructions
 - 1.1. Scope: Submit for the system giving optimum settings for controls.
 - 1.2. Product information: Include product description, date of purchase, performance characteristics, application (suitability for use), method of operation and control, and cleaning and maintenance requirements.
 - 1.3. Format: Paper and electronic copy.
 - 1.4. Number of copies: Two.
2. Record drawings
 - 2.1. Content: For all low voltage final circuits, the cable origin, circuit designation, route, loading, conductor material and c.s.a, insulation type and colour, number of cores per cable, number of cables in trunking and conduit;
Whether cables are run on surface, concealed in walls, floors, above suspended ceilings or within roof spaces;
Location, route and depth of underground cables;
Location of LV switchgear including distribution boards;
Routes of trunking, conduit, cable tray and cable ladders;
and Location of all electrical outlets, including isolators, starters, control equipment and electrical accessories Schematic drawings showing all low voltage final circuits, the cable origin, circuit designation, cable type, size, number of cores, size and type of overcurrent protective device..
 - 2.2. Format: Full size paper print drawing and Electronic drawing.
 - 2.3. Number of copies: Two.
3. Submittal date: At handover.

Ss_70_30_80/830 Spares

1. Plugs: Supply two for each socket outlet type.
2. Fuse links: Supply ten of each rating.

Ss_70_30_80/840 Maintenance

1. Servicing and maintenance: Submit proposals .
2. Duration: Until 12 months after Practical Completion.

Ω End of System

Ss_70_80_33_35

Hardwired general lighting systems

Systems

Ss_70_80_33_35 Hardwired general lighting systems

1. Description: **Contractors Responsibilities:**

The Contractor shall develop the tender design to completion, supply, install, co-ordinate with other contractors, test, commission and set to work the complete hard wired general lighting system. This shall include all necessary tools, labour, materials and equipment required to provide a complete working installation that fully meets the functional and performance criteria specified within this specification.

The Contractor shall include for provision of maintenance to the system, seasonal commissioning activities and rectification as required by the Contract and the Mechanical & Electrical Specification.

Function/Objectives:

A complete and fully functioning energy efficient lighting system to ensure a practical and comfortable, but robust environment whilst maintaining aesthetic interest.

Applicable Standards:

In addition to this specification, the lighting installation shall comply with the following standards and guidelines current at the time of tender:

- CIBSE Guides
- British Standards
- Current edition of the electrical wiring regulations.
- Building Regulations
- HSG 38 Lighting at Work.
- Regulatory Reform (Fire Safety) Order.
- The requirements of the Local Fire Officer.
- Building Regulations.

Any discrepancies identified by the contractor between the specification and the above documents shall be brought to the attention of the CA immediately.

Environmental Performance Assessment

The specification shall be read in conjunction with the latest version of the Environmental pre assessment (BREEAM, LEED, Well or other) to ensure that any credits targeted applicable to the design of this system are achieved.

Part L Building Regulation Compliance

The Contractor shall ensure that prior to the final selection and order of any mechanical or electrical equipment they refer to the "As Designed" Part L2 modelling report to ensure that the minimum equipment efficiencies as listed are achieved or bettered. As a bare minimum these will be as defined within the current edition of the Non Domestic Compliance guide, but will typically exceed these values so must be checked.

Where variations or value engineering recognises equipment efficiency or control strategy changes that are potentially detrimental to the anticipated Part L2 compliance outcome, the Contractor must review and make the necessary enhancements to other areas of the proposed design in order to maintain a compliant project with respect to Part L at completion. Where applicable any equipment and strategy change must also be reviewed against any design stage BREEAM pre-assessment credits.

System Description

The contractor shall supply, install, test, commission and set to work the complete lighting system.

The lighting scheme shall be functional and aesthetic to provide both sufficient illumination for tasks and to create a pleasant ambience.

The lighting installation shall generally comprise the following:

Room / Area	Description
Front of house area, identified as 'Lighting Designer'	Lighting in these areas has been designed by a specialist lighting designer, please contact Luke Artingstall, Artin Creative Lighting Design. Email: lukeart@artinlight.co.uk Tel: +44 (0) 7754056647
Office Areas	Suspended LED, up/down, continuous linear luminaires, with recessed LED down lights to form the corridor
Plant rooms, switch rooms, car park	Surface mounted linear LED IP65 luminaires
Kitchen	Recessed modular type LED IP65 luminaires
Stairs	Circular wall mounted LED luminaires
Store rooms	Surface mounted linear LED luminaires
External plant areas	Square wall mounted LED IP65 luminaires
	(refer to the luminaire schedule)

The contractor shall ensure that the luminaire is suitable for the ceiling construction proposed by the Architect.

Where it is required to meet Part L2A of the Building Regulations, where possible, all luminaires in regular use shall utilise low energy lamps (greater than 60 luminaire lumens / circuit-watt) with LED drivers and where applicable high frequency electronic ballasts.

The wiring shall generally be LS0H single core cables in trunking and flush steel conduit and shall be fully re-wireable. In the plant rooms, etc. final circuits will be installed in surface fixed metallic trunking and steel conduit.

The electrical accessories within all areas shall be white plastic type, except the plantroom, where the accessories shall be metal clad.

Lighting accessories in external locations shall be housed in minimum IP65 weatherproof enclosures and shall be suitable for an external environment.

All luminaires installed within suspended ceilings shall be supported independently of the ceiling by means of threaded rods, or by fixed by means of plywood to the ceiling support structure.

Generally, the final connection for recessed luminaires installed above suspended ceilings will be via three pin plug-in ceiling roses mounted on conduit boxes. The plug-in ceiling roses will include 2.5 meters of flexible cable from the rose to the luminaire terminal block. Where the ceiling not accessible the plug-in ceiling rose shall be in reach and removable from the hole left by the luminaire.

The lighting control for the building is as indicated in the lighting layout drawings and will include presence detection, absence detection, daylight dimming sensors as well as manual controls.

Presence detectors shall incorporate a 0-99 timer initially set to 15 minutes. Presence detectors will be of a type and positioned to ensure that they will react, and switch the luminaires on immediately when personnel enter the space.

The lighting shall be controlled via a Wireless Protocol. Controls shall be LDL Lighting Casambi system.

The designed illumination for each room / area shall be as the following table:

Room or area	Illumination level (lux)	Uniformity on working plane (minimum to average)	Working plane height (m)
Office	400	0.6	0.7
Circulation (incl. stairs)	100		Floor
Landlord comms/data room	300		Floor

Room or area	Illumination level (lux)	Uniformity on working plane (minimum to average)	Working plane height (m)
Reception	300		Desk
Café/Servery/Tea Point	300		Floor
Lounges	300		Floor
Toilets	200	0.4	Floor
Plantroom	200		Floor
Stores	100		Floor

Emergency Lighting

Function/Objectives:

A complete and fully functioning emergency lighting system to allow safe and efficient egress from the building in the event of a mains power failure shall be provided.

Applicable Standards:

In addition to this specification, the lighting installation shall comply with the following standards and guidelines current at the time of tender:

- CIBSE Guides
- British Standards
- Current edition of the electrical wiring regulations.
- Building Regulations
- HSG 38 Lighting at Work.
- Regulatory Reform (Fire Safety) Order 2005.
- The requirements of the Local Fire Officer.
- Building Regulations.

System Description:

The emergency lighting system will be provided designed in accordance with BS5266 and the requirements of the local fire officer.

An emergency lighting system will be provided to illuminate the escape routes to enable the occupants to safely evacuate the building in the event of an electrical supply failure.

Emergency or escape lighting will be provided throughout the building, and will generally consist of self-contained 3hr emergency battery back-up units.

Emergency escape lighting will be provided to all circulation routes, and open plan areas generally as required by the Fire strategy. The emergency lighting system will generally consist of maintained and non-maintained emergency luminaires.

Dedicated maintained and non-maintained exit box luminaires will be provided above all doors and along corridors to define escape routes, luminaires to be provided with the appropriate graphic and direction arrow and shall be coordinated with the Architect.

Strategic placing of emergency lighting will be employed to highlight changes in levels or direction, fire fighting equipment and any non-illuminated signage.

Emergency lighting luminaires will be wired from local lighting circuits and are to be tested by means of the wireless lighting control system.

Fire Alarm panel be provided with minimum 15 lux emergency lighting. Fire fighting equipment/Disable refuges and panic bars and security devices shall have minimum 5 lux.

Labelling

All equipment references and labelling shall be provided in accordance with the project labelling requirements.

Training

The contractor shall provide training for staff in the operation and maintenance of the lighting, control and emergency lighting system. The training shall be of an informal nature and shall be carried out on completion of the installation.

The contractor will provide fourteen working days notice prior to carrying out the training.

Commissioning

The contractor shall allow within their tendered costs the full commissioning of the complete lighting and emergency lighting system in accordance with this specification.

The Contract Administrator shall be given due opportunity and notice to witness this commissioning. The contractor shall inform the engineer of the commencement of commissioning at least two weeks in advance.

Drawings

See all relevant drawings in the drawing issue sheet.

Schematics

See all relevant schematics in the drawing issue sheet.

2. System performance: [Ss_70_80_33/210 Design of general lighting systems](#);
[Ss_70_80_33/215 Design of emergency lighting systems](#);
[Ss_70_80_33/220 Escape route lighting](#);
[Ss_70_80_33/225 Open area lighting](#);
[Ss_70_80_33/230 High risk task area lighting](#);
[Ss_70_80_33/235 Standby lighting](#);
[Ss_70_80_33/240 Lighting performance](#);
[Ss_70_80_33/245 Maintenance factor calculations](#);
[Ss_70_80_33/270 Lighting cables generally](#);
and [Ss_70_80_33/280 Conduit, trunking and ducting generally](#).
3. Final circuit cabling: [Pr_65_70_48_75 Single core non-sheathed \(LHSF\) insulated cables](#);
[Pr_65_70_48_29 Fire-resistant screened \(LSHF\) cables](#);
[Pr_65_70_15_06 Balanced twisted-pair cables](#);
[90-55-15/340 Flexible cords](#);
4. Cable Accessories: [Pr_65_70_11_15 Cable ties](#)
5. Containment: [Pr_65_70_11_12 Cable baskets](#);
[Pr_65_70_11_71 Rigid conduit](#);
[Pr_65_70_11_30 Flexible conduit](#);
[Pr_65_70_11_63 Pliable conduit](#); [Pr_65_70_11/410 Cable trunking and cable ducting for wall and ceiling mounting Type A](#)
6. Containment accessories: [Pr_20_29_03_83 Stainless steel chemical anchor rods](#);
[Pr_20_29_63_50 Masonry plugs Type A](#);
[Pr_65_70_11_20 Conduit fittings](#);
and [Pr_65_70_11_19 Channel cable supports](#).
7. Rewireable installation: Required.
8. Concealed installation: Required.
9. Luminaire types: Refer to luminaire schedule and manufacturers instructions.
10. Lamp types: Refer to luminaire schedule and manufacturers instructions.
11. Connections to luminaires: [Pr_65_72_97_18 Ceiling roses](#);
[Pr_65_72_97_47 Luminaire supporting couplers](#);
12. Lighting controls: [90-65-05/410 Combined daylight and occupancy detectors](#);
[90-60-25/325 Light switches](#);
[Pr_70_70_47_51 Mains voltage occupancy detectors](#);
[Pr_70_70_47_62 Photoelectric control units type A](#);
and [Pr_75_51_17_89 Time switches type A](#).
13. Accessories: [Pr_40_10_27_28 Externally illuminated emergency exit signs](#);
14. Electrical identification: [Pr_40_10_27_27 Electrical shock treatment signs](#) and [Pr_40_10_57_29 Equipment labels and warning notices type B](#).
15. Execution: [Ss_70_80_33/630 Installing general lighting systems](#);
[Ss_70_80_33/640 Installing emergency lighting systems](#);
16. System completion: [Ss_70_80_33/810 Testing and commissioning of general lighting systems](#);
[Ss_70_80_33/815 Photometric survey of general lighting systems](#);
[Ss_70_80_33/817 Photometric survey of emergency lighting systems](#);
[Ss_70_80_33/820 Documentation relating to general lighting](#);
[Ss_70_80_33/822 Documentation relating to emergency lighting](#);
[Ss_70_80_33/812 Testing and commissioning emergency lighting systems](#);

[Ss_70_80_33/840 Maintenance;](#)
and [Ss_70_80_33/830 Spares.](#)

System performance

[Ss_70_80_33/210](#) Design of general lighting systems

1. Design: Complete the installation design of the general lighting systems and Complete commissioning checklist in accordance with Commissioning Code L, Appendix LA2.
2. Standard: To BS EN 12464-1 and In accordance with SLLCode for lighting.
3. Design calculations: In order to comply with Building Regulations, the lighting installation, must meet minimum standards in terms of efficiency. The contractor shall confirm that their final proposals meet the buildings regulations and undertake calculations such as Luminaire efficacy calculations to confirm compliance.
4. Submit the following information: Luminaire layout drawings;
Luminaire photometric data, including flux fraction ratios, polar intensity curves and utilization factors;
Luminaire spacing tables;
Lamp and luminaire technical information;
Computer generated point calculations with contribution from inter-reflected light showing isolux contour plots for working plane and room surfaces;
Room surface reflectance values;
Schedule of design and calculated maintained average illuminance values;
and Schedule of design and calculated uniformity values.

[Ss_70_80_33/215](#) Design of emergency lighting systems

1. System designer: The contractor shall employ a emergency lighting specialist to undertake the installation design of the emergency lighting installation. The specialist shall be suitably certified such as BAFE Emergency Lighting Systems SP203-4 certified.
2. Design: Complete the installation design of the emergency lighting and signage systems.
3. Standards: To BS EN 1838, BS EN 50172 and in accordance with BS 5266-1;
In accordance with BS 5266-2;
In accordance with BS 5266-4;
and In accordance with BS 5266-6.
4. Submit the following information: Luminaire layout drawings;
Luminaire photometric data, including lamp light output data at beginning and end of battery discharge;
Luminaire spacing tables;
Lamp and luminaire technical information;
Isolux contour plots;
Schedule of design and calculated maintained average illuminance values;
and Schedule of design and calculated uniformity values.
5. Emergency lighting classification
 - 5.1. Type: Refer to the layout drawings for the type of emergency lighting system proposed.
 - 5.2. Duration of emergency mode: Minimum of 180 minutes battery autonomy.

[Ss_70_80_33/220](#) Escape route lighting

1. Position: Refer to emergency lighting layout drawings.
2. Minimum horizontal illuminance at floor level on centre line of escape route: In accordance with the latest edition of BS 5266-1.

[Ss_70_80_33/225](#) Open area lighting

1. Position: Refer to emergency lighting layout drawings.
2. Minimum maintained illuminance on the reference plane: In accordance with the latest edition of BS 5266-1.

[Ss_70_80_33/230](#) High risk task area lighting

1. Position: Refer to emergency lighting layout drawings.
2. Minimum maintained illuminance on the reference plane: In accordance with the latest edition of BS 5266-1.

[Ss_70_80_33/235](#) Standby lighting

1. Position: Refer to emergency lighting layout drawings.

2. Minimum illuminance on the working plane: In accordance with the latest edition of BS 5266-1.

Ss_70_80_33/240 Lighting performance

1. Task area: Minimum average illumination levels and uniformities shall be provided to worktop and floor heights. This shall dependant on the room and activities that will be undertaken by the user which shall be confirmed by the contractor within their installation lighting calculations and layouts.
2. Maintained average illuminance level (lx): Minimum average illuminance levels shall be provided in accordance with BS EN 12464-1, SLL Code for lighting and CIBSE guides. Refer to the layout drawings for any performance requirements.
3. Glare index (maximum): Refer to BS EN 12464-1 clause 5.2 which, via Tables 5.1—5.53 (column 4), details the maximum levels of glare for a wide range of applications. The lighting installation shall be in accordance with these maximum values.
4. Uniformity (minimum): Minimum uniformities shall be provided in accordance with BS EN 12464-1, SLL Code for lighting and CIBSE guides. Refer to the layout drawings for any performance requirements.
5. Colour rendering index (Ra): The minimum value of colour rendering index for distinct types of interiors (areas), tasks or activities are given in Tables 5.1 to 5.53 of BS EN 12464-1. The lighting installation shall be in accordance with these values.
6. Colour temperature (K): Refer to luminaire schedule and specification system description.
7. Means of control: Central and Local. Refer to the layout drawings and specification system description for requirements.

Ss_70_80_33/245 Maintenance factor calculations

1. Luminaire cleaning interval:
2. Lamp replacement strategy:
3. Maintenance factors: Maintenance factors shall be included within the contractors installation design lighting calculations and shall be in accordance with SSL Code for lighting, CIE 97-2005 and CIBSE Guides.

Ss_70_80_33/270 Lighting cables generally

1. Standard: In accordance with BS 7671.
2. Requirement: The contractor shall Submit proposals, including detailed design drawings, technical information, calculations and manufacturers' literature.
3. Conductor sizes (minimum)
 - 3.1. Lighting circuits: In accordance with the distribution board circuit schedules.
 - 3.2. Final connection: In accordance with the distribution board circuit schedules.
4. Cable sizes not stated: Submit proposals, technical information, calculations and manufacturers' literature.
5. Format: Cable calculations shall be undertaken using Amtech cable calculation software.

Ss_70_80_33/280 Conduit, trunking and ducting generally

1. Standard: In accordance with BS 7671.
2. Requirement: Submit proposals , including technical information, calculations and manufacturers' literature.
3. Conduit, trunking and ducting sizes not stated: Submit proposals, including detailed design drawings, technical information, calculations and manufacturers' literature.

Products

See 90-55-10/320 Cable bands in [Ss_70_30_45_45 Low-voltage distribution systems](#)

90-55-15/340 Flexible cords

1. Manufacturer: Prysmian or equal and approved.
2. Standard: To BS 8436.
3. Third party certification: British Approvals Service for Cables (BASEC) certified.
4. Light duty PVC insulated and sheathed flexible cords (LD PVC/ PVC cord, H03VV-F):
 - 4.1. Construction: PVC (Polyvinyl Chloride) Type TI2 according to BS EN 50363.
 - 4.2. Sheath colour: White
 - 4.3. Size: Refer to Distribution board schedules

5. Ordinary duty PVC insulated and sheathed flexible cords (PVC/ PVC cord, H05VV-F):
 - 5.1. Construction: PVC (Polyvinyl Chloride) Type TI2 according to BS EN 50363
 - 5.2. Sheath colour: White
 - 5.3. Size: Refer to Distribution board schedules
6. Ordinary duty 90° C PVC insulated and sheathed flexible cords (HR PVC/ PVC cord, H05V2V2-F):
 - 6.1. Construction: PVC (Polyvinyl Chloride) Type TI3 according to BS EN 50363
 - 6.2. Sheath colour: White
 - 6.3. Size: Refer to Distribution board schedules
7. Execution: [90-55-15/650 Extra low and low voltage cables in accessible roof spaces](#); [90-55-15/655 Extra low and low voltage surface mounted cables](#); and [Pr_65_70_48/665 Installing flexible cables](#).

90-60-25/325 Light switches

1. Manufacturer: MK or equal and approved.
2. Standard: To BS EN 60669-1.
3. Current rating: 20 A.
4. Actuating method: Extra-wide rocker bar switch;
Pull cord switch;
Rocker bar switch;
Rotary switch;
and Secret key switch.
5. Poles: Single pole.
6. Arrangement: Refer to the layout drawings for number of gangs and ways of lighting switches.
7. Mounting: Flush;
Grid;
and Surface.
8. Ingress protection (minimum): To suit the locations environmental conditions and in accordance with BS EN 60529.
9. Cable termination: Screwed;
Screwless for rigid conductors only;
and Screwless for rigid and flexible conductors.
10. Plate:
 - 10.1. Material: The minimum requirement is white plastic unless noted otherwise - refer to specification system description and electrical equipment schedules for further information.
 - 10.2. Finish: The minimum requirement is white plastic unless noted otherwise - refer to specification system description and electrical equipment schedules for further information.
11. Insert colour: The minimum requirement is white unless noted otherwise - refer to specification system description and electrical equipment schedules for further information. A colour contrasting insert shall be provided in accordance with the DDA regulations where required.
12. Execution: [Pr_65_72_97/630 Grid switch plates](#);
[Pr_65_72_97/640 Installing light switches](#);
and [Pr_65_72_97/610 Installing electrical accessories](#).

90-65-05/410 Combined daylight and occupancy detectors

1. Manufacturer: CP Electronics or equal and approved.
2. Daylight sensitivity: Adjustable.
3. Equipment interconnectivity: Wired.
4. Occupancy sensitivity: Fixed.
5. Range: Fixed.
6. Field of view: Fixed.
7. Remote setup/ override: By infra-red controller.
8. Mounting: Ceiling;
Flush;
Surface;
and Wall.
9. Ingress protection (minimum): To suit the locations environmental conditions and in accordance with BS EN 60529.

10. Adjustable sensor settings: Required.

11. Execution: [90-65-05/630 Installing combined daylight and occupancy sensors.](#)

See [Pr_20_29_03_83 Stainless steel chemical anchor rods](#) in [Ss_70_30_45_45 Low-voltage distribution systems](#)

See [Pr_20_29_63_50 Masonry plugs Type A](#) in [Ss_70_30_80_35 Hardwired voltage small power systems](#)

See [Pr_40_10_27_27 Electrical shock treatment signs](#) in [Ss_70_30_25_25 Earthing and bonding systems](#)

Pr_40_10_27_28 Externally illuminated emergency exit signs

1. Description:

2. Manufacturer: Refer to the luminaire schedule.

3. Graphical symbol format: To BS 5499-1 and To The Health and Safety (Safety Signs and Signals) Regulations 1996.

See [Pr_40_10_57_29 Equipment labels and warning notices type B](#) in [Ss_70_30_25_25 Earthing and bonding systems](#)

Pr_65_70_11/410 Cable trunking and cable ducting for wall and ceiling mounting Type A

1. Manufacturer:

2. Standards: To BS EN 50085-1 and BS EN 50085-2-1.

3. Installation position:

4. Format:

5. Resistance to compression:

6. Resistance to impact:

7. Temperature properties

7.1. Storage and transport temperature (minimum):

7.2. Installation and application temperature (minimum):

7.3. Application temperature (maximum):

8. Resistance to flame propagation:

9. Electrical properties:

10. Protection by enclosure

10.1. Protection against ingress of solid objects (minimum): To BS EN 60529, IP4X.

10.2. Protection against ingress of water (minimum): To BS EN 60529, IPX1.

10.3. Protection against access to hazardous parts (minimum): To BS EN 60529, IPXXD.

11. Access method:

12. Screening:

13. Sizes:

14. Compartments:

15. Accessories and fittings

15.1. Generally: Factory made by the cable trunking or ducting manufacturer and of the same material type and finish as the cable trunking or ducting.

15.2. Types:

16. Execution:

See [Pr_65_70_11_12 Cable baskets](#) in [Ss_70_30_45_45 Low-voltage distribution systems](#)

See [Pr_65_70_11_13 Cable cleats](#) in [Ss_70_30_45_45 Low-voltage distribution systems](#)

See [Pr_65_70_11_15 Cable ties](#) in [Ss_70_30_45_45 Low-voltage distribution systems](#)

See [Pr_65_70_11_17 Cable trays](#) in [Ss_70_30_45_45 Low-voltage distribution systems](#)

See [Pr_65_70_11_18 Cable trunking](#) in [Ss_70_30_80_35 Hardwired voltage small power systems](#)

See [Pr_65_70_11_19 Channel cable supports](#) in [Ss_70_30_45_45 Low-voltage distribution systems](#)

See [Pr_65_70_11_20 Conduit fittings](#) in [Ss_70_30_45_45 Low-voltage distribution systems](#)

See [Pr_65_70_11_30 Flexible conduit](#) in [Ss_70_30_45_45 Low-voltage distribution systems](#)

See [Pr_65_70_11_63 Pliable conduit](#) in [Ss_70_30_45_45 Low-voltage distribution systems](#)

See [Pr_65_70_11_71 Rigid conduit](#) in [Ss_70_30_45_45 Low-voltage distribution systems](#)

Pr_65_70_15_06 Balanced twisted-pair cables

1. Description:
2. Manufacturer: Excel or equal and approved.
3. Standard: To BS EN 50173-1 and To TIA 568-C.2.
4. Third party certification: British Approvals Service for Cables (BASEC) certified.
5. Category: 6A.
6. Cable type: U/FTP Screened twisted pair
7. Number of pairs: 4.
8. Size: In accordance with BS EN 50288.
9. Sheath
 - 9.1. Type: Low smoke zero halogen (LSZH).
 - 9.2. Colour: Blue.
10. Reaction to fire class
 - 10.1. Fire behaviour: C_{ca}. In accordance with BS EN 50575 and BS EN 13501-6.
 - 10.2. Additional classification for smoke production: s1a. In accordance with BS EN 50575 and BS EN 13501-6.
 - 10.3. Additional classification for flaming droplets and/ or particles: d1. In accordance with BS EN 50575 and BS EN 13501-6.
 - 10.4. Additional classification for acidity: a1. In accordance with BS EN 50575 and BS EN 13501-6.
11. Execution: [90-55-15/640 Extra low and low voltage cable routes](#); and [Pr_65_70_48/660 Installing low voltage cables in conduit and trunking](#).

See [Pr_65_70_48_29 Fire-resistant screened \(LSHF\) cables](#) in [Ss_70_30_45_45 Low-voltage distribution systems](#)

See [Pr_65_70_48_75 Single core non-sheathed \(LHSF\) insulated cables](#) in [Ss_70_30_80_35 Hardwired voltage small power systems](#)

Pr_65_72_97_18 Ceiling roses

1. Description:
2. Manufacturer: MK or equal and approved.
3. Standard: To BS 67.
4. Current rating: 6 A.
5. Material: Plastics.
6. Colour: White.
7. Mounting: Surface.
8. Execution: [Pr_65_72_97/610 Installing electrical accessories](#).

Pr_65_72_97_47 Luminaire supporting couplers

1. Description:
2. Manufacturer: MK or equal and approved
3. Standard: To BS 7001.
4. Plug type: Rewireable, independent.
5. Pin configuration: 3 pin and 4 pin.
6. Colour: Red and White.
7. Cable type: Low smoke zero halogen flexible cord.
8. Cable size: In accordance with the electrical distribution board schedules.
9. Flex length (maximum): 3 m.
10. Execution: [Pr_65_72_97/610 Installing electrical accessories](#).

Pr_70_70_47_51 Mains voltage occupancy detectors

1. Description:
2. Manufacturer: CP Electronics or equal and approved.
3. Standards:
4. Sensor type: Microwave and Passive infra-red.
5. Nominal voltage:
6. Rated current: 5 A and 10 A.
7. Detection method:
8. Occupancy sensitivity: Fixed.
9. Light level sensor:
10. Range: Fixed.
11. Field of view: Fixed.
12. Switching delay: Adjustable.
13. Remote setup/ override: By infra-red controller.
14. Mounting: Ceiling;
Flush;
Surface;
and Wall.
15. Ingress protection (minimum): To suit the locations environmental conditions and in accordance with BS EN 60529.
16. Adjustable sensor settings: Required.
17. Execution: [Pr_70_70_47/660 Installing mains voltage occupancy detectors.](#)

Pr_70_70_47_62 Photoelectric control units type A

1. Description:
2. Manufacturer: Hager or equal and approved.
3. Standard: To BS 5972.
4. Equipment interconnectivity: Wired. Photocell shall be interconnected to a separate time switch.
5. Inductive switching capacity: Shall meet the requirements of the connected load including any inrush currents that are created by LED lighting.
6. Switching settings
 - 6.1. Adjustable switching time delay: Required via remote sensor.
 - 6.2. On lighting level: Adjustable via remote sensor.
 - 6.3. Off lighting level: Adjustable via remote sensor.
 - 6.4. Timed on: The system shall be controlled via a programmable 7 day 24 h clock which shall be remote to the photoelectric control unit. The switching shall be via a contactor where required.
 - 6.5. Timed off: The system shall be controlled via a programmable 7 day 24 h clock which shall be remote to the photoelectric control unit. The switching shall be via a contactor where required.
7. Remote setup/ override: By remote controller.
8. Mounting: Ceiling;
Column top;
Flush;
Indoor;
Outdoor;
Surface;
and Wall.
9. Ingress protection (minimum): To suit the locations environmental conditions and in accordance with BS EN 60529.
10. Execution: [Pr_70_70_47/670 Installing photoelectric control units type A.](#)

Pr_75_51_17_89 Time switches type A

1. Description:
2. Manufacturer: Hager or equal and approved.
3. Standards: To BS EN 60730-1 and BS EN 60730-2-7.
4. Third party certification: British Electrotechnical Approvals Board Control Mark (BEAB).

5. Equipment interconnectivity: Wired.
6. Format: Electronic digital.
7. Programme capability: 3 on and 3 off operations per day and 48 on and 48 off operations per day.
8. Number of switching channels: Four.
9. Switching frequency:
10. Programme selection:
11. Programming method:
12. Programme access:
13. Display: Liquid crystal display (LCD).
14. Functions:
15. Override facility: Manual ON & OFF and return to automatic.
16. GMT/BST daylight saving: Automatic.
17. Battery backup: Not required. Unit shall retain its most recent settings.
18. Integral thermostat: To BS EN 60730-2-9
19. Special features:
20. Voltage rating
 - 20.1. Time switch:
 - 20.2. Ancillary equipment:
21. Inductive switching capacity: 5 A;
10 A;
and 20 A.
22. Cable termination capacity: Up to 4 mm².
23. Enclosure
 - 23.1. Mounting type:
 - 23.2. Mounting method:
 - 23.3. Ingress protection (minimum): To suit the locations environmental conditions and in accordance with BS EN 60529.
 - 23.4. Material and construction: Flame retardant ABS plastic
 - 23.5. Operating temperature (minimum):
 - 23.6. Operating temperature (maximum):
24. Accessories:
25. Execution: [Pr_75_51_17/620 Installing time switches type A.](#)

Execution

See [90-55-15/640 Extra low and low voltage cable routes in Ss_70_30_45_45 Low-voltage distribution systems](#)

See [90-55-15/645 Low voltage cables concealed in walls and partitions in Ss_70_30_45_45 Low-voltage distribution systems](#)

90-55-15/650 Extra low and low voltage cables in accessible roof spaces

1. Cables running across ceiling joists: [Pr_65_70_11_12 Cable baskets](#);
[Pr_65_70_11_17 Cable trays](#);
and [Pr_65_70_11_18 Cable trunking](#).

See [90-55-15/655 Extra low and low voltage surface mounted cables in Ss_70_30_45_45 Low-voltage distribution systems](#)

90-65-05/630 Installing combined daylight and occupancy sensors

1. General requirements: [Pr_70_70_47/605 Installing automatic lighting controls generally](#).
2. Position: Ceiling mounted, located to suit the occupancy pattern of the area under control and shielded from erroneous influences.
3. Interconnection: In accordance with manufacturers instructions.
4. Cable type: In accordance with manufacturers instructions.

See [Pr_20_29_03/611 Fixing anchors using cartridge-applied adhesive in Ss_70_30_45_45 Low-voltage distribution systems](#)

See [Pr_20_29_03/620](#) Fixing anchors using chemical anchor capsules in [Ss_70_30_45_45](#) Low-voltage distribution systems

See [Pr_65_70_11/621](#) Installing cable tray and cable ladder in [Ss_70_30_45_45](#) Low-voltage distribution systems

See [Pr_65_70_11/630](#) Installing cable basket in [Ss_70_30_45_45](#) Low-voltage distribution systems

See [Pr_65_70_11/640](#) Installing cable supports on roofs in [Ss_70_30_45_45](#) Low-voltage distribution systems

See [Pr_65_70_11/650](#) Multiple cable runs in [Ss_70_30_45_45](#) Low-voltage distribution systems

See [Pr_65_70_11/661](#) Cable support zones in [Ss_70_30_45_45](#) Low-voltage distribution systems

See [Pr_65_70_11/700](#) Installing conduit, trunking and ducting in [Ss_70_30_45_45](#) Low-voltage distribution systems

See [Pr_65_70_11/710](#) Installing conduit generally in [Ss_70_30_45_45](#) Low-voltage distribution systems

See [Pr_65_70_11/720](#) Installing rigid metallic conduit in [Ss_70_30_45_45](#) Low-voltage distribution systems

See [Pr_65_70_11/725](#) Installing rigid non metallic conduit in [Ss_70_30_45_45](#) Low-voltage distribution systems

See [Pr_65_70_11/740](#) Installing trunking generally in [Ss_70_30_80_35](#) Hardwired voltage small power systems

See [Pr_65_70_11/765](#) Conduit, trunking and ducting zones in [Ss_70_30_45_45](#) Low-voltage distribution systems

See [Pr_65_70_48/635](#) Installing low voltage cables in [Ss_70_30_45_45](#) Low-voltage distribution systems

See [Pr_65_70_48/660](#) Installing low voltage cables in conduit and trunking in [Ss_70_30_45_45](#) Low-voltage distribution systems

[Pr_65_70_48/665](#) Installing flexible cables

1. General requirements: [Pr_65_70_48/635](#) Installing low voltage cables.
2. Cables: Grip securely at connections. Where cord grips do not form an integral part of the accessory or equipment, provide separate proprietary cord grips.

See [Pr_65_70_48/735](#) Cable installation on channel cable supports, cable tray, cable ladder and cable basket in [Ss_70_30_45_45](#) Low-voltage distribution systems

See [Pr_65_72_97/610](#) Installing electrical accessories in [Ss_70_30_80_35](#) Hardwired voltage small power systems

[Pr_65_72_97/630](#) Grid switch plates

1. Spare modules: Provide blank inserts.

[Pr_65_72_97/640](#) Installing light switches

1. Multigang switches: Connect so that there is a logical relationship with luminaire positions.
2. Unused switch spaces: Fit with blanks.
3. Segregation: Internally segregate each phase with phase barriers. Include warning plates.

[Pr_70_70_47/605](#) Installing automatic lighting controls generally

1. Standard: In accordance with BS 7671.
2. Equipment and sensor identification labels: Provide.

[Pr_70_70_47/660](#) Installing mains voltage occupancy detectors

1. General requirements: [Pr_70_70_47/605](#) Installing automatic lighting controls generally.
2. Position: Ceiling mounted, located to suit the occupancy pattern of the area under control and shielded from erroneous influences.
3. Interconnection: In accordance with manufacturers instructions.

4. Cable type: In accordance with manufacturers instructions.
5. Light level sensor:

Pr_70_70_47/670 Installing photoelectric control units type A

1. General requirements: [Pr_70_70_47/605](#) Installing automatic lighting controls generally.
2. Position: Ceiling mounted, located to suit the occupancy pattern of the area under control and shielded from erroneous influences and Wall mounted, located to suit the occupancy pattern of the area under control and shielded from erroneous influences.
3. Interconnection: In accordance with manufacturers instructions.
4. Cable type: In accordance with manufacturers instructions.

Pr_75_51_17/620 Installing time switches type A

1. Position: Adjacent to electrical distribution boards and as indicated within the lighting layout drawings.
2. Interconnection
 - 2.1. Input: In accordance with manufacturers instructions.
 - 2.2. Output: In accordance with manufacturers instructions.

Ss_70_80_33/630 Installing general lighting systems

1. Standard: In accordance with BS 7671 and CIBSE Commissioning Code L.
2. Commissioning method statement: The contractor shall submit their proposals for review prior to commissioning.
3. Luminaire layout: As per contractors installation drawings. The lighting circuits shall be able to fully withstand the high inrush currents created by LED lighting.
4. Fixing master/ lighting distribution boxes: Direct to underside of floor slab and Suspended from drop rods. Distribution boxes shall also be wall mounted where applicable.
5. Connection of luminaire supporting couplers
 - 5.1. General luminaires: White plug with white cover.
 - 5.2. Flex length (maximum): In accordance with the luminaire manufacturers instructions.
6. Switches and controls
 - 6.1. Location: As per contractors installation drawings.
 - 6.2. Staircases: As per contractors installation drawings.
7. Rooms smaller than 4 m²: Restrict lighting circuits to one electrical phase.

Ss_70_80_33/640 Installing emergency lighting systems

1. Standards: In accordance with BS 5266-1 and BS 7671.
2. Connection of luminaire supporting couplers
 - 2.1. Emergency luminaires: Red plug with red cover.
 - 2.2. Flex length (maximum): In accordance with the luminaire manufacturers instructions.
3. Permanent electrical supplies to self-contained emergency luminaires: Derive from the closest general lighting circuit in accordance with the latest edition of BS5266-1.

System completion

Ss_70_80_33/810 Testing and commissioning of general lighting systems

1. Standards: In accordance with BS 7671 and CIBSE Commissioning Code L.
2. Test results: Submit two copies of system commissioning completion certificate.
3. Certificates of calibration for meters and instruments: Submit.

Ss_70_80_33/812 Testing and commissioning emergency lighting systems

1. Commissioning: In accordance with BS 5266-1, Annex H and In accordance with BS 5266-1, Annex I.
2. Results: Submit two copies of emergency lighting completion certificates, in accordance with BS 5266-1, Annex H, Figures H.1, H.2, H.3, and H.4;
Submit two copies of an emergency lighting completion certificate, in accordance with BS 5266-1, Annex I, Figures I.1 and I.2;
and Submit two copies of an emergency lighting completion certificate, in accordance with BS 5266-1, Annex K, Figures K.1 and K.2.

3. Certificates of calibration for meters and instruments: Submit.

Ss_70_80_33/815 Photometric survey of general lighting systems

1. Standard: In accordance with SLLCode for lighting.
2. Position: All
3. Test conditions: Full blackout.
Allow lamps and luminaire output to stabilize prior to beginning measurement.
4. Average illuminance measurement method: Full grid.
5. Results
 - 5.1. Submit for the following: Maintained average illuminance.
Diversity.
Uniformity.
 - 5.2. Format: Full size paper print and Electronic.
 - 5.3. Number of copies: Two.
6. Survey photographs: Submit for each location.

Ss_70_80_33/817 Photometric survey of emergency lighting systems

1. Standard: In accordance with BS 5266-1, Annex D.
2. Position: All
3. Test conditions: Full blackout.
Minimize extraneous light.
4. Results
 - 4.1. Format: Full size paper print and Electronic.
 - 4.2. Number of copies: Two.

Ss_70_80_33/820 Documentation relating to general lighting

1. Operating and maintenance instructions
 - 1.1. Scope: Submit for the system giving optimum settings for controls.
 - 1.2. Product information: Include product description, date of purchase, performance characteristics, application (suitability for use), method of operation and control, and cleaning and maintenance requirements.
 - 1.3. Format: Paper copy.
 - 1.4. Number of copies: Two.
2. Record drawings
 - 2.1. Content: General arrangement drawings showing the location of luminaires, lighting circuit distribution boxes, master and slave distribution boxes, switch modules, manual and automatic switches and controls including timeswitches, passive infra-red detectors, and daylight sensors and Schematic diagram showing all final circuit cabling, the cable origin, device addresses for automated controls, route from controls to luminaires, and the location of all joints and tees. Include conductor material and c.s.a., insulation type and colour, number of cores per cable, number of cables in ducts, on tray or ladder.
 - 2.2. Format: Paper and Electronic copy.
 - 2.3. Number of copies: Two.
3. Submittal date: At handover

Ss_70_80_33/822 Documentation relating to emergency lighting

1. Operating and maintenance instructions
 - 1.1. Scope: Submit for the system giving optimum settings for controls.
 - 1.2. Product information: Include product description, date of purchase, performance characteristics, application (suitability for use), method of operation and control, and cleaning and maintenance requirements.
 - 1.3. Format: Full size paper print and electronic
 - 1.4. Number of copies: Two.
2. Record drawings
 - 2.1. Content: General arrangement drawings showing the location of emergency luminaires, lighting circuit distribution boxes, master and slave distribution boxes, switch modules, manual and automatic emergency lighting test panels and Schematic diagram showing all final circuit cabling,

the cable origin, device addresses for automated controls, route from controls to luminaires, and the location of all joints and tees. Include conductor material and c.s.a., insulation type and colour, number of cores per cable, number of cables in ducts, on tray or ladder.

- 2.2. Format: Full size paper print drawing and Electronic drawing.
- 2.3. Number of copies: Two.
3. Submittal date: At handover.
4. Certification for re-engineered luminaires: Submit completed ICEL 1004 model test record certificate.
5. Logbook: Submit, including the following information: Date of commissioning of the system, including any certificate relating to alterations;
Date of each periodic inspection and test;
Date and brief details of each service, inspection or test carried out;
Dates and brief details of any defects and of remedial action taken;
Date and brief details of any alteration to the emergency lighting installation;
If any automatic testing device is employed, a description of the main characteristic and the mode of operation;
Details of replacement components of luminaires such as lamp type, battery and fuses.

Ss_70_80_33/830 Spares

1. Test keys for secret keyswitches: Three.
2. Sensors: One of each type.
3. Lamps
 - 3.1. Quantity of each type to be supplied: Two.
 - 3.2. Labelling: Label the lamps with the corresponding luminaire reference.

Ss_70_80_33/840 Maintenance

1. Servicing and maintenance: Undertake.
2. Duration: Until 12 months after completion.

Ω End of System

Ss_75_10_21_21

Data distribution systems

Systems

Ss_75_10_21_21 Data distribution systems

1. Description: Data Distribution system design is by others , only containment & power supplies are allowed for in this specification.
2. Cabling hierarchy
 - 2.1. Horizontal cabling:
 - 2.2. Consolidation points (CP):
 - 2.3. Consolidation point cabling:
 - 2.4. Telecommunications outlets (TO):
3. Containment: [Pr_65_70_11_12](#) Cable baskets; [Pr_65_70_11_71](#) Rigid conduit
4. Containment accessories: [Pr_65_70_11_20](#) Conduit fittings; [Pr_25_80_81_42](#) Intumescent linear gap seals; [Pr_25_80_81_42](#) Intumescent linear gap seals; [Pr_20_29_63_50](#) Masonry plugs; [Pr_20_29_03_83](#) Stainless steel chemical anchor rods; [Pr_20_29_03_84](#) Stainless steel chemical anchor sockets

Products

See [Pr_20_29_03_83](#) Stainless steel chemical anchor rods in [Ss_70_30_45_45](#) Low-voltage distribution systems

See [Pr_20_29_03_84](#) Stainless steel chemical anchor sockets in [Ss_70_30_45_45](#) Low-voltage distribution systems

Pr_20_29_63_50 Masonry plugs

Shared by: [Ss_75_40_02_11](#) Card access control systems

1. Manufacturer: Rawplug or equal and approved.
2. Format: To suit substrate, loads to be supported and conditions expected in use. To be matched with the associated screw lengths.
3. Size: To suit the installation and weight of equipment to be fixed.

See [Pr_25_80_81_42](#) Intumescent linear gap seals in [Ss_70_30_45_45](#) Low-voltage distribution systems

See [Pr_65_70_11_12](#) Cable baskets in [Ss_70_30_45_45](#) Low-voltage distribution systems

See [Pr_65_70_11_20](#) Conduit fittings in [Ss_70_30_45_45](#) Low-voltage distribution systems

See [Pr_65_70_11_71](#) Rigid conduit in [Ss_70_30_45_45](#) Low-voltage distribution systems

Execution

See [Pr_20_29_03/611](#) Fixing anchors using cartridge-applied adhesive in [Ss_70_30_45_45](#) Low-voltage distribution systems

See [Pr_20_29_03/620](#) Fixing anchors using chemical anchor capsules in [Ss_70_30_45_45](#) Low-voltage distribution systems

See [Pr_65_70_11/630](#) Installing cable basket in [Ss_70_30_45_45](#) Low-voltage distribution systems

See [Pr_65_70_11/650](#) Multiple cable runs in [Ss_70_30_45_45](#) Low-voltage distribution systems

See [Pr_65_70_11/661](#) Cable support zones in [Ss_70_30_45_45](#) Low-voltage distribution systems

See [Pr_65_70_11/700](#) Installing conduit, trunking and ducting in [Ss_70_30_45_45](#) Low-voltage distribution systems

See [Pr_65_70_11/710](#) Installing conduit generally in [Ss_70_30_45_45](#) Low-voltage distribution systems

See [Pr_65_70_11/720](#) Installing rigid metallic conduit in [Ss_70_30_45_45](#) Low-voltage distribution systems

See [Pr_65_70_11/725 Installing rigid non metallic conduit](#) in [Ss_70_30_45_45 Low-voltage distribution systems](#)

See [Pr_65_70_11/765 Conduit, trunking and ducting zones](#) in [Ss_70_30_45_45 Low-voltage distribution systems](#)

Ω End of System

Ss_75_10_46_05

Audio frequency induction loop systems

Systems

Ss_75_10_46_05 Audio frequency induction loop systems

1. Description: **Contractors Responsibilities**

The Contractor shall develop the tender design to completion, supply, install, co-ordinate with other contractors, test, commission and set to work the complete induction loop system. This shall include all necessary tools, labour, materials and equipment required to provide a complete working installation that fully meets the functional and performance criteria specified within this specification.

The Contractor shall include for provision of maintenance to the system, seasonal commissioning activities and rectification as required by the Contract and the Mechanical & Electrical Specification.

Function/Objectives

A complete and fully operational induction loop system installation shall be provided.

Applicable Standards

In addition to this specification, the induction loop installation shall comply with the following standards and guidelines current at the time of tender:

- Building Regulations
- British Standards
- The requirements of the local Building Control Authority
- Relevant HSE Guidance
- BSRIA Standards & Guidance notes
- CIBSE Guides & Notes.
- MoD Specifications, Design and Maintenance Guides and Technical Bulletins.
- Client Specific Requirements.
- Manufacturers recommendations.
- Health Technical Memoranda

Any discrepancies identified by the contractor between the specification and the above documents shall be brought to the attention of the CA immediately.

System Description

The contractor shall supply, install, test and commission a complete Hearing Loop System (HLS).

Permanently installed Induction Loop Systems shall be provided at the following locations and areas, or as shown on relevant electrical drawings or room data sheets:

- Reception Desk(s)
- Meeting/Training Rooms
- Bookable Group Rooms

Induction loop systems shall be supplied and installed by a specialist sub-contractor and shall take account of the effect of building structure and overspill where applicable. Where there is metal construction in use and the room is over 4m wide a single loop of wire around the perimeter of the space may not be appropriate and a Multi-loop system design may be required.

The induction loop specialist shall confirm construction-related signal losses and provide a single loop or Multi loop system, as required.

Simple perimeter loops are not acceptable in cases where there are multiple adjacent spaces with induction loop systems installed, and a low spill Multi-loop system design should be used instead.

The Contractor shall, at the earliest opportunity in the project:

- Show that cross-talk between adjacent looped areas (whether part of this contract or not), and that magnetic spill from any induction loop system where the signal is defined as 'confidential' will, by design, be less than -40dB with normal signal levels.
- Provide evidence that the field strength of the proposed systems will meet the requirements of IEC 60118-4, whilst taking account of any metal within the building structure. Where necessary, the effect

of metal shall be assessed by site survey and test using trial loops on relevant construction, carried out by a competent test specialist.

- If the above assessments prove that an induction loop system may not be suitable the Contractor may suggest alternative assistive listening technologies such as infrared, this must be approved by the client before proceeding.

Induction loops

Loops connected to the induction loop system shall meet the following requirements:

- Loop wire containment shall be of non-metallic construction or must not create any closed circuits and only earthed in one position. This restriction does not apply to the loop feed wiring between a loop amplifier and the start of the loop itself.
- Where flat copper tape is accepted for use under carpet or other floor coverings, this does not require the use of containment and shall be installed according to the manufacturer's recommendations and current best practice.
- All cabling should be concealed within the fabric of the building, unless specified otherwise.

Audio inputs

Audio inputs shall be defined by the use of the room and the requirements of the listeners. The audio provided to the induction loop system must always provide an improvement in signal to noise ratio over the acoustic sound within the room. The Contractor is required to:

- Provide dedicated microphones and associated audio equipment for the induction loop system.
- Co-ordinate with the AV contractor to obtain a line level feed from the AV system
- Provide a line level connection from the sound reinforcement system to the induction loop system.
- Provide suitable input plates for connection into the induction loop system.

Where a sound reinforcement system is provided, a line level feed from this to the induction loop system should be used where appropriate. This feed should not vary in level with loudspeaker volume adjustment. In some cases, this can be the only input, however dedicated HLS microphones may also be required.

Where microphones are being provided for the induction loop system they must be as close as possible to the talking position. Directional types are often most effective. In larger rooms with multiple talking positions more than one microphone is usually required, this may mean additional preamps, mixers or auto-mixing / gating facilities are needed.

A single boundary microphone mounted on the ceiling is unlikely to provide sufficient rejection of background acoustic noise in most rooms and should not be used unless it can be demonstrated that the system delivers tangible benefit to the hard of hearing.

Input levels shall not be adjustable at the signal source or connection point.

Induction loop system drivers

Each induction loop system must use a dedicated hearing loop driver meeting the following general requirements plus those specific to a type A or type B driver as defined below.

- True 'current drive' output
- Frequency response from 80Hz to 6.5kHz
- Automatic gain control (AGC) optimised for speech with a dynamic range greater than 36dB
- Metal loss correction with an adjustable gain slope range of at least 0dB to +3dB per octave
- Front panel indication of audio signal activity on the input and output of the unit

Type A: Area coverage loop driver:

Where the horizontal loop area that must be covered is in excess of 2m x 2m, for either a one-phase or two-phase (Multi-loop) system, each hearing loop driver shall have the following characteristics:

- Rated current and voltage capable of driving the designed loop without clipping or distortion of the signal with full power bandwidth up to at least 1.6kHz
- Capable of delivering a 1kHz sinewave at the rated current and voltage into a load for at least 20 seconds continuously without damage to the unit or interruption of the output signal.
- Input facilities of a type and connection suitable for the intended audio inputs to the system. Balanced inputs shall be available, microphone inputs shall have phantom power available.
- Facility to attach the driver to a local area network providing remote monitoring and control.
- Height no greater than 45mm (i.e. 1U of standard 19" rack space) per unit.
- Power supply and transformer must be integrated into the unit.
- Where a Multi-loop system is required, a single 1U driver shall be provided that is capable of driving two separate outputs with a 90° phase shift accurate to $\pm 1^\circ$ from 100Hz to 5kHz.

Type B: Counter / local area loop driver:

Where the loop system is to assist a single end user in a defined location such as a retail counter or information point, each hearing loop driver shall have the following characteristics:

- Current capability of at least 2.2A rms with 1KHz sine signal
- Voltage output of no less than 4.5V peak at maximum current.
- 2 inputs: 1 microphone input and 1 input switchable between microphone or line
- Panel / wall mounting capability (using screws or other appropriate and reliable fixing)

Installation

If the proposed contractor is not experienced with induction loop systems or audio systems to the level required in order to competently install and commission these systems, then some or all of the work should be sub-contracted to a specialist with the necessary experience.

The contractor shall:

- Co-ordinate with other relevant contractors to ensure that all appropriate audio signals are connected to the hearing loop system and transmitted clearly.
- Wire and connect to all items of equipment in accordance with the manufacturer's recommendations.
- Ensure complete segregation of the HLS from any other ELV or LV wiring system.
- Follow good practice to ensure that system design does not cause potential ground loops.
- All wiring between loops and equipment locations shall be installed in appropriate containment.
- All wiring, including that inside equipment enclosures or racks, will be of a neat and tidy appearance. Wiring shall be identified at both ends of each cable.
- Following installation, the resistance of each loop circuit and isolation from electrical ground shall be tested and recorded. The Client shall have the opportunity to witness these tests.

Commissioning

All commissioning must be carried out using a true RMS, dedicated induction loop system field strength meter meeting the requirements of IEC 60118-4, with a valid calibration certificate available. Each complete system must be commissioned in accordance with IEC 60118-4 and a certificate of conformity clearly stating test results and performance against this standard must be issued for each HLS. The Client shall have the opportunity to witness these tests.

Training and maintenance

All systems, methods of use and routine maintenance checks must be demonstrated to the end user. For each loop location a loop receiver shall be provided for operational staff to check and monitor the performance of the induction loop system. The receiver shall have a headphone output, low cut filter and field strength indicators as required by IEC 60118-4.

Training shall be provided that enables operational staff to understand the proper use of the induction loop system and how to ensure that people can make use of the system effectively.

Operation and Maintenance manuals shall be provided which include 'as fitted' drawings, data sheets and instruction manuals for all items of hardware and operational instructions for the use and testing of all systems.

Drawings

See all relevant drawings in the drawing issue sheet.

Schematics

See all relevant schematics in the drawing issue sheet.

2. System performance: [Ss_75_10_46/210 Design of induction loop systems](#); [Ss_75_10_46/220 System objectives](#); and [Ss_75_10_46/230 Multiple loops](#).
3. System manufacturer: Ampetronic or equal and approved.
4. Source equipment: [Pr_60_75_06_53 Microphones](#) and Public address system.
5. Distribution equipment: [Pr_70_75_36_40 Induction loop amplifiers type B](#); [Pr_70_75_36_43 Induction loop transformers](#); and [Pr_70_75_36_40 Induction loop amplifiers type A](#).
6. Equipment interconnectivity: Wired & Portable
7. Loop cabling

- 7.1. Loop arrangement: [Pr_70_75_36_41 Induction loop pads](#);
Single loop;
and Multiple loops.
- 7.2. Cable type: In accordance with the manufacturers instructions.
- 7.3. Cable accessories: [90-55-10/320 Cable bands Type B](#);
[Pr_65_70_11_15 Cable ties Type B](#) and
[Pr_65_70_11_13 Cable cleats Type B](#)
- 7.4. Containment: [Pr_65_70_11_71 Rigid conduit Type B](#);
[Pr_65_70_11_12 Cable baskets Type B](#);
[Pr_65_70_11_17 Cable trays Type B](#);
[Pr_65_70_11_18 Cable trunking Type C](#);
[Pr_65_70_11_09 Buried conduit Type A](#);
[Pr_65_70_11_30 Flexible conduit Type B](#);
and [Pr_65_70_11_63 Pliable conduit Type B](#).
- 7.5. Rewireable installation: Required.
- 7.6. Concealed installation: Required.
8. System accessories: [Pr_80_51_51_06 Audio frequency induction loop field strength meters](#);
[Pr_70_75_36_45 Induction loop monitor receivers](#);
[Pr_70_75_36_42 Induction loop signal generators](#);
and [Pr_40_10_27_43 Induction loop system signs](#).
9. Execution: [Ss_75_10_46/630 Installing induction-loop systems generally](#);
[Ss_75_10_46/670 Installing induction-loop cabling](#);
and [Ss_75_10_46/700 Installing loop pads](#).
10. System completion: [Ss_75_10_46/810 Testing and commissioning induction-loop systems generally](#);
[Ss_75_10_46/815 Equipment labelling and system diagrams](#);
[Ss_75_10_46/820 Documentation](#);
[Ss_75_10_46/840 Maintenance](#);
[Ss_75_10_46/850 Verification certificate](#);
[Ss_75_10_46/860 Acceptance certificate](#);
and [Ss_75_10_46/870 Subjective testing](#).

System performance

[Ss_75_10_46/210](#) Design of induction loop systems

1. Design: The contractor shall appoint a specialist sub-contractor to develop the design of the induction-loop system.
2. Qualifications of designer: Member of the Institute of Sound and Communication Engineers and Member of the Professional Lighting and Sound Association.
3. Standard: In accordance with BS 7594, class A2 (Portable or handheld self-contained equipment);
In accordance with BS 7594, class A3 (Small volume systems, e.g. for use in counters, signage, intercom, etc);
In accordance with BS 7594, class A4 (Perimeter loop for coverage of a single volume);
In accordance with BS 7594, class A5 (Multiple loop systems);
In accordance with BS 7594, class A6 (Handheld or body worn personal loops);
and In accordance with BS 7594, class A7 (Specialist loops not covered by classes A1–A6)
4. Variations: None.
5. Requirement: Submit proposals including detailed design drawings, technical information including location, type and size of loop cable, calculations and manufacturers' literature.
6. System design certificate: Submit with design proposals.
7. Equipment: Provide electrical supplies to equipment requiring power.

[Ss_75_10_46/220](#) System objectives

1. Standard: The systems or components thereof shall comply with the latest versions of:
 - IEC 60118-4 (also referred to as BS EN 60118-4)
 - IEC TR 63079 (also referred to as BS 7594)
 - BS 8300 (Design of buildings and their approaches to meet the needs of disabled people)
 - Approved document M, Volume 2 of the Building Regulations
 - The Equality Act
 - BS 62489-1
2. System objectives: Refer to the specification system description.
3. Environment: Indoors.

4. Listening plane: Horizontal plane 1450 mm above finished floor level.
5. Coverage area: Full coverage shall be provided in each of the areas.
6. Working area: To be determined by the induction loop specialist.
7. Frequency response: Maximum variation of ± 3 dB over the range 100 Hz–5 kHz.
8. Field Strength: Field strength at the listening plane (ear height) should be 400mA/m sine wave @ 1kHz and checked using a suitable meter.
Field strength must remain within a tolerance of ± 3 dB over the entire listening area.
9. Speech transmission index value (minimum):

Ss_75_10_46/230 Multiple loops

1. Objective: To cover a large area;
To improve coverage in areas with interference caused by steel in the building fabric;
and To minimize overspill.

Products

90-55-10/320 Cable bands Type B

1. Manufacturer: Thorsman or equal and approved.
2. Material: Perforated steel bands.
3. Protective covering: LSHF.

Pr_40_10_27_43 Induction loop system signs

1. Description:
2. Manufacturer: Ampetronic or equal and approved.
3. Standard: In accordance with BS 7594.
4. Requirements
 - 4.1. Equipment identification: In accordance with BS 7594.
 - 4.2. Areas where an induction-loop system is installed: In accordance with BS 7594.
 - 4.3. Areas where reception of the induction-loop system does not meet the system performance: In accordance with BS 7594.
5. Material: Laminated PVC
6. Dimensions: To suit the project requirements:
Small: 99 x 128mm
Large: 197 x 252mm

Pr_60_75_06_53 Microphones

1. Description:
2. Manufacturer: Ampetronic or equal and approved.
3. Standard: To BS EN 60268-4.
4. Element: Induction loop specialists recommendation
5. Frequency response: Match system parameters.
6. Polar pattern: Uni-directional (cardioid).
7. Sensitivity (open circuit): -55 dB V/Pa at 1000 Hz.
8. Impedance (maximum): Low - less than 600 ohm.
9. Controls: None.
10. Connectivity: XLR male connection.
11. Cable length (minimum):
12. Mounting method: Desktop.
13. Accessories: Fixed microphone stand;
Gooseneck stand;
and Separate power supply.

Pr_65_70_11_09 Buried conduit Type A

1. Description:
2. Manufacturer: Legrand or equal and approved.

3. Standards: To BS EN 61386-1 and BS EN 61386-24.
4. Mechanical properties
 - 4.1. Resistance to compression: Heavy duty
 - 4.2. Resistance to impact: Normal
5. Resistance to bending: Rigid.
6. Electrical characteristics: With electrical continuity and insulating characteristics.
7. Resistance to external influences
 - 7.1. Protection against ingress of solid objects (minimum): To BS EN 60529, IP4X.
 - 7.2. Protection against ingress of water (minimum): To BS EN 60529, IPX0.
8. Resistance to corrosion: High protection, inside and outside.
9. Resistance to flame propagation: Non-flame propagating.
10. Sizes (OD): Minimum of 25mm overall diameter.
11. Execution: [Pr_65_70_11/735 Installing conduit connections to equipment Type A](#) and Reference to missing clause Installing conduit in concrete.

[Pr_65_70_11_12](#) Cable baskets Type B

1. Description:
2. Manufacturer: Legrand or equal and approved.
3. Standard: To BS EN 61537.
4. Material: Metallic - Refer to specification system description and electrical equipment schedules for cable basket duty requirements (medium duty shall be the minimum duty unless noted otherwise). The cable basket material shall be suitable for the installed environment and shall be able to withstand any corrosion effects caused by the environment.
5. Coating material: Hot dip galvanized and stainless steel in corrosive environments.
6. Resistance against flame propagation: Non-flame propagating
7. Electrical Properties: The cable basket containment system shall be electrically continuous.
8. Sizes
 - 8.1. Width: As per the layout drawings.
 - 8.2. Side height: 54 mm.
9. Features
 - 9.1. Segregation: Cable dividers shall be provided where services such as fire alarm cabling share the same cable basket for example.
 - 9.2. Protective cover: Not required.
10. Execution: Reference to missing clause Cable support zones;
Reference to missing clause Installing cable basket;
and Reference to missing clause Multiple cable runs.

[Pr_65_70_11_13](#) Cable cleats Type B

1. Description:
2. Manufacturer: CMP or equal and approved.
3. Standard: To BS EN 61914.
4. Format: To suit cable type and cable manufacturers instructions.
5. Material: Metallic throughout all areas including escape routes and non escape routes. Non-metallic cable cleats may be used in external locations.
6. Temperatures for permanent installation
 - 6.1. Maximum: In accordance with BS EN 61914 and to suit project requirements and environmental conditions.
 - 6.2. Minimum: In accordance with BS EN 61914 and to suit project requirements and environmental conditions.
7. Resistance to impact: Heavy.
8. Type of retention or resistance to electromechanical forces: Resistant to electromechanical forces, withstanding one short circuit.
9. Environmental influences
 - 9.1. Non-metallic and composite components: Resistant to ultraviolet light.

9.2. Metallic and composite components: High resistance to corrosion.

Pr_65_70_11_15 Cable ties Type B

1. Description:
2. Manufacturer: Thorsman or equal and approved.
3. Standard: To BS EN 62275.
4. Format: Wrap around self-locking releasable.
5. Material: Metal.
6. Loop tensile strength (minimum): Manufacturer's standard .
7. Temperatures for permanent installation
 - 7.1. Maximum: To suit the location and environmental conditions.
 - 7.2. Minimum: To suit the location and environmental conditions.
8. Contribution to fire : Non-flame propagating.
9. Environmental influences
 - 9.1. Non-metallic and composite components: Resistant to ultraviolet light.
 - 9.2. Metallic and composite components: Resistant to corrosion.

Pr_65_70_11_17 Cable trays Type B

1. Description:
2. Manufacturer: Legrand or equal and approved.
3. Standard: To BS EN 61537.
4. Material: Metallic (perforated) - The cable tray material shall be suitable for the installed environment and shall be able to withstand any corrosion effects caused by the environment.
5. Duty: Heavy duty shall be the minimum duty unless noted otherwise.
6. Resistance against flame propagation: Non-flame propagating.
7. Electrical properties
 - 7.1. Continuity characteristics: With electrical continuity.
 - 7.2. Conductivity characteristics: With electrical conductive system component.
8. Coating material: Hot dip galvanized and stainless steel in corrosive environments.
9. Temperature properties for transport, storage, installation and application
 - 9.1. Minimum: In accordance with BS EN 61537 and to suit project requirements and environmental conditions.
 - 9.2. Maximum: In accordance with BS EN 61537 and to suit project requirements and environmental conditions.
10. Mechanical properties
 - 10.1. Cable tray free base area: Class X - up to 80% perforation in the cable tray free base area.
 - 10.2. Resistance to impact: In accordance with BS EN 61537 and to suit project requirements and environmental conditions.
11. Width: As per the layout drawings.
12. Features
 - 12.1. Flange type: Return Flange.
 - 12.2. Segregation: Cable dividers shall be provided where services such as fire alarm cabling share the same cable basket for example.
 - 12.3. Protective cover: Required where additional mechanical impact protection is required. In addition, cable tray covers are required in external areas to protect cables from vermin or the effects of UV rays for example.
13. Execution: [Pr_65_70_11/621 Installing cable tray and cable ladder Type B.](#)

Pr_65_70_11_18 Cable trunking Type C

1. Description:
2. Manufacturer: Legrand or equal and approved.
3. Standards: To BS EN 50085-1 and BS EN 50085-2-1.
4. Installation position: In accordance with the contractors installation information.
5. Format: Wall, ceiling and suspended mounted trunking.

6. Resistance to compression: Not applicable.
7. Resistance to impact: Minimum of 2 Joules.
8. Temperature properties
 - 8.1. Storage and transport temperature (minimum): In accordance with BS EN 50085 and to suit project requirements and environmental conditions.
 - 8.2. Installation and application temperature (minimum): In accordance with BS EN 50085 and to suit project requirements and environmental conditions.
 - 8.3. Application temperature (maximum): In accordance with BS EN 50085 and to suit project requirements and environmental conditions.
9. Resistance to flame propagation: Non-flame propagating.
10. Electrical properties: With electrical continuity characteristics.
11. Protection by enclosure
 - 11.1. Protection against ingress of solid objects (minimum): To BS EN 60529, IP4X.
 - 11.2. Protection against ingress of water (minimum): To BS EN 60529, IPX1.
 - 11.3. Protection against access to hazardous parts (minimum): To BS EN 60529, IPXXD.
12. Access method: With tools.
13. Screening: Required.
14. Sizes: As per the layout drawings
15. Compartments: As per the layout drawings.
16. Accessories and fittings
 - 16.1. Generally: Factory made of the same material type and finish as trunking or ducting.
 - 16.2. Types: Cable retainers,
Pin racks,
Earth Links,
Stirrup hangers,
Overhead hangers,
Loose partitions,
PVC edging strips,
Fasteners.
17. Execution: [Pr_65_70_11/765 Conduit, trunking and ducting zones Type B](#) and [Pr_65_70_11/740 Installing trunking generally Type B](#).

Pr_65_70_11_30 Flexible conduit Type B

1. Description:
2. Manufacturer: Legrand or equal and approved.
3. Standards: To BS EN 61386-1 and BS EN 61386-23.
4. Mechanical properties
 - 4.1. Resistance to compression: Medium.
 - 4.2. Resistance to impact: Medium.
5. Transport, installation and application
 - 5.1. Lower temperature (minimum): In accordance with BS EN 61386 and to suit project requirements and environmental conditions.
 - 5.2. Upper temperature (maximum): In accordance with BS EN 61386 and to suit project requirements and environmental conditions.
6. Resistance to bending: Flexible.
7. Electrical characteristics: With electrical continuity and insulating characteristics.
8. Resistance to external influences
 - 8.1. Protection against ingress of solid objects (minimum): To BS EN 60529, IP4X.
 - 8.2. Protection against ingress of water (minimum): To BS EN 60529, IPX0.
9. Resistance to corrosion: High protection inside and out. To BS EN 61386-1, Class 4.
10. Tensile strength: Medium.
11. Resistance to flame propagation: Non-flame propagating.
12. Suspended load capacity: Medium.
13. Sizes (OD): Minimum of 25mm overall diameter.

14. Execution: [Pr_65_70_11/735 Installing conduit connections to equipment Type A](#);
[Pr_65_70_11/765 Conduit, trunking and ducting zones Type B](#);
and [Pr_65_70_11/715 Installing pliable and flexible conduit Type A](#).

Pr_65_70_11_63 Pliable conduit Type B

1. Description:
2. Manufacturer: Legrand or equal and approved.
3. Standards: To BS EN 61386-1 and BS EN 61386-22.
4. Mechanical properties
 - 4.1. Resistance to compression: Medium.
 - 4.2. Resistance to impact: Medium.
5. Transport, installation and application
 - 5.1. Lower temperature (minimum): In accordance with BS EN 61386 and to suit project requirements and environmental conditions.
 - 5.2. Upper temperature (maximum): In accordance with BS EN 61386 and to suit project requirements and environmental conditions.
6. Resistance to bending: Pliable, self-recovering.
7. Electrical characteristics: With electrical continuity and insulating characteristics.
8. Resistance to external influences
 - 8.1. Protection against ingress of solid objects (minimum): To BS EN 60529, IP4X.
 - 8.2. Protection against ingress of water (minimum): To BS EN 60529, IPX0.
9. Resistance to corrosion: High protection, inside and outside.
10. Tensile strength: Medium.
11. Resistance to flame propagation: Non-flame propagating.
12. Suspended load capacity: Medium.
13. Sizes (OD): Minimum of 25mm overall diameter.
14. Execution: [Pr_65_70_11/715 Installing pliable and flexible conduit Type A](#);
[Pr_65_70_11/735 Installing conduit connections to equipment Type A](#);
and [Pr_65_70_11/765 Conduit, trunking and ducting zones Type B](#).

Pr_65_70_11_71 Rigid conduit Type B

1. Description:
2. Manufacturer: Legrand or equal and approved.
3. Standards: To BS EN 61386-1 and BS EN 61386-21.
4. Mechanical properties
 - 4.1. Resistance to compression: Heavy.
 - 4.2. Resistance to impact: Heavy.
5. Transport, installation and application
 - 5.1. Lower temperature (minimum): In accordance with BS EN 61386 and to suit project requirements and environmental conditions.
 - 5.2. Upper temperature (maximum): In accordance with BS EN 61386 and to suit project requirements and environmental conditions.
6. Resistance to bending: Rigid.
7. Electrical characteristics: With electrical continuity properties.
8. Resistance to external influences
 - 8.1. Protection against ingress of solid objects (minimum): To BS EN 60529, IP4X.
 - 8.2. Protection against ingress of water (minimum): To BS EN 60529, IPX0.
9. Resistance to corrosion: High protection, inside and outside.
10. Tensile strength: Heavy.
11. Resistance to flame propagation: Non-flame propagating.
12. Suspended load capacity: Heavy.
13. Colour: To match main containment
14. Sizes (OD): Minimum 25 mm overall diameter. Minimum 1.2mm tubing thickness.

15. Execution: [Pr_65_70_11/720 Installing rigid metallic conduit Type B](#);
[Pr_65_70_11/725 Installing rigid non metallic conduit Type B](#);
[Pr_65_70_11/735 Installing conduit connections to equipment Type A](#);
 and [Pr_65_70_11/765 Conduit, trunking and ducting zones Type B](#).

Pr_70_75_36_40 Induction loop amplifiers type A

1. Description:
2. Manufacturer: Ampetronic or equal and approved.
3. Type: Type A: Area coverage loop driver. Where the horizontal loop area that must be covered is in excess of 2m x 2m, for either a one-phase or two-phase (Multi-loop) system.
4. Standard: To BS EN 60118-4.
5. Format: Current drive.
6. Inputs
 - 6.1. Quantity: Input facilities of a type and connection suitable for the intended audio inputs to the system. Balanced inputs shall be available, microphone inputs shall have phantom power available.

Facility to attach the driver to a local area network providing remote monitoring and control.
 - 6.2. Type: XLR socket.
 - 6.3. Mix control: Required.
7. Total harmonic distortion: 0.5 %.
8. Light emitting diode (LED) indication: Loop active.
Power on/ off.
9. Output loop impedance
 - 9.1. Minimum:
 - 9.2. Maximum:
10. Phantom power: Required.
11. Features: Rated current and voltage capable of driving the designed loop without clipping or distortion of the signal with full power bandwidth up to at least 1.6kHz.
Capable of delivering a 1kHz sinewave at the rated current and voltage into a load for at least 20 seconds continuously without damage to the unit or interruption of the output signal.
Power supply and transformer must be integrated into the unit.
12. Auxiliary voltage output: Required.
13. Mounting: The following mounting options shall be provided to suit the project requirements:
 - Rack mounted;
 - Under counter;
 - Wall.

Pr_70_75_36_40 Induction loop amplifiers type B

1. Description:
2. Manufacturer: Ampetronic or equal and approved.
3. Type: Type B: Counter / local area loop driver
4. Standard: To BS EN 60118-4.
5. Format: Current drive.
6. Inputs
 - 6.1. Quantity: 2 inputs: 1 microphone input and 1 input switchable between microphone or line
 - 6.2. Type: XLR socket.
 - 6.3. Mix control: Required.
7. Total harmonic distortion: 0.5 %.
8. Light emitting diode (LED) indication: Loop active.
Power on/ off.
9. Output loop impedance
 - 9.1. Minimum:
 - 9.2. Maximum:
10. Phantom power: Required.
11. Features:
 - Current capability of at least 2.2A rms with 1KHz sine signal.
 - Voltage output of no less than 4.5V peak at maximum current.

12. Auxiliary voltage output: Required.
13. Mounting: The following mounting options shall be provided to suit the project requirements:
 - Rack mounted;
 - Under counter;
 - Wall.

Pr_70_75_36_41 Induction loop pads

1. Description:
2. Manufacturer: Ampetronic or equal and approved.
3. Loop cables: Encapsulated within flexible 300D Polyester fire retardant cover.

Pr_70_75_36_42 Induction loop signal generators

1. Description:
2. Manufacturer: Ampetronic or equal and approved.
3. Purpose: Confidence tone;
Test tone;
and Timing signal.
4. Power supply: Battery.
5. Output connector: Stereo 3.5 mm audio.
6. Magnetic field strength (relative to 0 dB at 0.56 A/m): 0 dB for test tones and - 6 dB for confidence tones.
7. Duty (on:off): 1:4.

Pr_70_75_36_43 Induction loop transformers

1. Description:
2. Manufacturer: Ampetronic or equal and approved.
3. Format: Combining and Matching.
4. Enclosure
 - 4.1. Ingress protection (minimum): To suit the location and environmental conditions and in accordance with BS EN 60529.
 - 4.2. Material: Polycarbonate.
 - 4.3. Finish: Powder coated.
 - 4.4. Colour: Black.

Pr_70_75_36_45 Induction loop monitor receivers

1. Description:
2. Manufacturer: Ampetronic or equal and approved.
3. Format: Portable.
4. Frequency Response: Standard: Flat 85Hz - 6kHz $\pm$ 0.5dB.
Low Cut: 400Hz - 6kHz - 3dB (similar to hearing aid).
5. Frequency response
 - 5.1. Response range (relative to 0 dB at 0.56 A/m):
 - 5.2. Characteristics:
6. Loudspeaker output: >100mW into 16 Ohm load.
7. Distortion: <0.5% THD @ 1KHz
8. Headphone output: Required. Stereo headphones to be provided with impedance 32 Ohm per side.
9. On/ off with volume control: Required.
10. Alarm output: Required.
11. Battery low indicator: Required.

Pr_80_51_51_06 Audio frequency induction loop field strength meters

1. Description:
2. Manufacturer: Ampetronic or equal and approved.
3. Format: A Magnetic Field Strength Meter for measuring, setting up and commissioning an induction loop system to the requirements of IEC60118-4.

The meter shall be complete with three calibrated operational modes for the assessment of Background Noise, Field Strength and Frequency Response as required to ensure correct function of the loop system. The meter shall also double as a loop listener, with a headphone output to listen to the signal in the loop.

4. Quantity: One per induction-loop.
5. Background Noise: To determine the level of the background magnetic field present in the intended location for the loop system. Also used to measure low level signals to assess overspill outside a loop system:
 - A-Weighted filter
 - True RMS detection referenced to 400mA/m
 - Scale -42 to -12dB
 - Audio (headphone) output is post filter for monitoring
6. Field Strength: A broad band measurement to measure field strength delivered by the system:
 - Broad band measurement 50Hz to 8kHz
 - True RMS detection referenced to 400 mA/m
 - Scale -22 to +8dB with 1dB intervals from -3 to +6dB
 - Suitable for use with sine wave, pink noise, or combination signals (provided), or any other real signals
7. Frequency Response: Third octave filters for measuring performance across the required frequency spectrum as required by IEC60118-4.

Used to confirm adequate power at high frequencies as required for good intelligibility. Used to assess frequency dependent loss due to metal structures, and to optimise frequency compensation:

- Third octave bands at 100Hz, 1kHz and 5kHz
 - True RMS detection
 - Scale resolution to 1dB
 - For use with pink noise only (signal provided)
 - Audio (headphone) output is post filter
8. Magnetic Field Measurement: Coil orientation - Vertical when unit held upright.
Reference level - 400mA/m (In Field strength mode)
Frequency response - 50Hz to 8kHz ± 0.25 dB and 30Hz to 10kHz -3dB.
Gain stability - Better than 0.5dB over all conditions
 9. Frequency response
 - 9.1. Response range (relative to 0 dB at 0.56 A/m):
 - 9.2. Characteristics:
 10. Display: Flying spot LED bar graph with wide viewing angle.
Colour coded (green for -3dB to +3dB)
 11. Audio input (headphone): 16 Ohm min (32 Ohm per side).
3.5mm stereo jack connector.
 12. Battery low indicator: Required.
 13. Execution: [Pr_80_51_51/620 Installing electrical monitoring and metering equipment Type A.](#)

Execution

[Pr_65_70_11/621](#) Installing cable tray and cable ladder Type B

1. Standards: In accordance with BS 7671 and IETGuidance Note 1.
2. Preparation
 - 2.1. Burrs and sharp edges: Make smooth.
 - 2.2. Cutting: Minimize and make good edges. Cuts to cable tray to be square along an unperforated line.
 - 2.3. Treatment of cut surface: Extend 25 mm beyond the cut. Match finish of cable supports.
3. Access: Provide space around cable ladder and tray to permit access for installing and maintaining cables.
4. Joints and expansion couplers
 - 4.1. Joints and expansion couplers: Locate between the bracket support and the quarter point.
 - 4.2. Position:
 - 4.3. Number of joints: Minimize.
 - 4.4. Lengths of cable ladder and tray: Maximize.
 - 4.5. Ends: Blank with end plates.

5. Changes of size and direction: Manufacturer's accessories of the same material type, pattern, finish and thickness as cable supports.
6. Fire barriers: Provide where required to maintain fire performance of fabric.
7. Protective covers: Provide to cables requiring mechanical protection.
8. Support
 - 8.1. Fixing arrangement: Independently fix and support from building structure using threaded rod fixed to channel cable support with shake proof washers and hex nuts;
Independently fix and support from building structure using threaded rod fixed into expanding anchors;
and Independently fix and support from building structure using threaded rod fixed into resin injection anchors.
 - 8.2. Clearance from building fabric (minimum): 20 mm.
9. Components: Avoid contact between dissimilar metals. Contact between dissimilar materials shall not occur in external environments. Where un-avoidable a suitable insulator shall be provided between the metals to prevent any corrosion occurring.
10. Routing of cable ladder and tray: The contractor shall submit installation drawings showing the proposed routes of cable ladder and cable tray.

Pr_65_70_11/700 Installing conduit, trunking and ducting Type B

1. Standards: In accordance with BS 7671 and IET Guidance Note 1.
2. Preparation: Cut square. Remove burrs and sharp edges to make smooth.
3. Protection of metallic conduit, trunking and ducting
 - 3.1. Joints and ends: Remove grease, oil, dirt and rust before applying protective paint. Paint immediately following installation.
 - 3.2. Protective paint
 - 3.2.1. Generally: Compatible with conduit, trunking and ducting finish.
 - 3.2.2. Type: Match factory finish.
4. Cross-sectional area: Maintain throughout the conduit, trunking and ducting length.
5. Arrangement: Position vertically and horizontally in line with equipment served, and parallel with building lines.
6. Spare containment: Install one spare 25 mm diameter conduit from each distribution board to the nearest accessible void space, terminating in a conduit box with lid.
7. Draw wires: Install galvanized soft iron wires within spare conduit, trunking and ducting.
8. Distance from other services running parallel (minimum)
 - 8.1. Generally: 150 mm.
 - 8.2. Above radiators: 1000 mm.
 - 8.3. Steam services: 600 mm.
9. Drainage of conduit, trunking and ducting: Locate drainage outlets at lowest points in conduit, trunking and ducting installed externally, and where condensation may occur.
10. Fire barriers: Provide to maintain integrity of fire compartments.
11. Rewireable installations: Enable rewiring from accessible boxes or accessories only.
12. Support: Independently fix and support conduit, trunking and ducting from building structure.
13. Cleaning: Clean insides of conduit, trunking and ducting before installing cables.
14. Cabling: Install when conduit, trunking and ducting enclosure is complete.
15. Submittals: Submit manufacturer's technical information. Submit drawings showing the proposed routes of conduit, trunking and ducting and the location of service outlets.

Pr_65_70_11/715 Installing pliable and flexible conduit Type A

1. General requirements: Reference to missing clause Installing conduit generally and [Pr_65_70_11/700 Installing conduit, trunking and ducting Type B](#).
2. Fixings: Distance saddle;
Saddle;
Spacer bar saddle;
and Steel p-clip with PVC insert.
3. Joints: Push fit and Threaded.
4. Connections to trunking: Female adaptors and externally screwed brass bushes.
5. Connections to equipment: Flange mount and Threaded bush.

Pr_65_70_11/720 Installing rigid metallic conduit Type B

1. General requirements: Reference to missing clause Installing conduit generally and [Pr_65_70_11/700 Installing conduit, trunking and ducting Type B](#).
2. Fixings: Distance saddle;
Saddle;
and Spacer bar saddle.
3. Joints: Plain and Screwed.
4. Threaded conduits: Tightly screw to ensure electrical continuity, with no thread showing.
5. Conduit connections to boxes and items of equipment, other than those with threaded entries: Earthing coupling with male brass bush and protective conductor.

Pr_65_70_11/725 Installing rigid non metallic conduit Type B

1. General requirements: Reference to missing clause Installing conduit generally and [Pr_65_70_11/700 Installing conduit, trunking and ducting Type B](#).
2. Fixings: Distance saddle;
Saddle;
and Spacer bar saddle.
3. Joints: Compression and Threaded.
4. Conduit connections to boxes and items of equipment: Threaded bushed entries.

Pr_65_70_11/735 Installing conduit connections to equipment Type A

1. General requirements: Reference to missing clause Installing conduit generally and [Pr_65_70_11/700 Installing conduit, trunking and ducting Type B](#).
2. Surface mounted equipment
 - 2.1. Concealed conduit: Conceal the final connection.
 - 2.2. Exposed conduit: Contain the final connection from the conduit box within flexible metal conduit.
3. Equipment subject to vibration: Flexible metal conduit of adequate length to facilitate removal of equipment for maintenance. Final termination in swivel connectors.
4. Connections to external equipment: Flexible conduit.

Pr_65_70_11/740 Installing trunking generally Type B

1. Changes of direction: Manufacturer's bends and tees.
2. Joints
 - 2.1. Generally: Manufacturer's jointing fittings. Maintain rigidity of trunking across joint.
 - 2.2. Number of joints: Minimize.
 - 2.3. Lengths of trunking: Maximize.
 - 2.4. Open ends: Blank using manufacturer's removable end caps.
 - 2.5. Metal edging: Protect with PVC edging strip.
 - 2.6. Electrical continuity: Maintain at each joint with a copper link fitted on the outside of the trunking.
3. Connections to conduit, boxes, equipment and accessories: Screwed couplings, adaptors, connectors and glands, with rubber bushes at open ends.
4. Connections to trunking covers: Minimize.
5. Electrical continuity of covers: Electrically continuous with the trunking or provide protective conductors.
6. Access: Provide space around trunking to permit access for installing and maintaining cables. Set out access with covers on a continuous face to allow cabling to be laid in throughout its entire length.
7. Trunking passing through building fabric openings: Provide fixed trunking covers. Extend covers 50 mm from both sides of the opening.
8. Cable retaining straps: Required except when trunking cover is on top.

Pr_65_70_11/765 Conduit, trunking and ducting zones Type B

1. General requirements: [Pr_65_70_11/700 Installing conduit, trunking and ducting Type B](#).
2. Ceiling voids: Provide clear distance of 150 mm (minimum) between underside of any conduit, trunking or trunking and the topside of ceiling.

Pr_80_51_51/620 Installing electrical monitoring and metering equipment Type A

1. Standard: In accordance with BS 7671.
2. Digital metering equipment: Connect to building management system.

Ss_75_10_46/630 Installing induction-loop systems generally

1. Installation: In accordance with BS 7594 and BS 7671.
2. Equipment interconnectivity: All components of the induction loop system to be derived from the same electrical phase.

Ss_75_10_46/670 Installing induction-loop cabling

1. Position: As per contractors installation information. Ceiling level and Floor level.
2. Timing: Keep cabling dry. Commence internal cabling when building enclosure provides permanently dry conditions.
3. Cables: Install in one length. Segregate from band II voltages.
4. Cable pulling: As per contractors installation information.
5. Cables passing through walls: Sleeve with conduit or pipeduct. Bush at both ends.
6. Jointing: At equipment and terminal fittings only.
7. Separation from other audio cables when run in parallel (minimum): 1 m.
8. Cable route: Permanently identify.

Ss_75_10_46/700 Installing loop pads

1. Position: Concealed below counter top.
2. Fixing: Self adhesive hook and loop tape.

System completion

Ss_75_10_46/810 Testing and commissioning induction-loop systems generally

1. Standard: In accordance with BS 7594.
2. System commissioning agent: System manufacturer.
3. Notice before commencing tests (minimum): Two weeks.
4. System commissioning
 - 4.1. Magnetic field strength: Measure.
 - 4.2. Speech transmission index value (minimum): Measure in accordance with BS EN 60268-16.
 - 4.3. General requirements: All commissioning must be carried out using a true RMS, dedicated hearing loop field strength meter meeting the requirements of IEC 60118-4, with a valid calibration certificate available. Each complete system must be commissioned in accordance with IEC 60118-4 and a certificate of conformity clearly stating test results and performance against this standard must be issued for each HLS.
5. Cable testing: Measure the insulation resistance between conductors, between each conductor and earth, and between each conductor and any screen. Measure the continuity of loop cable, and earth continuity.
6. Loop circuit: Measure resistance. Verify loop is operating within design limits.
7. Test results: Submit.

Ss_75_10_46/815 Equipment labelling and system diagrams

1. Equipment rack: Label with a unique identification code.
2. Final amplifiers: Label with induction-loop identification information.
3. System diagram
 - 3.1. Include the following: Show the location and identity of system equipment and routes.
 - 3.2. Position: Next to the final amplifier.

Ss_75_10_46/820 Documentation

1. Operating and maintenance instructions
 - 1.1. Scope: Submit for the system giving optimum settings for controls.
 - 1.2. Product information:

- 1.3. Format: Paper and electronic.
- 1.4. Number of copies: Two.
2. Logbook: Submit one copy in accordance with BS 7594, Section 6, clause 27.
3. Record drawings
 - 3.1. Content:
 - 3.2. Format: Full size paper print drawing and Electronic drawing.
 - 3.3. Number of copies: Two.
4. Submittal date: At handover.
5. Certification
 - 5.1. Design certificate: Submit two copies in accordance with BS 7594, Annex D.1.
 - 5.2. Installation certificate: Submit two copies in accordance with BS 7594, Annex D.2.
 - 5.3. Commissioning certificate: Submit two copies in accordance with BS 7594, Annex D.3.

Ss_75_10_46/840 Maintenance

1. Servicing and maintenance: Undertake.
2. Duration: Until 12 months after Practical Completion.

Ss_75_10_46/850 Verification certificate

1. System verification agent: System manufacturer.
2. Verification certificate: Submit two copies in accordance with BS 7594, Annex D.5.

Ss_75_10_46/860 Acceptance certificate

1. Acceptance certificate: Submit two copies in accordance with BS 7594, Annex D.4.

Ss_75_10_46/870 Subjective testing

1. Area of test: In each induction loop location.
2. Objective: Standard tests shall be supplemented by a hearing aid user.
3. Timing: Prior to practical completion.
4. Panellists: To be arranged by contractor and agreed with client representative.
5. Results: Submit.

Ω End of System

Ss_75_40_02_11

Card access control systems

Systems

Ss_75_40_02_11 Card access control systems

1. Description: Data Distribution system design is by others , only containment & power supplies are allowed for in this specification.
2. Containment: [Pr_65_70_11_12 Cable baskets](#); [Pr_65_70_11_17 Cable trays Type E](#)
3. Containment accessories: [Pr_65_70_11_20 Conduit fittings](#); [Pr_25_80_81_42 Intumescent linear gap seals](#); [Pr_25_80_81_42 Intumescent linear gap seals](#); [Pr_20_29_63_50 Masonry plugs](#); [Pr_20_29_03_83 Stainless steel chemical anchor rods](#); [Pr_20_29_03_84 Stainless steel chemical anchor sockets](#)
4. Rewireable installation:
5. Concealed installation:
6. System accessories:
7. Execution:
8. System completion:

Products

See [Pr_20_29_03_83 Stainless steel chemical anchor rods](#) in [Ss_70_30_45_45 Low-voltage distribution systems](#)

See [Pr_20_29_03_84 Stainless steel chemical anchor sockets](#) in [Ss_70_30_45_45 Low-voltage distribution systems](#)

See [Pr_20_29_63_50 Masonry plugs](#) in [Ss_75_10_21_21 Data distribution systems](#)

See [Pr_25_80_81_42 Intumescent linear gap seals](#) in [Ss_70_30_45_45 Low-voltage distribution systems](#)

See [Pr_65_70_11_12 Cable baskets](#) in [Ss_70_30_45_45 Low-voltage distribution systems](#)

Pr_65_70_11_17 Cable trays Type E

Shared by: [Ss_75_40_75_40 Intruder detection and alarm systems](#)

1. Description:
2. Manufacturer: Legrand or equal and approved.
3. Standard: To BS EN 61537.
4. Material: Metallic (perforated) - The cable tray material shall be suitable for the installed environment and shall be able to withstand any corrosion effects caused by the environment.
5. Duty: Heavy duty shall be the minimum duty unless noted otherwise.
6. Resistance against flame propagation: Non-flame propagating.
7. Electrical properties
 - 7.1. Continuity characteristics: With electrical continuity.
 - 7.2. Conductivity characteristics: With electrical conductive system component.
8. Coating material: Hot dip galvanized and stainless steel in corrosive environments.
9. Temperature properties for transport, storage, installation and application
 - 9.1. Minimum: In accordance with BS EN 61537 and to suit project requirements and environmental conditions.
 - 9.2. Maximum: In accordance with BS EN 61537 and to suit project requirements and environmental conditions.
10. Mechanical properties
 - 10.1. Cable tray free base area: Class X - up to 80% perforation in the cable tray free base area.
 - 10.2. Resistance to impact: In accordance with BS EN 61537 and to suit project requirements and environmental conditions.
11. Width: As per the layout drawings.

12. Features

- 12.1. Flange type: Return Flange.
- 12.2. Segregation: Cable dividers shall be provided where services such as fire alarm cabling share the same cable basket for example.
- 12.3. Protective cover: Required where additional mechanical impact protection is required. In addition, cable tray covers are required in external areas to protect cables from vermin or the effects of UV rays for example.

13. Execution: [Pr_65_70_11/621 Installing cable tray and cable ladder Type E](#).

See [Pr_65_70_11_20 Conduit fittings](#) in [Ss_70_30_45_45 Low-voltage distribution systems](#)

Execution

See [Pr_20_29_03/611 Fixing anchors using cartridge-applied adhesive](#) in [Ss_70_30_45_45 Low-voltage distribution systems](#)

See [Pr_20_29_03/620 Fixing anchors using chemical anchor capsules](#) in [Ss_70_30_45_45 Low-voltage distribution systems](#)

[Pr_65_70_11/621](#) Installing cable tray and cable ladder Type E

1. Standards: In accordance with BS 7671 and IET Guidance Note 1.
2. Preparation
 - 2.1. Burrs and sharp edges: Make smooth.
 - 2.2. Cutting: Minimize and make good edges. Cuts to cable tray to be square along an unperforated line.
 - 2.3. Treatment of cut surface: Extend 25 mm beyond the cut. Match finish of cable supports.
3. Access: Provide space around cable ladder and tray to permit access for installing and maintaining cables.
4. Joints and expansion couplers
 - 4.1. Joints and expansion couplers: Locate between the bracket support and the quarter point.
 - 4.2. Position:
 - 4.3. Number of joints: Minimize.
 - 4.4. Lengths of cable ladder and tray: Maximize.
 - 4.5. Ends: Blank with end plates.
5. Changes of size and direction: Manufacturer's accessories of the same material type, pattern, finish and thickness as cable supports.
6. Fire barriers: Provide where required to maintain fire performance of fabric.
7. Protective covers: Provide to cables requiring mechanical protection.
8. Support
 - 8.1. Fixing arrangement: Independently fix and support from building structure using threaded rod fixed to channel cable support with shake proof washers and hex nuts;
Independently fix and support from building structure using threaded rod fixed into expanding anchors;
and Independently fix and support from building structure using threaded rod fixed into resin injection anchors.
 - 8.2. Clearance from building fabric (minimum): 20 mm.
9. Components: Avoid contact between dissimilar metals. Contact between dissimilar materials shall not occur in external environments. Where un-avoidable a suitable insulator shall be provided between the metals to prevent any corrosion occurring.
10. Routing of cable ladder and tray: The contractor shall submit installation drawings showing the proposed routes of cable ladder and cable tray.

See [Pr_65_70_11/630 Installing cable basket](#) in [Ss_70_30_45_45 Low-voltage distribution systems](#)

See [Pr_65_70_11/650 Multiple cable runs](#) in [Ss_70_30_45_45 Low-voltage distribution systems](#)

See [Pr_65_70_11/661 Cable support zones](#) in [Ss_70_30_45_45 Low-voltage distribution systems](#)

See [Pr_65_70_11/700 Installing conduit, trunking and ducting](#) in [Ss_70_30_45_45 Low-voltage distribution systems](#)

Ω End of System

Ss_75_40_53_86 Surveillance CCTV systems

Systems

Ss_75_40_53_86 Surveillance CCTV systems

1. Description: CCTV system design is by others , only containment & power supplies are allowed for in this specification.
2. System performance:
3. System manufacturer:
4. Format:
5. Automatic activation of cameras:
6. Video motion detection:
7. Video based detection system:
8. Remote monitoring:
9. Surveillance equipment:
10. Camera housings:
11. Control equipment:
12. Uninterruptible power supply: Required.
13. Telemetry transmitters:
14. Telemetry receivers:
15. Data storage:
16. Cable type: [Pr_65_70_15_06 Balanced twisted-pair cables Type A](#) and [Pr_65_70_15_13 Coaxial cables](#).
17. Cable accessories: [Pr_65_70_11_13 Cable cleats Type G](#);
[Pr_65_70_11_15 Cable ties Type G](#) and
[90-55-10/320 Cable bands Type G](#)
18. Containment: [Pr_65_70_11_12 Cable baskets Type G](#);
[Pr_65_70_11_17 Cable trays Type G](#);
[Pr_65_70_11_18 Cable trunking Type H](#);
[Pr_65_70_11_63 Pliable conduit Type G](#);
[90-55-10/385 PVC trunking](#);
[Pr_65_70_11_30 Flexible conduit Type G](#);
[Pr_65_70_11_71 Rigid conduit Type G](#);
and [Pr_65_70_11_09 Buried conduit](#).
19. Containment accessories: [Pr_20_29_63_50 Masonry plugs Type B](#);
[Pr_65_70_11_20 Conduit fittings Type A](#);
[Pr_25_80_81_42 Intumescent linear gap seals Type A](#);
[Pr_25_80_81_44 Intumescent trunking pillows type A](#);
[Pr_20_29_03_83 Stainless steel chemical anchor rods Type A](#);
and [Pr_65_70_11_19 Channel cable supports Type A](#).
20. Containment accessories:
21. Rewireable installation: Required.
22. Concealed installation: Required.
23. System accessories:
24. Execution:
25. System completion:

Products

90-55-10/320 Cable bands Type G

1. Manufacturer: Thorsman or equal and approved.
2. Material: Perforated steel bands.
3. Protective covering: LSHF.

90-55-10/385 PVC trunking

1. Manufacturer: MK or equal and approved
2. Standard: To BS 4678-4.
3. Sizes: Refer to layout drawings and electrical equipment schedules.
4. Compartments: Three compartment trunking
5. Accessories and fittings:
 - 5.1. Generally: Factory made by the cable trunking manufacturer and of the same material type and finish as the cable trunking.
 - 5.2. Types: PVC trunking shall be complete with PVC covers, proprietary bends, end caps, hanger brackets and socket plates.
6. Strength class: Medium.
7. Colour: White.
8. Execution: [Pr_65_70_11/700 Installing conduit, trunking and ducting Type G](#) and [Pr_65_70_11/740 Installing trunking generally Type G](#).

Pr_20_29_03_83 Stainless steel chemical anchor rods Type A

1. Description:
2. Manufacturer: To be provided by cable channel support manufacturer
3. Certification: Where a European Assessment Document (EAD) or European Technical Assessment Guideline (ETAG) is available, provide a European Technical Assessment (ETA) with CE marking and a Declaration of Performance (DoP). Otherwise provide third party certification by a United Kingdom Accreditation Service (UKAS)-approved independent laboratory.
4. Head arrangement: Nut and washer.
5. End arrangement: Flat.
6. Steel grade: A2 to BS EN ISO 3506-1 and A4 to BS EN ISO 3506-1.
7. Size
 - 7.1. Thread diameter: To suit the fixing requirements.
 - 7.2. Length: To suit the fixing requirements.
8. Execution: [Pr_20_29_03/611 Fixing anchors using cartridge-applied adhesive Type A](#) and [Pr_20_29_03/620 Fixing anchors using chemical anchor capsules Type A](#).

Pr_20_29_63_50 Masonry plugs Type B

1. Description:
2. Manufacturer: Rawplug or equal and approved.
3. Format: To suit substrate, loads to be supported and conditions expected in use. To be matched with the associated screw lengths.
4. Size: To suit the installation and weight of equipment to be fixed.

Pr_25_80_81_42 Intumescent linear gap seals Type A

1. Description:
2. Manufacturer: Envirograf or equal and approved.
3. Standard: In accordance with BS 476-22 and BS EN 1363-1. Fire rating duration shall meet the same fire rating of the compartment.
4. Third party certification: LPCB approved.
5. Size: To suit size of fire rated opening.
6. Fixing: Self-adhesive.
7. Execution: [Pr_65_70_11/700 Installing conduit, trunking and ducting Type G](#).

Pr_25_80_81_44 Intumescent trunking pillows type A

1. Description:
2. Manufacturer: Envirograf or equal and approved.
3. Standard: In accordance with BS 476-22 and BS EN 1363-1. Fire rating duration shall meet the same fire rating of the compartment.
4. Third party certification: LPCB approved.
5. Size: To suit size of fire rated opening.

6. Execution: [Pr_65_70_11/700 Installing conduit, trunking and ducting Type G.](#)

Pr_65_70_11_09 Buried conduit

1. Description:
2. Manufacturer: Legrand or equal and approved.
3. Standards: To BS EN 61386-1 and BS EN 61386-24.
4. Mechanical properties
 - 4.1. Resistance to compression: Heavy duty
 - 4.2. Resistance to impact: Normal
5. Resistance to bending: Rigid.
6. Electrical characteristics: With electrical continuity and insulating characteristics.
7. Resistance to external influences
 - 7.1. Protection against ingress of solid objects (minimum): To BS EN 60529, IP4X.
 - 7.2. Protection against ingress of water (minimum): To BS EN 60529, IPX0.
8. Resistance to corrosion: High protection, inside and outside.
9. Resistance to flame propagation: Non-flame propagating.
10. Sizes (OD): Minimum of 25mm overall diameter.
11. Execution: [Pr_65_70_11/735 Installing conduit connections to equipment](#) and [Pr_65_70_11/730 Installing conduit in concrete.](#)

Pr_65_70_11_12 Cable baskets Type G

1. Description:
2. Manufacturer: Legrand or equal and approved.
3. Standard: To BS EN 61537.
4. Material: Metallic - Refer to specification system description and electrical equipment schedules for cable basket duty requirements (medium duty shall be the minimum duty unless noted otherwise). The cable basket material shall be suitable for the installed environment and shall be able to withstand any corrosion effects caused by the environment.
5. Coating material: Hot dip galvanized and stainless steel in corrosive environments.
6. Resistance against flame propagation: Non-flame propagating
7. Electrical Properties: The cable basket containment system shall be electrically continuous.
8. Sizes
 - 8.1. Width: As per the layout drawings.
 - 8.2. Side height: 54 mm.
9. Features
 - 9.1. Segregation: Cable dividers shall be provided where services such as fire alarm cabling share the same cable basket for example.
 - 9.2. Protective cover: Not required.
10. Execution: [Pr_65_70_11/661 Cable support zones Type A;](#)
[Pr_65_70_11/630 Installing cable basket Type A;](#)
 and [Pr_65_70_11/650 Multiple cable runs Type A.](#)

Pr_65_70_11_13 Cable cleats Type G

1. Description:
2. Manufacturer: CMP or equal and approved.
3. Standard: To BS EN 61914.
4. Format: To suit cable type and cable manufacturers instructions.
5. Material: Metallic throughout all areas including escape routes and non escape routes. Non-metallic cable cleats may be used in external locations.
6. Temperatures for permanent installation
 - 6.1. Maximum: In accordance with BS EN 61914 and to suit project requirements and environmental conditions.
 - 6.2. Minimum: In accordance with BS EN 61914 and to suit project requirements and environmental conditions.

7. Resistance to impact: Heavy.
8. Type of retention or resistance to electromechanical forces: Resistant to electromechanical forces, withstanding one short circuit.
9. Environmental influences
 - 9.1. Non-metallic and composite components: Resistant to ultraviolet light.
 - 9.2. Metallic and composite components: High resistance to corrosion.

Pr_65_70_11_15 Cable ties Type G

1. Description:
2. Manufacturer: Thorsman or equal and approved.
3. Standard: To BS EN 62275.
4. Format: Wrap around self-locking releasable.
5. Material: Metal.
6. Loop tensile strength (minimum): Manufacturer's standard .
7. Temperatures for permanent installation
 - 7.1. Maximum: To suit the location and environmental conditions.
 - 7.2. Minimum: To suit the location and environmental conditions.
8. Contribution to fire : Non-flame propagating.
9. Environmental influences
 - 9.1. Non-metallic and composite components: Resistant to ultraviolet light.
 - 9.2. Metallic and composite components: Resistant to corrosion.

Pr_65_70_11_17 Cable trays Type G

1. Description:
2. Manufacturer: Legrand or equal and approved.
3. Standard: To BS EN 61537.
4. Material: Metallic (perforated) - The cable tray material shall be suitable for the installed environment and shall be able to withstand any corrosion effects caused by the environment.
5. Duty: Heavy duty shall be the minimum duty unless noted otherwise.
6. Resistance against flame propagation: Non-flame propagating.
7. Electrical properties
 - 7.1. Continuity characteristics: With electrical continuity.
 - 7.2. Conductivity characteristics: With electrical conductive system component.
8. Coating material: Hot dip galvanized and stainless steel in corrosive environments.
9. Temperature properties for transport, storage, installation and application
 - 9.1. Minimum: In accordance with BS EN 61537 and to suit project requirements and environmental conditions.
 - 9.2. Maximum: In accordance with BS EN 61537 and to suit project requirements and environmental conditions.
10. Mechanical properties
 - 10.1. Cable tray free base area: Class X - up to 80% perforation in the cable tray free base area.
 - 10.2. Resistance to impact: In accordance with BS EN 61537 and to suit project requirements and environmental conditions.
11. Width: As per the layout drawings.
12. Features
 - 12.1. Flange type: Return Flange.
 - 12.2. Segregation: Cable dividers shall be provided where services such as fire alarm cabling share the same cable basket for example.
 - 12.3. Protective cover: Required where additional mechanical impact protection is required. In addition, cable tray covers are required in external areas to protect cables from vermin or the effects of UV rays for example.
13. Execution: [Pr_65_70_11/621 Installing cable tray and cable ladder Type G.](#)

Pr_65_70_11_18 Cable trunking Type H

1. Description:
2. Manufacturer: Legrand or equal and approved.
3. Standards: To BS EN 50085-1 and BS EN 50085-2-1.
4. Installation position: In accordance with the contractors installation information.
5. Format: Wall, ceiling and suspended mounted trunking.
6. Resistance to compression: Not applicable.
7. Resistance to impact: Minimum of 2 Joules.
8. Temperature properties
 - 8.1. Storage and transport temperature (minimum): In accordance with BS EN 50085 and to suit project requirements and environmental conditions.
 - 8.2. Installation and application temperature (minimum): In accordance with BS EN 50085 and to suit project requirements and environmental conditions.
 - 8.3. Application temperature (maximum): In accordance with BS EN 50085 and to suit project requirements and environmental conditions.
9. Resistance to flame propagation: Non-flame propagating.
10. Electrical properties: With electrical continuity characteristics.
11. Protection by enclosure
 - 11.1. Protection against ingress of solid objects (minimum): To BS EN 60529, IP4X.
 - 11.2. Protection against ingress of water (minimum): To BS EN 60529, IPX1.
 - 11.3. Protection against access to hazardous parts (minimum): To BS EN 60529, IPXXD.
12. Access method: With tools.
13. Screening: Required.
14. Sizes: As per the layout drawings
15. Compartments: As per the layout drawings.
16. Accessories and fittings
 - 16.1. Generally: Factory made of the same material type and finish as trunking or ducting.
 - 16.2. Types: Cable retainers,
Pin racks,
Earth Links,
Stirrup hangers,
Overhead hangers,
Loose partitions,
PVC edging strips,
Fasteners.
17. Execution: [Pr_65_70_11/765 Conduit, trunking and ducting zones Type G](#) and [Pr_65_70_11/740 Installing trunking generally Type G](#).

Pr_65_70_11_19 Channel cable supports Type A

1. Description:
2. Manufacturer: Legrand or equal and approved.
3. Standard: To BS 6946.
4. Format: Plain and Slotted.
5. Dimensions: To suit the containment support requirements.
6. Material: Carbon steel. Stainless steel in external type environments.
7. Finish: Hot dip galvanized.
8. Accessories
 - 8.1. Manufacturer: As channel cable support.
 - 8.2. Type: 90° brackets;
Base plates;
Beam clamps;
Channel type cantilever arms;
End caps;
Internal connectors;
Threaded rod;
Threaded rod connectors;

Trapeze hangers;
U bolt type beam clamps;
and Window type beam clamps.

9. Execution: [Pr_65_70_11/610 Installing channel cable supports](#);
[Pr_65_70_11/640 Installing cable supports on roofs Type A](#);
[Pr_65_70_11/650 Multiple cable runs Type A](#);
and [Pr_65_70_11/661 Cable support zones Type A](#).

Pr_65_70_11_20 Conduit fittings Type A

1. Description:
2. Manufacturer: Shall be provided to match manufacturer of conduit.
3. Standards: To BS EN 61386-1 and to BS EN 61386-21, BS EN 61386-22, or BS EN 61386-23 as appropriate; or to BS 4607-1.
4. Material
 - 4.1. Type: Stainless steel and PVC-U. Metallic conduit or metallic cable supports must be provided in ceilings throughout all areas where in the event of fire the unsupported cabling could impede fire fighting activities.
 - 4.2. Finish: Match conduit.
5. Conduit boxes: Fit covers of same material and finish as boxes. Include brass earthing terminals in PVC-U boxes.
6. Plugs
 - 6.1. For metallic boxes: Hexagonal malleable iron and Slotted brass.
 - 6.2. For non-metallic boxes: Solvent PVC-U and Hexagon screwed PVC-U.
7. Locknuts
 - 7.1. For metallic boxes: Hexagonal malleable iron and Hexagonal carbon steel.
 - 7.2. For non-metallic boxes: Hexagonal PVC-U and Knurled circular PVC-U.
8. Execution: [Pr_65_70_11/700 Installing conduit, trunking and ducting Type G](#).

Pr_65_70_11_30 Flexible conduit Type G

1. Description:
2. Manufacturer: Legrand or equal and approved.
3. Standards: To BS EN 61386-1 and BS EN 61386-23.
4. Mechanical properties
 - 4.1. Resistance to compression: Medium.
 - 4.2. Resistance to impact: Medium.
5. Transport, installation and application
 - 5.1. Lower temperature (minimum): In accordance with BS EN 61386 and to suit project requirements and environmental conditions.
 - 5.2. Upper temperature (maximum): In accordance with BS EN 61386 and to suit project requirements and environmental conditions.
6. Resistance to bending: Flexible.
7. Electrical characteristics: With electrical continuity and insulating characteristics.
8. Resistance to external influences
 - 8.1. Protection against ingress of solid objects (minimum): To BS EN 60529, IP4X.
 - 8.2. Protection against ingress of water (minimum): To BS EN 60529, IPX0.
9. Resistance to corrosion: High protection inside and out. To BS EN 61386-1, Class 4.
10. Tensile strength: Medium.
11. Resistance to flame propagation: Non-flame propagating.
12. Suspended load capacity: Medium.
13. Sizes (OD): Minimum of 25mm overall diameter.
14. Execution: [Pr_65_70_11/735 Installing conduit connections to equipment](#);
[Pr_65_70_11/765 Conduit, trunking and ducting zones Type G](#);
and [Pr_65_70_11/715 Installing pliable and flexible conduit](#).

Pr_65_70_11_63 Pliable conduit Type G

1. Description:
2. Manufacturer: Legrand or equal and approved.
3. Standards: To BS EN 61386-1 and BS EN 61386-22.
4. Mechanical properties
 - 4.1. Resistance to compression: Medium.
 - 4.2. Resistance to impact: Medium.
5. Transport, installation and application
 - 5.1. Lower temperature (minimum): In accordance with BS EN 61386 and to suit project requirements and environmental conditions.
 - 5.2. Upper temperature (maximum): In accordance with BS EN 61386 and to suit project requirements and environmental conditions.
6. Resistance to bending: Pliable, self-recovering.
7. Electrical characteristics: With electrical continuity and insulating characteristics.
8. Resistance to external influences
 - 8.1. Protection against ingress of solid objects (minimum): To BS EN 60529, IP4X.
 - 8.2. Protection against ingress of water (minimum): To BS EN 60529, IPX0.
9. Resistance to corrosion: High protection, inside and outside.
10. Tensile strength: Medium.
11. Resistance to flame propagation: Non-flame propagating.
12. Suspended load capacity: Medium.
13. Sizes (OD): Minimum of 25mm overall diameter.
14. Execution: [Pr_65_70_11/715 Installing pliable and flexible conduit](#);
[Pr_65_70_11/735 Installing conduit connections to equipment](#);
 and [Pr_65_70_11/765 Conduit, trunking and ducting zones Type G](#).

Pr_65_70_11_71 Rigid conduit Type G

1. Description:
2. Manufacturer: Legrand or equal and approved.
3. Standards: To BS EN 61386-1 and BS EN 61386-21.
4. Mechanical properties
 - 4.1. Resistance to compression: Heavy.
 - 4.2. Resistance to impact: Heavy.
5. Transport, installation and application
 - 5.1. Lower temperature (minimum): In accordance with BS EN 61386 and to suit project requirements and environmental conditions.
 - 5.2. Upper temperature (maximum): In accordance with BS EN 61386 and to suit project requirements and environmental conditions.
6. Resistance to bending: Rigid.
7. Electrical characteristics: With electrical continuity properties.
8. Resistance to external influences
 - 8.1. Protection against ingress of solid objects (minimum): To BS EN 60529, IP4X.
 - 8.2. Protection against ingress of water (minimum): To BS EN 60529, IPX0.
9. Resistance to corrosion: High protection, inside and outside.
10. Tensile strength: Heavy.
11. Resistance to flame propagation: Non-flame propagating.
12. Suspended load capacity: Heavy.
13. Colour: To match main containment
14. Sizes (OD): Minimum 25 mm overall diameter. Minimum 1.2mm tubing thickness.
15. Execution: [Pr_65_70_11/720 Installing rigid metallic conduit Type G](#);
[Pr_65_70_11/725 Installing rigid non metallic conduit Type G](#);
[Pr_65_70_11/735 Installing conduit connections to equipment](#);
 and [Pr_65_70_11/765 Conduit, trunking and ducting zones Type G](#).

Pr_65_70_15_06 Balanced twisted-pair cables Type A

1. Description:
2. Manufacturer: Excel or equal and approved.
3. Standard: To BS EN 50173-1 and To TIA 568-C.2.
4. Third party certification: British Approvals Service for Cables (BASEC) certified.
5. Category: 6A.
6. Cable type: U/FTP Screened twisted pair
7. Number of pairs: 4.
8. Size: In accordance with BS EN 50288.
9. Sheath
 - 9.1. Type: Low smoke zero halogen (LSZH).
 - 9.2. Colour: Blue.
10. Reaction to fire class
 - 10.1. Fire behaviour: C_{ca}. In accordance with BS EN 50575 and BS EN 13501-6.
 - 10.2. Additional classification for smoke production: s1a. In accordance with BS EN 50575 and BS EN 13501-6.
 - 10.3. Additional classification for flaming droplets and/ or particles: d1. In accordance with BS EN 50575 and BS EN 13501-6.
 - 10.4. Additional classification for acidity: a1. In accordance with BS EN 50575 and BS EN 13501-6.
11. Execution: [90-55-15/640 Extra low and low voltage cable routes Type A](#);
[90-55-15/650 Extra low and low voltage cables in accessible roof spaces Type A](#);
[90-55-15/655 Extra low and low voltage surface mounted cables Type A](#);
 and [Pr_65_70_48/660 Installing low voltage cables in conduit and trunking Type A](#).

Pr_65_70_15_13 Coaxial cables

1. Description:
2. Manufacturer: Excel or equal and approved.
3. Standards: To BS EN 50117-1 and BS EN 50117-9-1;
 To BS EN 50117-1 and BS EN 50117-10-1;
 To BS EN 50117-1 and BS EN 50117-11-1;
 To BS EN 50117-1 and BS EN 50117-9-2;
 To BS EN 50117-1 and BS EN 50117-3;
 and To BS EN 50117-1 and BS EN 50117-4.
4. Third party certification: British Approvals Service for Cables (BASEC) certified and Confederation of Aerial Industries (CAI) Benchmark certified.
5. Conductor
 - 5.1. Sheath colour: Black.
 - 5.2. Nominal impedance: 75 ohm.
6. Reaction to fire class
 - 6.1. Fire behaviour: In accordance with BS EN 50575 and BS EN 13501-6.
 - 6.2. Additional classification for smoke production: In accordance with BS EN 50575 and BS EN 13501-6.
 - 6.3. Additional classification for flaming droplets and/ or particles: In accordance with BS EN 50575 and BS EN 13501-6.
 - 6.4. Additional classification for acidity: In accordance with BS EN 50575 and BS EN 13501-6.
7. Execution: [90-55-15/640 Extra low and low voltage cable routes Type A](#);
[90-55-15/650 Extra low and low voltage cables in accessible roof spaces Type A](#);
[90-55-15/655 Extra low and low voltage surface mounted cables Type A](#);
 and [Pr_65_70_48/660 Installing low voltage cables in conduit and trunking Type A](#).

Execution

90-55-15/640 Extra low and low voltage cable routes Type A

1. Cables generally:
 - 1.1. Concealed cable runs to wall accessories: Run vertically from the accessory.

- 1.2. Exposed cable runs: The contractor shall contain cabling within rigid conduit where cable runs are exposed. Final connection to containment shall be within flexible conduit.
2. Distance from other services running parallel (minimum): 150 mm. Position cables below heating pipes.

90-55-15/650 Extra low and low voltage cables in accessible roof spaces Type A

1. Cables running across ceiling joists: [Pr_65_70_11_12 Cable baskets Type G](#);
[Pr_65_70_11_17 Cable trays Type G](#);
and [Pr_65_70_11_18 Cable trunking Type H](#).

90-55-15/655 Extra low and low voltage surface mounted cables Type A

1. Fastening: Direct to surface.
2. Orientation: Dress cables flat, free from twists, kinks and strain.
3. Terminating cables when not using glands: Take sheathing of cables into accessory boxes and equipment and protect against abrasion with grommets.

Pr_20_29_03/611 Fixing anchors using cartridge-applied adhesive Type A

1. Position: In accordance with contractors installation information.
2. Preparation of surface, hole into which chemical is applied: Drill hole to correct diameter and depth. Clean drill hole and remove all dust, water and debris.
3. Installation: Dispense to waste until an even colour and then pump into hole. Insert stud or socket with a twisting action.
4. Curing: Allow to cure prior to attaching fixture.

Pr_20_29_03/620 Fixing anchors using chemical anchor capsules Type A

1. Position: In accordance with contractors installation information.
2. Preparation of surface, hole into which chemical is applied: Drill hole to correct diameter and depth. Clean drill hole and remove all dust, water and debris.
3. Installation: Place capsule in drill hole. Drive stud through capsule until stud reaches the base of the hole or the depth marker on the stud is reached.
4. Curing: Allow to cure prior to attaching fixture.

Pr_65_70_11/610 Installing channel cable supports

1. Standards: In accordance with BS 7671, IET Guidance Note 1 and BEAMA Best practice guide to cable ladder and cable tray systems: Channel support systems and other associated supports.
2. Preparation
 - 2.1. Burrs and sharp edges: Make smooth.
 - 2.2. Cutting: Minimize and make good edges. Cuts to slotted channel cable supports to be square along an unperforated line.
 - 2.3. Treatment of cut surface: Extend 25 mm beyond the cut. Match finish of cable supports.
3. Access: Provide space around channel cable supports to permit access for installing and maintaining cables.
4. Joints and expansion couplers
 - 4.1. Position: Locate between the bracket support and the quarter point.
 - 4.2. Number of joints: Minimize.
 - 4.3. Lengths of cable supports: Maximize.
5. Fire barriers: Provide where required to maintain fire performance of fabric.
6. Changes of size and direction: Manufacturer's accessories of the same material type, pattern, finish and thickness as channel cable supports.
7. Support
 - 7.1. Fixing arrangement: Independently fix and support from building structure using threaded rod fixed into expanding anchors and Independently fix and support from building structure using threaded rod fixed into resin injection anchors.
 - 7.2. Clearance from building fabric (minimum): 20 mm.
8. Components: Avoid contact between dissimilar metals.
9. Routing of channel cable supports: Submit drawings showing the proposed routes.

Pr_65_70_11/621 Installing cable tray and cable ladder Type G

1. Standards: In accordance with BS 7671 and IET Guidance Note 1.
2. Preparation
 - 2.1. Burrs and sharp edges: Make smooth.
 - 2.2. Cutting: Minimize and make good edges. Cuts to cable tray to be square along an unperforated line.
 - 2.3. Treatment of cut surface: Extend 25 mm beyond the cut. Match finish of cable supports.
3. Access: Provide space around cable ladder and tray to permit access for installing and maintaining cables.
4. Joints and expansion couplers
 - 4.1. Joints and expansion couplers: Locate between the bracket support and the quarter point.
 - 4.2. Position:
 - 4.3. Number of joints: Minimize.
 - 4.4. Lengths of cable ladder and tray: Maximize.
 - 4.5. Ends: Blank with end plates.
5. Changes of size and direction: Manufacturer's accessories of the same material type, pattern, finish and thickness as cable supports.
6. Fire barriers: Provide where required to maintain fire performance of fabric.
7. Protective covers: Provide to cables requiring mechanical protection.
8. Support
 - 8.1. Fixing arrangement: Independently fix and support from building structure using threaded rod fixed to channel cable support with shake proof washers and hex nuts;
Independently fix and support from building structure using threaded rod fixed into expanding anchors;
and Independently fix and support from building structure using threaded rod fixed into resin injection anchors.
 - 8.2. Clearance from building fabric (minimum): 20 mm.
9. Components: Avoid contact between dissimilar metals. Contact between dissimilar materials shall not occur in external environments. Where un-avoidable a suitable insulator shall be provided between the metals to prevent any corrosion occurring.
10. Routing of cable ladder and tray: The contractor shall submit installation drawings showing the proposed routes of cable ladder and cable tray.

Pr_65_70_11/630 Installing cable basket Type A

1. Standards: In accordance with BS 7671 and IET Guidance Note 1.
2. Joints: Cut adjacent cross basket wires. Make smooth any burrs or edges.
3. Accessories: Form on site and connect with basket manufacturer's coupling components.
4. Fire barriers: Provide where required to maintain fire performance of fabric.
5. Support
 - 5.1. Fixing arrangement: Independently fix and support from building structure using threaded rod fixed to channel cable support with shake proof washers and hex nuts;
Independently fix and support from building structure using threaded rod fixed into expanding anchors;
and Independently fix and support from building structure using threaded rod fixed into resin injection anchors.
 - 5.2. Clearance from building fabric (minimum): 20 mm.
6. Components: Avoid contact between dissimilar metals.
7. Routing of cable basket: The contractor shall submit installation drawings showing the proposed routes of cable basket.

Pr_65_70_11/640 Installing cable supports on roofs Type A

1. Position: Elevate above roof.
2. Mounting: Load spreading supports.

Pr_65_70_11/650 Multiple cable runs Type A

1. Requirement: Use cable basket when three or more cables are run in parallel;
Use cable ladder when two or more cables run in parallel;

Use cable tray when three or more cables are run in parallel;
and Use cable trunking when three or more conduits are run in parallel.

Pr_65_70_11/661 Cable support zones Type A

1. Ceiling voids: Provide clear distance of 150 mm (minimum) between underside of any cable supports and brackets and the topside of ceiling.

Pr_65_70_11/700 Installing conduit, trunking and ducting Type G

1. Standards: In accordance with BS 7671 and IET Guidance Note 1.
2. Preparation: Cut square. Remove burrs and sharp edges to make smooth.
3. Protection of metallic conduit, trunking and ducting
 - 3.1. Joints and ends: Remove grease, oil, dirt and rust before applying protective paint. Paint immediately following installation.
 - 3.2. Protective paint
 - 3.2.1. Generally: Compatible with conduit, trunking and ducting finish.
 - 3.2.2. Type: Match factory finish.
4. Cross-sectional area: Maintain throughout the conduit, trunking and ducting length.
5. Arrangement: Position vertically and horizontally in line with equipment served, and parallel with building lines.
6. Spare containment: Install one spare 25 mm diameter conduit from each distribution board to the nearest accessible void space, terminating in a conduit box with lid.
7. Draw wires: Install galvanized soft iron wires within spare conduit, trunking and ducting.
8. Distance from other services running parallel (minimum)
 - 8.1. Generally: 150 mm.
 - 8.2. Above radiators: 1000 mm.
 - 8.3. Steam services: 600 mm.
9. Drainage of conduit, trunking and ducting: Locate drainage outlets at lowest points in conduit, trunking and ducting installed externally, and where condensation may occur.
10. Fire barriers: Provide to maintain integrity of fire compartments.
11. Rewireable installations: Enable rewiring from accessible boxes or accessories only.
12. Support: Independently fix and support conduit, trunking and ducting from building structure.
13. Cleaning: Clean insides of conduit, trunking and ducting before installing cables.
14. Cabling: Install when conduit, trunking and ducting enclosure is complete.
15. Submittals: Submit manufacturer's technical information. Submit drawings showing the proposed routes of conduit, trunking and ducting and the location of service outlets.

Pr_65_70_11/710 Installing conduit generally Type A

1. Fixing: Fix securely. Fix boxes independently of conduit.
2. Changes of direction: Conduit boxes or bends site formed by machine. Do not use elbows, tees or inspection bends.
3. Joints
 - 3.1. Generally: Manufacturer's jointing fittings shall be provided.
 - 3.2. Number of joints: Minimize.
 - 3.3. Lengths of conduit: Maximize.
 - 3.4. Open ends: Plug.
 - 3.5. At movement joints in structure: Manufactured expansion coupling. Install adaptable boxes on both sides of joint at a maximum distance of 300 mm.
4. Connections to boxes, trunking, equipment and accessories: Screwed couplings with rubber bushes at open ends.
5. Conduit boxes
 - 5.1. Generally: Install flush with finished surfaces. Provide extension rings if required.
 - 5.2. Fixing screws: Countersunk, or round-headed screws.
 - 5.3. Number of fixings (minimum): Two.
 - 5.4. Lids: Fasten with brass slot pan head screws.

6. Rear outlet boxes: Locate where surface conduits pass through walls to external equipment.
7. Draw-in boxes
 - 7.1. Spacing (maximum): 10 m.
 - 7.2. Number of bends between draw-in boxes (maximum): Two.
 - 7.3. Floors: Do not install draw-in boxes in floors.
8. Conduit in walls: Avoid concealed horizontal runs.
9. Suspended ceiling installations: Fasten outlet boxes to structure above ceiling.

Pr_65_70_11/715 Installing pliable and flexible conduit

1. General requirements: [Pr_65_70_11/710 Installing conduit generally Type A](#) and [Pr_65_70_11/700 Installing conduit, trunking and ducting Type G](#).
2. Fixings: Distance saddle;
Saddle;
Spacer bar saddle;
and Steel p-clip with PVC insert.
3. Joints: Push fit and Threaded.
4. Connections to trunking: Female adaptors and externally screwed brass bushes.
5. Connections to equipment: Flange mount and Threaded bush.

Pr_65_70_11/720 Installing rigid metallic conduit Type G

1. General requirements: [Pr_65_70_11/710 Installing conduit generally Type A](#) and [Pr_65_70_11/700 Installing conduit, trunking and ducting Type G](#).
2. Fixings: Distance saddle;
Saddle;
and Spacer bar saddle.
3. Joints: Plain and Screwed.
4. Threaded conduits: Tightly screw to ensure electrical continuity, with no thread showing.
5. Conduit connections to boxes and items of equipment, other than those with threaded entries: Earthing coupling with male brass bush and protective conductor.

Pr_65_70_11/725 Installing rigid non metallic conduit Type G

1. General requirements: [Pr_65_70_11/710 Installing conduit generally Type A](#) and [Pr_65_70_11/700 Installing conduit, trunking and ducting Type G](#).
2. Fixings: Distance saddle;
Saddle;
and Spacer bar saddle.
3. Joints: Compression and Threaded.
4. Conduit connections to boxes and items of equipment: Threaded bushed entries.

Pr_65_70_11/730 Installing conduit in concrete

1. General requirements: [Pr_65_70_11/700 Installing conduit, trunking and ducting Type G](#) and [Pr_65_70_11/710 Installing conduit generally Type A](#).
2. Fastening: Fix securely to reinforcement. Fix boxes to formwork to prevent displacement of boxes.
3. Protection of containment: Seal exposed openings during construction.
4. Concrete cover to conduit (minimum): 30 mm.
5. Integrity of conduit: Inspect and verify immediately concrete construction is complete.
6. Conduit in structural slabs: Submit drawings showing proposed route and location.

Pr_65_70_11/735 Installing conduit connections to equipment

1. General requirements: [Pr_65_70_11/710 Installing conduit generally Type A](#) and [Pr_65_70_11/700 Installing conduit, trunking and ducting Type G](#).
2. Surface mounted equipment
 - 2.1. Concealed conduit: Conceal the final connection.
 - 2.2. Exposed conduit: Contain the final connection from the conduit box within flexible metal conduit.
3. Equipment subject to vibration: Flexible metal conduit of adequate length to facilitate removal of equipment for maintenance. Final termination in swivel connectors.

4. Connections to external equipment: Flexible conduit.

Pr_65_70_11/740 Installing trunking generally Type G

1. Changes of direction: Manufacturer's bends and tees.
2. Joints
 - 2.1. Generally: Manufacturer's jointing fittings. Maintain rigidity of trunking across joint.
 - 2.2. Number of joints: Minimize.
 - 2.3. Lengths of trunking: Maximize.
 - 2.4. Open ends: Blank using manufacturer's removable end caps.
 - 2.5. Metal edging: Protect with PVC edging strip.
 - 2.6. Electrical continuity: Maintain at each joint with a copper link fitted on the outside of the trunking.
3. Connections to conduit, boxes, equipment and accessories: Screwed couplings, adaptors, connectors and glands, with rubber bushes at open ends.
4. Connections to trunking covers: Minimize.
5. Electrical continuity of covers: Electrically continuous with the trunking or provide protective conductors.
6. Access: Provide space around trunking to permit access for installing and maintaining cables. Set out access with covers on a continuous face to allow cabling to be laid in throughout its entire length.
7. Trunking passing through building fabric openings: Provide fixed trunking covers. Extend covers 50 mm from both sides of the opening.
8. Cable retaining straps: Required except when trunking cover is on top.

Pr_65_70_11/765 Conduit, trunking and ducting zones Type G

1. General requirements: [Pr_65_70_11/700 Installing conduit, trunking and ducting Type G](#).
2. Ceiling voids: Provide clear distance of 150 mm (minimum) between underside of any conduit, trunking or trunking and the topside of ceiling.

Pr_65_70_48/660 Installing low voltage cables in conduit and trunking Type A

1. Cable installation: Orderly and capable of being withdrawn.
2. Single core wiring: Arrange using the loop-in method.
3. Cables within trunking: Tie at 2 m intervals for cables of the same circuit reference. Label ties with circuit reference number at 10 m intervals.
4. Cables in vertical conduit: Provide cable clamps in accessible conduit boxes at 5 m intervals.
5. Extra low voltage cables: Install within a separate partition from low voltage cables where installed in multi compartment trunking.

Ω End of System

Ss_75_40_75_40

Intruder detection and alarm systems

Systems

Ss_75_40_75_40 Intruder detection and alarm systems

1. Description: Intruder Detection and alarm system design is by others , only containment & power supplies are allowed for in this specification.
2. Power Supply: To BS EN 50131-1, type A.
3. Notification equipment:
4. Detectors:
5. Cable Type: In accordance with manufacturers instructions.
6. Cable Accessories: [90-55-10/320 Cable bands Type E](#);
[Pr_65_70_11_15 Cable ties Type E](#);
[Pr_65_70_11_13 Cable cleats Type E](#)
7. Containment: [Pr_65_70_11_12 Cable baskets Type E](#);
[Pr_65_70_11_17 Cable trays Type E](#);
[Pr_65_70_11_71 Rigid conduit Type E](#);
[Pr_65_70_11_18 Cable trunking Type F](#);
[Pr_65_70_11_09 Buried conduit Type D](#);
[Pr_65_70_11_30 Flexible conduit Type E](#);
[Pr_65_70_11_63 Pliable conduit Type E](#)
8. Warning Devices:
9. Cable type:
10. Containment:
11. Containment accessories:
12. Rewireable installation: Required.
13. Concealed installation: Required.
14. System accessories:
15. Execution: .
16. System completion: .

Products

90-55-10/320 Cable bands Type E

1. Manufacturer: Thorsman or equal and approved.
2. Material: Perforated steel bands.
3. Protective covering: LSHF.

Pr_65_70_11_09 Buried conduit Type D

1. Description:
2. Manufacturer: Legrand or equal and approved.
3. Standards: To BS EN 61386-1 and BS EN 61386-24.
4. Mechanical properties
 - 4.1. Resistance to compression: Heavy duty
 - 4.2. Resistance to impact: Normal
5. Resistance to bending: Rigid.
6. Electrical characteristics: With electrical continuity and insulating characteristics.
7. Resistance to external influences
 - 7.1. Protection against ingress of solid objects (minimum): To BS EN 60529, IP4X.
 - 7.2. Protection against ingress of water (minimum): To BS EN 60529, IPX0.
8. Resistance to corrosion: High protection, inside and outside.
9. Resistance to flame propagation: Non-flame propagating.
10. Sizes (OD): Minimum of 25mm overall diameter.

11. Execution: [Pr_65_70_11/735 Installing conduit connections to equipment Type D](#) and Reference to missing clause Installing conduit in concrete.

[Pr_65_70_11_12](#) Cable baskets Type E

1. Description:
2. Manufacturer: Legrand or equal and approved.
3. Standard: To BS EN 61537.
4. Material: Metallic - Refer to specification system description and electrical equipment schedules for cable basket duty requirements (medium duty shall be the minimum duty unless noted otherwise). The cable basket material shall be suitable for the installed environment and shall be able to withstand any corrosion effects caused by the environment.
5. Coating material: Hot dip galvanized and stainless steel in corrosive environments.
6. Resistance against flame propagation: Non-flame propagating
7. Electrical Properties: The cable basket containment system shall be electrically continuous.
8. Sizes
 - 8.1. Width: As per the layout drawings.
 - 8.2. Side height: 54 mm.
9. Features
 - 9.1. Segregation: Cable dividers shall be provided where services such as fire alarm cabling share the same cable basket for example.
 - 9.2. Protective cover: Not required.
10. Execution: Reference to missing clause Cable support zones;
Reference to missing clause Installing cable basket;
and Reference to missing clause Multiple cable runs.

[Pr_65_70_11_13](#) Cable cleats Type E

1. Description:
2. Manufacturer: CMP or equal and approved.
3. Standard: To BS EN 61914.
4. Format: To suit cable type and cable manufacturers instructions.
5. Material: Metallic throughout all areas including escape routes and non escape routes. Non-metallic cable cleats may be used in external locations.
6. Temperatures for permanent installation
 - 6.1. Maximum: In accordance with BS EN 61914 and to suit project requirements and environmental conditions.
 - 6.2. Minimum: In accordance with BS EN 61914 and to suit project requirements and environmental conditions.
7. Resistance to impact: Heavy.
8. Type of retention or resistance to electromechanical forces: Resistant to electromechanical forces, withstanding one short circuit.
9. Environmental influences
 - 9.1. Non-metallic and composite components: Resistant to ultraviolet light.
 - 9.2. Metallic and composite components: High resistance to corrosion.

[Pr_65_70_11_15](#) Cable ties Type E

1. Description:
2. Manufacturer: Thorsman or equal and approved.
3. Standard: To BS EN 62275.
4. Format: Wrap around self-locking releasable.
5. Material: Metal.
6. Loop tensile strength (minimum): Manufacturer's standard .
7. Temperatures for permanent installation
 - 7.1. Maximum: To suit the location and environmental conditions.
 - 7.2. Minimum: To suit the location and environmental conditions.
8. Contribution to fire : Non-flame propagating.

9. Environmental influences

- 9.1. Non-metallic and composite components: Resistant to ultraviolet light.
- 9.2. Metallic and composite components: Resistant to corrosion.

See [Pr_65_70_11_17 Cable trays Type E](#) in [Ss_75_40_02_11 Card access control systems](#)

Pr_65_70_11_18 Cable trunking Type F

1. Description:
2. Manufacturer: Legrand or equal and approved.
3. Standards: To BS EN 50085-1 and BS EN 50085-2-1.
4. Installation position: In accordance with the contractors installation information.
5. Format: Wall, ceiling and suspended mounted trunking.
6. Resistance to compression: Not applicable.
7. Resistance to impact: Minimum of 2 Joules.
8. Temperature properties
 - 8.1. Storage and transport temperature (minimum): In accordance with BS EN 50085 and to suit project requirements and environmental conditions.
 - 8.2. Installation and application temperature (minimum): In accordance with BS EN 50085 and to suit project requirements and environmental conditions.
 - 8.3. Application temperature (maximum): In accordance with BS EN 50085 and to suit project requirements and environmental conditions.
9. Resistance to flame propagation: Non-flame propagating.
10. Electrical properties: With electrical continuity characteristics.
11. Protection by enclosure
 - 11.1. Protection against ingress of solid objects (minimum): To BS EN 60529, IP4X.
 - 11.2. Protection against ingress of water (minimum): To BS EN 60529, IPX1.
 - 11.3. Protection against access to hazardous parts (minimum): To BS EN 60529, IPXXD.
12. Access method: With tools.
13. Screening: Required.
14. Sizes: As per the layout drawings
15. Compartments: As per the layout drawings.
16. Accessories and fittings
 - 16.1. Generally: Factory made of the same material type and finish as trunking or ducting.
 - 16.2. Types: Cable retainers,
Pin racks,
Earth Links,
Stirrup hangers,
Overhead hangers,
Loose partitions,
PVC edging strips,
Fasteners.
17. Execution: [Pr_65_70_11/765 Conduit, trunking and ducting zones Type E](#) and [Pr_65_70_11/740 Installing trunking generally Type E](#).

Pr_65_70_11_30 Flexible conduit Type E

1. Description:
2. Manufacturer: Legrand or equal and approved.
3. Standards: To BS EN 61386-1 and BS EN 61386-23.
4. Mechanical properties
 - 4.1. Resistance to compression: Medium.
 - 4.2. Resistance to impact: Medium.
5. Transport, installation and application
 - 5.1. Lower temperature (minimum): In accordance with BS EN 61386 and to suit project requirements and environmental conditions.
 - 5.2. Upper temperature (maximum): In accordance with BS EN 61386 and to suit project requirements and environmental conditions.

6. Resistance to bending: Flexible.
7. Electrical characteristics: With electrical continuity and insulating characteristics.
8. Resistance to external influences
 - 8.1. Protection against ingress of solid objects (minimum): To BS EN 60529, IP4X.
 - 8.2. Protection against ingress of water (minimum): To BS EN 60529, IPX0.
9. Resistance to corrosion: High protection inside and out. To BS EN 61386-1, Class 4.
10. Tensile strength: Medium.
11. Resistance to flame propagation: Non-flame propagating.
12. Suspended load capacity: Medium.
13. Sizes (OD): Minimum of 25mm overall diameter.
14. Execution: [Pr_65_70_11/735 Installing conduit connections to equipment Type D](#);
[Pr_65_70_11/765 Conduit, trunking and ducting zones Type E](#);
 and [Pr_65_70_11/715 Installing pliable and flexible conduit Type D](#).

Pr_65_70_11_63 Pliable conduit Type E

1. Description:
2. Manufacturer: Legrand or equal and approved.
3. Standards: To BS EN 61386-1 and BS EN 61386-22.
4. Mechanical properties
 - 4.1. Resistance to compression: Medium.
 - 4.2. Resistance to impact: Medium.
5. Transport, installation and application
 - 5.1. Lower temperature (minimum): In accordance with BS EN 61386 and to suit project requirements and environmental conditions.
 - 5.2. Upper temperature (maximum): In accordance with BS EN 61386 and to suit project requirements and environmental conditions.
6. Resistance to bending: Pliable, self-recovering.
7. Electrical characteristics: With electrical continuity and insulating characteristics.
8. Resistance to external influences
 - 8.1. Protection against ingress of solid objects (minimum): To BS EN 60529, IP4X.
 - 8.2. Protection against ingress of water (minimum): To BS EN 60529, IPX0.
9. Resistance to corrosion: High protection, inside and outside.
10. Tensile strength: Medium.
11. Resistance to flame propagation: Non-flame propagating.
12. Suspended load capacity: Medium.
13. Sizes (OD): Minimum of 25mm overall diameter.
14. Execution: [Pr_65_70_11/715 Installing pliable and flexible conduit Type D](#);
[Pr_65_70_11/735 Installing conduit connections to equipment Type D](#);
 and [Pr_65_70_11/765 Conduit, trunking and ducting zones Type E](#).

Pr_65_70_11_71 Rigid conduit Type E

1. Description:
2. Manufacturer: Legrand or equal and approved.
3. Standards: To BS EN 61386-1 and BS EN 61386-21.
4. Mechanical properties
 - 4.1. Resistance to compression: Heavy.
 - 4.2. Resistance to impact: Heavy.
5. Transport, installation and application
 - 5.1. Lower temperature (minimum): In accordance with BS EN 61386 and to suit project requirements and environmental conditions.
 - 5.2. Upper temperature (maximum): In accordance with BS EN 61386 and to suit project requirements and environmental conditions.
6. Resistance to bending: Rigid.
7. Electrical characteristics: With electrical continuity properties.

8. Resistance to external influences
 - 8.1. Protection against ingress of solid objects (minimum): To BS EN 60529, IP4X.
 - 8.2. Protection against ingress of water (minimum): To BS EN 60529, IPX0.
9. Resistance to corrosion: High protection, inside and outside.
10. Tensile strength: Heavy.
11. Resistance to flame propagation: Non-flame propagating.
12. Suspended load capacity: Heavy.
13. Colour: To match main containment
14. Sizes (OD): Minimum 25 mm overall diameter. Minimum 1.2mm tubing thickness.
15. Execution: [Pr_65_70_11/720 Installing rigid metallic conduit Type E](#);
[Pr_65_70_11/725 Installing rigid non metallic conduit Type E](#);
[Pr_65_70_11/735 Installing conduit connections to equipment Type D](#);
 and [Pr_65_70_11/765 Conduit, trunking and ducting zones Type E](#).

Execution

See [Pr_65_70_11/621 Installing cable tray and cable ladder Type E](#) in [Ss_75_40_02_11 Card access control systems](#)

[Pr_65_70_11/700](#) Installing conduit, trunking and ducting Type E

1. Standards: In accordance with BS 7671 and IET Guidance Note 1.
2. Preparation: Cut square. Remove burrs and sharp edges to make smooth.
3. Protection of metallic conduit, trunking and ducting
 - 3.1. Joints and ends: Remove grease, oil, dirt and rust before applying protective paint. Paint immediately following installation.
 - 3.2. Protective paint
 - 3.2.1. Generally: Compatible with conduit, trunking and ducting finish.
 - 3.2.2. Type: Match factory finish.
4. Cross-sectional area: Maintain throughout the conduit, trunking and ducting length.
5. Arrangement: Position vertically and horizontally in line with equipment served, and parallel with building lines.
6. Spare containment: Install one spare 25 mm diameter conduit from each distribution board to the nearest accessible void space, terminating in a conduit box with lid.
7. Draw wires: Install galvanized soft iron wires within spare conduit, trunking and ducting.
8. Distance from other services running parallel (minimum)
 - 8.1. Generally: 150 mm.
 - 8.2. Above radiators: 1000 mm.
 - 8.3. Steam services: 600 mm.
9. Drainage of conduit, trunking and ducting: Locate drainage outlets at lowest points in conduit, trunking and ducting installed externally, and where condensation may occur.
10. Fire barriers: Provide to maintain integrity of fire compartments.
11. Rewireable installations: Enable rewiring from accessible boxes or accessories only.
12. Support: Independently fix and support conduit, trunking and ducting from building structure.
13. Cleaning: Clean insides of conduit, trunking and ducting before installing cables.
14. Cabling: Install when conduit, trunking and ducting enclosure is complete.
15. Submittals: Submit manufacturer's technical information. Submit drawings showing the proposed routes of conduit, trunking and ducting and the location of service outlets.

[Pr_65_70_11/715](#) Installing pliable and flexible conduit Type D

1. General requirements: Reference to missing clause Installing conduit generally and [Pr_65_70_11/700 Installing conduit, trunking and ducting Type E](#).
2. Fixings: Distance saddle;
Saddle;
Spacer bar saddle;
and Steel p-clip with PVC insert.
3. Joints: Push fit and Threaded.

4. Connections to trunking: Female adaptors and externally screwed brass bushes.
5. Connections to equipment: Flange mount and Threaded bush.

Pr_65_70_11/720 Installing rigid metallic conduit Type E

1. General requirements: Reference to missing clause Installing conduit generally and [Pr_65_70_11/700 Installing conduit, trunking and ducting Type E](#).
2. Fixings: Distance saddle;
Saddle;
and Spacer bar saddle.
3. Joints: Plain and Screwed.
4. Threaded conduits: Tightly screw to ensure electrical continuity, with no thread showing.
5. Conduit connections to boxes and items of equipment, other than those with threaded entries: Earthing coupling with male brass bush and protective conductor.

Pr_65_70_11/725 Installing rigid non metallic conduit Type E

1. General requirements: Reference to missing clause Installing conduit generally and [Pr_65_70_11/700 Installing conduit, trunking and ducting Type E](#).
2. Fixings: Distance saddle;
Saddle;
and Spacer bar saddle.
3. Joints: Compression and Threaded.
4. Conduit connections to boxes and items of equipment: Threaded bushed entries.

Pr_65_70_11/735 Installing conduit connections to equipment Type D

1. General requirements: Reference to missing clause Installing conduit generally and [Pr_65_70_11/700 Installing conduit, trunking and ducting Type E](#).
2. Surface mounted equipment
 - 2.1. Concealed conduit: Conceal the final connection.
 - 2.2. Exposed conduit: Contain the final connection from the conduit box within flexible metal conduit.
3. Equipment subject to vibration: Flexible metal conduit of adequate length to facilitate removal of equipment for maintenance. Final termination in swivel connectors.
4. Connections to external equipment: Flexible conduit.

Pr_65_70_11/740 Installing trunking generally Type E

1. Changes of direction: Manufacturer's bends and tees.
2. Joints
 - 2.1. Generally: Manufacturer's jointing fittings. Maintain rigidity of trunking across joint.
 - 2.2. Number of joints: Minimize.
 - 2.3. Lengths of trunking: Maximize.
 - 2.4. Open ends: Blank using manufacturer's removable end caps.
 - 2.5. Metal edging: Protect with PVC edging strip.
 - 2.6. Electrical continuity: Maintain at each joint with a copper link fitted on the outside of the trunking.
3. Connections to conduit, boxes, equipment and accessories: Screwed couplings, adaptors, connectors and glands, with rubber bushes at open ends.
4. Connections to trunking covers: Minimize.
5. Electrical continuity of covers: Electrically continuous with the trunking or provide protective conductors.
6. Access: Provide space around trunking to permit access for installing and maintaining cables. Set out access with covers on a continuous face to allow cabling to be laid in throughout its entire length.
7. Trunking passing through building fabric openings: Provide fixed trunking covers. Extend covers 50 mm from both sides of the opening.
8. Cable retaining straps: Required except when trunking cover is on top.

Pr_65_70_11/765 Conduit, trunking and ducting zones Type E

1. General requirements: [Pr_65_70_11/700 Installing conduit, trunking and ducting Type E](#).

2. Ceiling voids: Provide clear distance of 150 mm (minimum) between underside of any conduit, trunking or trunking and the topside of ceiling.

Ω End of System

Ss_75_50_11_05 Assistance call systems

Systems

Ss_75_50_11_05 Assistance call systems

9. Description: **Contractors Responsibilities**

The Contractor shall develop the tender design to completion, supply, install, co-ordinate with other contractors, test, commission and set to work the complete disabled WC call assistance system. This shall include all necessary tools, labour, materials and equipment required to provide a complete working installation that fully meets the functional and performance criteria specified within this specification.

The Contractor shall include for provision of maintenance to the system, seasonal commissioning activities and rectification as required by the Contract and the Mechanical & Electrical Specification.

Function/Objectives

A complete and fully operational disabled WC call assistance alarm installation shall be provided.

Applicable Standards

In addition to this specification, the disabled WC call assistance alarm installation shall comply with the following standards and guidelines current at the time of tender:

- Building Regulations
- British Standards
- The requirements of the local Building Control Authority
- Relevant HSE Guidance
- BSRIA Standards & Guidance notes
- CIBSE Guides & Notes.
- MoD Specifications, Design and Maintenance Guides and Technical Bulletins.
- Client Specific Requirements.
- Manufacturers recommendations.

Any discrepancies identified by the contractor between the specification and the above documents shall be brought to the attention of the CA immediately.

System Description

The contractor shall supply, install, test, commission and set to work a complete disabled toilet alarm system.

All disabled persons WC facilities will be provided with the facility to call for assistance using a pull cord complete with reassurance lamp, wall mounted reset button and over door buzzer indicator. Reset of the call signal will be from the point of origin.

The disabled WC alarm system shall include for integration with the disabled refuge system.

Alarms will be presented on the disabled refuge master stations.

The disabled WC's shall be provided with a surface ceiling mounted pull cord unit with integral reassurance lamp and red lens. The pull cord shall be red in colour, 3 metres in length and terminate 450mm from the floor level with two number 50mm red circular bangles. One positioned at 800-1000mm and the other set at 100mm above floor level.

The ceiling pull cord shall be positioned so that it can be operated from the toilet and adjacent floor area.

The closing of this switch shall activate the alarm.

Visual and audible feedback shall be provided to indicate the alarm has been triggered.

An over door lamp/tone generator shall be provided over the head of the door leading into the disabled WC. The unit shall be centred above the doorway and placed where it will be seen and heard by people able to provide assistance and identify where help is required.

The unit shall be recessed and incorporate an illuminated red lens and audible tone generator and shall be activated once the pull cord switch has been operated.

The unit shall be labelled "DISABLED WC ALARM".

A recessed reset push with integral reassurance lamp with amber lens shall also be provided to the inside of the disabled WC room, located adjacent the door leading into the room. The unit shall be clearly marked "RESET" and sited so it is out of reach of the toilet.

The activation of this reset unit shall reset the system, extinguish and silence all visual and audible alarms.

The Contractor will be responsible for demonstrating the complete system operation and training building / FM staff to operate the system fully.

The Contractor shall include for full time attendance throughout handover and training period.

Drawings

Refer to the drawings issue sheet for all relevant drawings.

Schematics

Refer to the drawings issue sheet for all relevant schematics.

10. System performance: [Ss_75_50_11/230 Integration with other alarm and security systems](#).
11. System manufacturer: Baldwin Boxall or equal and approved.
12. Operating voltage: 12 V d.c.
13. Zones: Refer to the specification system description and layout drawings.
14. Equipment interconnectivity: Wired.
15. Call actuator: [Pr_75_75_04_03 Assistance call press button units](#) and [Pr_75_75_04_04 Assistance call pull cord units](#).
16. Alarm indication: [Pr_70_75_94_58 Overdoor indicator units](#) and [Pr_75_75_04_01 Assistance call indicator units](#).
17. Manual alarm reset: [Pr_75_75_04_05 Assistance call reset units](#).
18. Primary power supply: [Pr_75_75_04_02 Assistance call power supply units](#).
19. Secondary power supply:
20. Circuit monitoring: Open circuit and Short circuit.
21. Cable type:
22. Containment: [Pr_65_70_11_71 Rigid conduit](#) and [Pr_65_70_11_18 Cable trunking](#).
23. Rewireable installation: Required.
24. Concealed installation: Required.
25. Execution: [Ss_75_50_11/630 Installing emergency assistance alarm systems](#).
26. System completion: [Ss_75_50_11/810 Testing and commissioning assistance call systems generally](#); [Ss_75_50_11/825 Calibration certificates](#); [Ss_75_50_11/830 Documentation for emergency assistance alarm systems](#); and [Ss_75_50_11/840 Maintenance](#).

System performance

[Ss_75_50_11/230](#) Integration with other alarm and security systems

12. Systems to be integrated: Refer to the specification system description and layout drawings / schematics.
13. Objectives: Refer to the specification system description.
14. Equipment and mode of operation:

Products

[Pr_65_70_11_18](#) Cable trunking

8. Description:
9. Manufacturer: Legrand or equal and approved.

10. Standards: To BS EN 50085-1 and BS EN 50085-2-1.
11. Installation position: In accordance with the contractors installation information.
12. Format: Wall, ceiling and suspended mounted trunking.
13. Resistance to compression: Not applicable.
14. Resistance to impact: Minimum of 2 Joules.
15. **Temperature properties**
 - 15.1. Storage and transport temperature (minimum): In accordance with BS EN 50085 and to suit project requirements and environmental conditions.
 - 15.2. Installation and application temperature (minimum): In accordance with BS EN 50085 and to suit project requirements and environmental conditions.
 - 15.3. Application temperature (maximum): In accordance with BS EN 50085 and to suit project requirements and environmental conditions.
16. Resistance to flame propagation: Non-flame propagating.
17. Electrical properties: With electrical continuity characteristics.
18. **Protection by enclosure**
 - 18.1. Protection against ingress of solid objects (minimum): To BS EN 60529, IP4X.
 - 18.2. Protection against ingress of water (minimum): To BS EN 60529, IPX1.
 - 18.3. Protection against access to hazardous parts (minimum): To BS EN 60529, IPXXD.
19. Access method: With tools.
20. Screening: Required.
21. Sizes: As per the layout drawings
22. Compartments: As per the layout drawings.
23. **Accessories and fittings**
 - 23.1. Generally: Factory made of the same material type and finish as trunking or ducting.
 - 23.2. Types: Cable retainers,
Pin racks,
Earth Links,
Stirrup hangers,
Overhead hangers,
Loose partitions,
PVC edging strips,
Fasteners.
24. Execution: [Pr_65_70_11/765 Conduit, trunking and ducting zones](#) and [Pr_65_70_11/740 Installing trunking generally](#).

[Pr_65_70_11_71](#) Rigid conduit

8. Description:
9. Manufacturer: Legrand or equal and approved.
10. Standards: To BS EN 61386-1 and BS EN 61386-21.
11. **Mechanical properties**
 - 11.1. Resistance to compression: Heavy.
 - 11.2. Resistance to impact: Heavy.
12. **Transport, installation and application**
 - 12.1. Lower temperature (minimum): In accordance with BS EN 61386 and to suit project requirements and environmental conditions.
 - 12.2. Upper temperature (maximum): In accordance with BS EN 61386 and to suit project requirements and environmental conditions.
13. Resistance to bending: Rigid.
14. Electrical characteristics: With electrical continuity properties.
15. **Resistance to external influences**
 - 15.1. Protection against ingress of solid objects (minimum): To BS EN 60529, IP4X.
 - 15.2. Protection against ingress of water (minimum): To BS EN 60529, IPX0.
16. Resistance to corrosion: High protection, inside and outside.
17. Tensile strength: Heavy.
18. Resistance to flame propagation: Non-flame propagating.

19. Suspended load capacity: Heavy.
20. Colour: To match main containment
21. Sizes (OD): Minimum 25 mm overall diameter. Minimum 1.2mm tubing thickness.
22. Execution: [Pr_65_70_11/720 Installing rigid metallic conduit](#);
[Pr_65_70_11/725 Installing rigid non metallic conduit](#);
[Pr_65_70_11/735 Installing conduit connections to equipment](#);
and [Pr_65_70_11/765 Conduit, trunking and ducting zones](#).

Pr_70_75_94_58 Overdoor indicator units

7. Description:
8. Manufacturer: Baldwin Boxall or equal and approved.
9. Standards: In accordance with BS 8300-2.
10. Mounting type: Semi recessed and Surface mounted.
11. Material: White plastics.
12. Ingress protection (minimum): To suit the locations environmental conditions and in accordance with BS EN 50131-1.
13. Visual indicator: Red.
14. Integral buzzer: Required.
15. Execution: [Pr_70_75_94/650 Installing overdoor indicators](#).

Pr_75_75_04_01 Assistance call indicator units

8. Description:
9. Manufacturer: Baldwin Boxall or equal and approved.
10. Mounting: Wall mounted.
11. Zone indication: Engrave with zone description.
12. Visual indication: Individual zone red illuminated indicators.
13. **Audible indication**
 - 13.1. Tone: Distinguishable from the fire alarm system.
 - 13.2. Alarm mute facility: Required.
14. Execution: [Pr_75_75_04/660 Installing remote indicators](#).

Pr_75_75_04_02 Assistance call power supply units

7. Description:
8. Manufacturer: Shall be provided by the system manufacturer.
9. Standards: To BS EN 54-4 and in accordance with BS 5839-9.
10. Standby source: Rechargeable battery.
11. Standby capacity: Manufacturer's standard .
12. Integral replaceable fuse: Required.
13. Power-on indicator: Required.
14. **Enclosure**
 - 14.1. Mounting type:
 - 14.2. Material:
 - 14.3. Finish:
 - 14.4. Colour:
 - 14.5. Security:
15. Features:
16. Accessories:
17. Execution: [Pr_75_75_04/680 Installing power supply units](#).

Pr_75_75_04_03 Assistance call press button units

7. Description:
8. Manufacturer: Baldwin Boxall or equal and approved.
9. Standards: In accordance with BS 8300-2.

10. Mounting type: Wall, semi recessed and Wall, surface mounted.
11. Material: White plastics.
12. Ingress protection (minimum):
13. Accessories: Integral red illuminated reassurance indicator and Integral red illuminated alarm indicator.
14. Execution: [Pr_75_75_04/620 Installing press button units](#).

Pr_75_75_04_04 Assistance call pull cord units

3. Description:
4. Manufacturer: Baldwin Boxall or equal and approved.
5. Standards: In accordance with BS 8300-2.
6. Mounting type: Surface.
7. Material: Plastic.
8. Colour: White.
9. **Cord**
 - 9.1. Material: Nylon.
 - 9.2. Colour: Red.
 - 9.3. Pull handles: Two circular pull handles.
 - 9.4. Length: Sufficient so that maximum height above floor to the lowest pull handle is 200 mm and the maximum height to the highest pull handle is 1200 mm.
10. Accessories: Integral orange illuminated reassurance indicator and Integral red illuminated alarm indicator.
11. Audible indication: Not required.
12. Visual indication: Not required.
13. Ingress protection (minimum): To BS EN 60529, IP30.
14. Execution: [Pr_75_75_04/610 Installing pull cords](#).

Pr_75_75_04_05 Assistance call reset units

3. Description:
4. Manufacturer: Baldwin Boxall or equal and approved.
5. Standards: In accordance with BS 8300-2.
6. Mounting type: Surface.
7. Material: Polycarbonate.
8. Colour:
9. Ingress protection (minimum): To suit the location and environmental conditions
10. Audible indication: Required.
11. Visual indication: Integral reassurance LED.
12. Features:
13. Execution: [Pr_75_75_04/670 Installing reset units](#).

Execution

Pr_65_70_11/700 Installing conduit, trunking and ducting

2. Standards: In accordance with BS 7671 and IET Guidance Note 1.
3. Preparation: Cut square. Remove burrs and sharp edges to make smooth.
4. **Protection of metallic conduit, trunking and ducting**
 - 4.1. Joints and ends: Remove grease, oil, dirt and rust before applying protective paint. Paint immediately following installation.
 - 4.2. **Protective paint**
 - 4.2.1. Generally: Compatible with conduit, trunking and ducting finish.
 - 4.2.2. Type: Match factory finish.
5. Cross-sectional area: Maintain throughout the conduit, trunking and ducting length.
6. Arrangement: Position vertically and horizontally in line with equipment served, and parallel with building lines.

7. Spare containment: Install one spare 25 mm diameter conduit from each distribution board to the nearest accessible void space, terminating in a conduit box with lid.
8. Draw wires: Install galvanized soft iron wires within spare conduit, trunking and ducting.
9. **Distance from other services running parallel (minimum)**
 - 9.1. Generally: 150 mm.
 - 9.2. Above radiators: 1000 mm.
 - 9.3. Steam services: 600 mm.
10. Drainage of conduit, trunking and ducting: Locate drainage outlets at lowest points in conduit, trunking and ducting installed externally, and where condensation may occur.
11. Fire barriers: Provide to maintain integrity of fire compartments.
12. Rewireable installations: Enable rewiring from accessible boxes or accessories only.
13. Support: Independently fix and support conduit, trunking and ducting from building structure.
14. Cleaning: Clean insides of conduit, trunking and ducting before installing cables.
15. Cabling: Install when conduit, trunking and ducting enclosure is complete.
16. Submittals: Submit manufacturer's technical information. Submit drawings showing the proposed routes of conduit, trunking and ducting and the location of service outlets.

Pr_65_70_11/710 Installing conduit generally

5. Fixing: Fix securely. Fix boxes independently of conduit.
6. Changes of direction: Conduit boxes or bends site formed by machine. Do not use elbows, tees or inspection bends.
7. **Joints**
 - 7.1. Generally: Manufacturer's jointing fittings shall be provided.
 - 7.2. Number of joints: Minimize.
 - 7.3. Lengths of conduit: Maximize.
 - 7.4. Open ends: Plug.
 - 7.5. At movement joints in structure: Manufactured expansion coupling. Install adaptable boxes on both sides of joint at a maximum distance of 300 mm.
8. Connections to boxes, trunking, equipment and accessories: Screwed couplings with rubber bushes at open ends.
9. **Conduit boxes**
 - 9.1. Generally: Install flush with finished surfaces. Provide extension rings if required.
 - 9.2. Fixing screws: Countersunk, or round-headed screws.
 - 9.3. Number of fixings (minimum): Two.
 - 9.4. Lids: Fasten with brass slot pan head screws.
10. Rear outlet boxes: Locate where surface conduits pass through walls to external equipment.
11. **Draw-in boxes**
 - 11.1. Spacing (maximum): 10 m.
 - 11.2. Number of bends between draw-in boxes (maximum): Two.
 - 11.3. Floors: Do not install draw-in boxes in floors.
12. Conduit in walls: Avoid concealed horizontal runs.
13. Suspended ceiling installations: Fasten outlet boxes to structure above ceiling.

Pr_65_70_11/720 Installing rigid metallic conduit

2. General requirements: [Pr_65_70_11/710 Installing conduit generally](#) and [Pr_65_70_11/700 Installing conduit, trunking and ducting](#).
3. Fixings: Distance saddle; Saddle; and Spacer bar saddle.
4. Joints: Plain and Screwed.
5. Threaded conduits: Tightly screw to ensure electrical continuity, with no thread showing.
6. Conduit connections to boxes and items of equipment, other than those with threaded entries: Earthing coupling with male brass bush and protective conductor.

Pr_65_70_11/725 Installing rigid non metallic conduit

2. General requirements: [Pr_65_70_11/710 Installing conduit generally](#) and [Pr_65_70_11/700 Installing conduit, trunking and ducting](#).
3. Fixings: Distance saddle;
Saddle;
and Spacer bar saddle.
4. Joints: Compression and Threaded.
5. Conduit connections to boxes and items of equipment: Threaded bushed entries.

Pr_65_70_11/735 Installing conduit connections to equipment

8. General requirements: [Pr_65_70_11/710 Installing conduit generally](#) and [Pr_65_70_11/700 Installing conduit, trunking and ducting](#).
9. **Surface mounted equipment**
 - 9.1. Concealed conduit: Conceal the final connection.
 - 9.2. Exposed conduit: Contain the final connection from the conduit box within flexible metal conduit.
10. Equipment subject to vibration: Flexible metal conduit of adequate length to facilitate removal of equipment for maintenance. Final termination in swivel connectors.
11. Connections to external equipment: Flexible conduit.

Pr_65_70_11/740 Installing trunking generally

3. Changes of direction: Manufacturer's bends and tees.
4. **Joints**
 - 4.1. Generally: Manufacturer's jointing fittings. Maintain rigidity of trunking across joint.
 - 4.2. Number of joints: Minimize.
 - 4.3. Lengths of trunking: Maximize.
 - 4.4. Open ends: Blank using manufacturer's removable end caps.
 - 4.5. Metal edging: Protect with PVC edging strip.
 - 4.6. Electrical continuity: Maintain at each joint with a copper link fitted on the outside of the trunking.
5. Connections to conduit, boxes, equipment and accessories: Screwed couplings, adaptors, connectors and glands, with rubber bushes at open ends.
6. Connections to trunking covers: Minimize.
7. Electrical continuity of covers: Electrically continuous with the trunking or provide protective conductors.
8. Access: Provide space around trunking to permit access for installing and maintaining cables. Set out access with covers on a continuous face to allow cabling to be laid in throughout its entire length.
9. Trunking passing through building fabric openings: Provide fixed trunking covers. Extend covers 50 mm from both sides of the opening.
10. Cable retaining straps: Required except when trunking cover is on top.

Pr_65_70_11/765 Conduit, trunking and ducting zones

6. General requirements: [Pr_65_70_11/700 Installing conduit, trunking and ducting](#).
7. Ceiling voids: Provide clear distance of 150 mm (minimum) between underside of any conduit, trunking or trunking and the topside of ceiling.

Pr_70_75_94/650 Installing overdoor indicators

4. Position:
5. Mounting arrangement: On wall, 200 mm above door top.

Pr_75_75_04/610 Installing pull cords

2. Mounting arrangement: Ceiling mounted.
3. Position within room: Within reach of persons using the toilet;
Within reach of persons using the bath;
Within reach of persons using the changing accommodation;
and Within reach of persons in bed.
4. Pull handles: Set one at 100 mm and the second between 800 mm and 1000 mm above the floor.

Pr_75_75_04/620 Installing press button units

2. Mounting arrangement: Wall mounted.
3. Position within room: Within reach of persons using the toilet and within reach of persons using the changing accommodation and 1000mm above finished floor level to the bottom edge of the unit.
4. Mounting height:

Pr_75_75_04/660 Installing remote indicators

6. Position: At Central Location e.g. Reception and/or other secondary locations.
7. Mounting arrangement:

Pr_75_75_04/670 Installing reset units

3. Position: Wall mounted.
4. Mounting arrangement: On the Inside of the door leading into the Accessible WC.
5. Mounting height: In accordance with BS8300.

Pr_75_75_04/680 Installing power supply units

6. Position: As per contractors installation information.
7. Final connection:
 - 7.1. Accessory type: Key switched fused connection unit.
 - 7.2. Cable type: As per contractors installation information.
8. **Final connection**
 - 8.1. Accessory type:
 - 8.2. Cable type:

Ss_75_50_11/630 Installing emergency assistance alarm systems

4. Standard: In accordance with BS 7671.

System completion

Ss_75_50_11/810 Testing and commissioning assistance call systems generally

11. Standards: Submit proposals .
12. Notice before commencing commissioning: 7 d.
13. System commissioning agent: Submit proposals .
14. Controls: Verify operation.
15. Alarm signalling: Verify operation.
16. Results: Submit proposals .

Ss_75_50_11/825 Calibration certificates

5. Certificates of calibration for meters and instruments: Submit.

Ss_75_50_11/830 Documentation for emergency assistance alarm systems

5. Operating and maintenance instructions

- 5.1. Scope: Submit for the system giving optimum settings for controls.
- 5.2. Product information: Include product description, date of purchase, performance characteristics, application (suitability for use), method of operation and control, and cleaning and maintenance requirements.
- 5.3. Format: Electronic & Paper copy.
- 5.4. Number of copies: Two.

6. Record drawings

- 6.1. Content: General arrangement drawings showing the location of all power supply units, pullcords reset units, and visual alarm signal devices.
Schematic diagram showing all control cabling, the cable origin, route from power supply units to pullcords, reset units, visual alarm signal devices. Include conductor material and c.s.a, insulation type and colour, number of cores per cable, number of cables in ducts, on tray or ladder.
- 6.2. Format: Full size paper print drawing and Electronic drawing.

- 6.3. Number of copies: Two.
- 7. Submittal date: At handover.

Ss_75_50_11/840 Maintenance

- 5. Servicing and maintenance: Undertake.
- 6. Duration: Until 12 months after Practical Completion.

Ω End of System

Ss_75_50_11_27 Emergency voice communication systems

Systems

Ss_75_50_11_27 Emergency voice communication systems

1. Description: **Contractors Responsibilities**

The Contractor shall develop the tender design to completion, supply, install, co-ordinate with other contractors, test, commission and set to work the complete disabled refuge system. This shall include all necessary tools, labour, materials and equipment required to provide a complete working installation that fully meets the functional and performance criteria specified within this specification.

The Contractor shall include for provision of maintenance to the system, seasonal commissioning activities and rectification as required by the Contract and the Mechanical & Electrical Specification.

Function/Objectives

A complete and fully operational disabled refuge system installation shall be provided.

Applicable Standards

In addition to this specification, the disabled refuge installation shall comply with the following standards and guidelines current at the time of tender:

- Building Regulations
- British Standards
- The requirements of the local Building Control Authority
- Relevant HSE Guidance
- BSRIA Standards & Guidance notes
- CIBSE Guides & Notes.
- MoD Specifications, Design and Maintenance Guides and Technical Bulletins.
- Client Specific Requirements.
- Manufacturers recommendations.

Any discrepancies identified by the contractor between the specification and the above documents shall be brought to the attention of the CA immediately.

System Description

The contractor shall supply, install, test and commission a complete disabled refuge alarm system. The system shall be in accordance with BS5839-9.

The EVC system shall comprise a central control panel located adjacent the fire alarm control panel within the lower ground floor reception area and a number of 2-way intercom remote call points located in the designated disabled refuge areas as indicated on the drawings.

The central control panel shall be supplied via an integral battery/charger unit capable of providing a standby capacity after mains failure for a minimum of 24 hours in normal operation. The system shall be interfaced with the fire alarm such that the operation of the remote intercom call points may only be activated in the event of a fire alarm being initiated.

The system shall be wired in fully monitored loops using fire rated enhanced soft skin cabling concealed within the building fabric.

The disabled refuge system will provide two-way communication between the designated disabled refuge areas and the master/repeat stations. The system will enable fire wardens and designated evacuation leaders to identify who needs assistance and to direct the evacuation prior to the arrival of the Fire and Rescue Service.

Disabled refuge master station and repeat stations shall be provided as indicated in the drawings. The master/repeat stations shall be networked together and each shall have the ability to see all of the disabled refuge communication outstations on the entire system.

The two-way disabled refuge communication system shall be a complete, monitored, bidirectional, full duplex or VOX operated voice communication system.

The disabled refuge system shall only be operational on activation of the fire alarm system.

The master stations shall incorporate an integral battery sized to allow for 24 hours standby operation followed by 3 hours of continuous active operation.

All master-stations shall be complete with a handset and shall be flush mounted with a stainless-steel finish, with final positions to be agreed with the Architect.

Disabled refuge communication outstations shall be Type B units with a green finish, surface mounted, hands free type, with final positions to be agreed with the Architect.

The disabled refuge system shall include for integration of the disabled WC alarm system.

The disabled refuge system cabling shall be soft sheathed standard fire resistant cabling with red LSOH oversheath and wired in a loop configuration. Cables shall be BS 6387 CWZ rated.

The power supply for the disabled refuge master stations shall be derived directly from the main switchboard and shall be connected to the master station using "standard" fire resistant cable and a key switched fused connection-unit engraved "DO NOT SWITCH OFF".

Disabled refuge system cables shall be generally installed on cable tray where three or more cables are run together. Cabling shall be flush within walls and shall be contained within galvanised steel conduit.

Disabled refuge cables shall be retained in position by a suitable fire resistant method.

The Contractor will be responsible for demonstrating the complete system operation and training building / FM staff to operate the system fully.

The Contractor shall include for full time attendance throughout handover and training period.

Drawings

See all relevant drawings in the drawing issue sheet.

Schematics

See all relevant schematics in the drawing issue sheet.

2. System performance: [Ss_75_50_11/230 Integration with other alarm and security systems.](#)
[Ss_75_50_11/220 Design of emergency voice communication systems](#)
3. System manufacturer: Baldwin Boxall or equal and approved.
4. Operating voltage: 12 V d.c and 24 V d.c.
5. Zones: Refer to the specification system description and layout drawings / schematic.
6. Equipment interconnectivity: Wired (in loop configuration).
7. Call actuator: [Pr_75_75_94_23 Disabled refuge outstations.](#)
8. Control and indicating equipment: [Pr_75_75_94_22 Disabled refuge master stations.](#)
9. Alarm indication: Sounders and visual indicators.
10. Primary power supply: [Pr_75_75_04_02 Assistance call power supply units.](#)
11. Secondary power supply:
12. Circuit monitoring: Open circuit and short circuit.
13. Cable type: [Pr_65_70_48_29 Fire-resistant screened \(LSHF\) cables.](#)
14. Containment: [Pr_65_70_11_18 Cable trunking;](#)
[Pr_65_70_11_12 Cable baskets;](#)
and [Pr_65_70_11_71 Rigid conduit.](#)
15. Rewireable installation: Required.
16. Concealed installation: Required.
17. System accessories: [Pr_60_70_06_06 Backup battery supply;](#)
and [Pr_75_75_04_73 Portable communicators.](#)
18. Execution: [Ss_75_50_11/640 Installing emergency voice communication systems.](#)
19. System completion: [Ss_75_50_11/835 Documentation for emergency voice communication systems;](#)
[Ss_75_50_11/860 Acceptance certificate;](#)
[Ss_75_50_11/840 Maintenance;](#)
and [Ss_75_50_11/850 Verification certificate.](#)

System performance

Ss_75_50_11/220 Design of emergency voice communication systems

1. System designer:
2. Design: Complete the design of the emergency voice communication system in accordance with BS 5839-9 and BS 7671.
3. Requirement:
4. Communication strategy:
5. System design certificate:

Ss_75_50_11/230 Integration with other alarm and security systems

1. Objectives: Refer to the specification system description.
2. Systems to be integrated: Refer to the specification system description and layout drawings / schematics.
3. Interfaces to equipment not forming part of the assistance call system:
4. Equipment and mode of operation:

Products

See [90-55-10/320 Cable bands](#) in [Ss_70_30_45_45 Low-voltage distribution systems](#)

Pr_60_70_06_06 Backup battery supply

1. Description:
2. Manufacturer: Shall be provided by the system manufacturer.
3. Standards: To BS EN 54-4 and in accordance with BS 5839-9.
4. Standby duration: 2 h.
5. Duration of operation:
6. Charge indicator: Green.
7. Battery enclosure: White plastics.
8. Execution: [Pr_60_70_06/690 Installing battery backup supplies](#).

See [Pr_65_70_11_12 Cable baskets](#) in [Ss_70_30_45_45 Low-voltage distribution systems](#)

See [Pr_65_70_11_13 Cable cleats](#) in [Ss_70_30_45_45 Low-voltage distribution systems](#)

See [Pr_65_70_11_18 Cable trunking](#) in [Ss_70_30_80_35 Hardwired voltage small power systems](#)

See [Pr_65_70_11_71 Rigid conduit](#) in [Ss_70_30_45_45 Low-voltage distribution systems](#)

See [Pr_65_70_48_29 Fire-resistant screened \(LSHF\) cables](#) in [Ss_70_30_45_45 Low-voltage distribution systems](#)

Pr_75_75_04_02 Assistance call power supply units

1. Description:
2. Manufacturer: Shall be provided by the system manufacturer.
3. Standard: To BS EN 54-4.
4. Standby source: Rechargeable battery.
5. Standby capacity: Manufacturer's standard .
6. Integral replaceable fuse: Required.
7. Power-on indicator: Required.
8. Execution: Installing power supply units.

Pr_75_75_04_73 Portable communicators

1. Description:
2. Manufacturer: Shall be provided by the system manufacturer.
3. Number to be supplied: To suit the project requirements.
4. Chargers: Supply one for each portable communicator.

Pr_75_75_94_22 Disabled refuge master stations

1. Description:
2. Manufacturer: Baldwin Boxall or equal and approved.
3. Standard: In accordance with BS 5839-9.
4. Enclosure
 - 4.1. Mounting type: Wall mounted;
Flush mounted;
Semi recessed;
and Surface mounted.
 - 4.2. Material:
 - 4.3. Finish:
 - 4.4. Colour:
 - 4.5. Security:
5. Communication interface: Telephone handset and Microphone on flexible arm with panel mounted loudspeaker.
6. Accessories: Manufacturer's standard .
7. Execution: [Pr_75_75_94/630 Installing disabled refuge master station.](#)

Pr_75_75_94_23 Disabled refuge outstations

1. Description:
2. Manufacturer: Baldwin Boxall or equal and approved.
3. Standard: In accordance with BS 5839-9, Type A and In accordance with BS 5839-9, Type B.
4. Mounting type: Flush;
Semi recessed;
and Surface mounted.
5. Material:
6. Colour:
7. Accessories: Induction Loop
8. Execution: [Pr_75_75_94/640 Installing disabled refuge outstations.](#)

Execution

See [90-55-15/640 Extra low and low voltage cable routes in Ss_70_30_45_45 Low-voltage distribution systems](#)

See [90-55-15/645 Low voltage cables concealed in walls and partitions in Ss_70_30_45_45 Low-voltage distribution systems](#)

See [90-55-15/655 Extra low and low voltage surface mounted cables in Ss_70_30_45_45 Low-voltage distribution systems](#)

Pr_60_70_06/690 Installing battery backup supplies

1. Position: As per contractors installation information.
- See [Pr_65_70_11/630 Installing cable basket in Ss_70_30_45_45 Low-voltage distribution systems](#)
- See [Pr_65_70_11/650 Multiple cable runs in Ss_70_30_45_45 Low-voltage distribution systems](#)
- See [Pr_65_70_11/661 Cable support zones in Ss_70_30_45_45 Low-voltage distribution systems](#)
- See [Pr_65_70_11/700 Installing conduit, trunking and ducting in Ss_70_30_45_45 Low-voltage distribution systems](#)
- See [Pr_65_70_11/710 Installing conduit generally in Ss_70_30_45_45 Low-voltage distribution systems](#)
- See [Pr_65_70_11/720 Installing rigid metallic conduit in Ss_70_30_45_45 Low-voltage distribution systems](#)
- See [Pr_65_70_11/725 Installing rigid non metallic conduit in Ss_70_30_45_45 Low-voltage distribution systems](#)

See [Pr_65_70_11/740](#) Installing trunking generally in [Ss_70_30_80_35](#) Hardwired voltage small power systems

See [Pr_65_70_11/765](#) Conduit, trunking and ducting zones in [Ss_70_30_45_45](#) Low-voltage distribution systems

See [Pr_65_70_48/635](#) Installing low voltage cables in [Ss_70_30_45_45](#) Low-voltage distribution systems

See [Pr_65_70_48/660](#) Installing low voltage cables in conduit and trunking in [Ss_70_30_45_45](#) Low-voltage distribution systems

See [Pr_65_70_48/735](#) Cable installation on channel cable supports, cable tray, cable ladder and cable basket in [Ss_70_30_45_45](#) Low-voltage distribution systems

[Pr_75_75_94/630](#) Installing disabled refuge master station

1. Standard: In accordance with BS 5839-9.
2. Position: As per contractors installation drawings.
3. Mounting arrangement:
4. Mounting height:
5. Power supply: Derive from a dedicated circuit from the main switchboard and connect to CIE via unswitched fused connection units.

[Pr_75_75_94/640](#) Installing disabled refuge outstations

1. Standard: In accordance with BS 5839-9.
2. Position: As per contractors installation drawings.
3. Mounting height: To comply with Part M and DDA requirements.
4. Power supply: In accordance with contractors circuit schedules and via key switched fused connection units.

[Ss_75_50_11/640](#) Installing emergency voice communication systems

1. Standards: In accordance with BS 7671 and BS 5839-9.
2. Wiring arrangement: In accordance with manufacturers instructions.

System completion

[Ss_75_50_11/835](#) Documentation for emergency voice communication systems

1. Operating and maintenance instructions
 - 1.1. Scope: Submit for the system giving optimum settings for controls.
 - 1.2. Product information: Include product description, date of purchase, performance characteristics, application (suitability for use) method of operation and control, and cleaning and maintenance requirements.
 - 1.3. Format: Electronic and Paper copy.
 - 1.4. Number of copies: Two.
2. Record drawings
 - 2.1. Content: General arrangement drawings showing the location of all outstations, master stations, sounders, visual alarm signal devices and power supply units and Schematic diagram showing all control cabling, the cable origin, route from power supply units to master stations and outstations, sounders, visual alarm signal devices. Include conductor material and c.s.a, insulation type and colour, number of cores per cable, number of cables in ducts, on tray or ladder.
 - 2.2. Format: Full size paper print drawings and Electronic drawings.
 - 2.3. Number of copies: Two.
3. Submittal date: At handover.
4. Test certificates
 - 4.1. Design certificate: Submit two copies in accordance with BS 5839-9 Annex C.1.
 - 4.2. Installation certificate: Submit two copies in accordance with BS 5839-9, Annex C.2.
 - 4.3. Commissioning certificate: Submit two copies in accordance with BS 5839-9, Annex C.3.

Ss_75_50_11/840 Maintenance

1. Servicing and maintenance: Undertake.
2. Duration: Until 12 months after Practical Completion.

Ss_75_50_11/850 Verification certificate

1. System verification agent: Specialist manufacturer / installer
2. Verification certificate: Submit two copies in accordance with BS 5839-9, Annex C.5.

Ss_75_50_11/860 Acceptance certificate

1. Acceptance certificate: Submit two copies in accordance with BS 5839-9, Annex C.4.

Ω End of System

Ss_75_50_28_29

Fire detection and alarm systems

Systems

Ss_75_50_28_29 Fire detection and alarm systems

1. Description: **Contractors Responsibilities**

The Contractor shall develop the tender design to completion, supply, install, co-ordinate with other contractors, test, commission and set to work the complete fire detection and alarm system. This shall include all necessary tools, labour, materials and equipment required to provide a complete working installation that fully meets the functional and performance criteria specified within this specification.

The Contractor shall include for provision of maintenance to the system, seasonal commissioning activities and rectification as required by the Contract and the Mechanical & Electrical Specification.

Function/Objectives

A complete and fully operational fire detection and alarm system installation shall be provided.

Applicable Standards

In addition to this specification, the fire detection and alarm installation shall comply with the following standards and guidelines current at the time of tender:

- Building Regulations
- British Standards
- The requirements of the local Building Control Authority
- Relevant HSE Guidance
- BSRIA Standards & Guidance notes
- CIBSE Guides & Notes.
- MoD Specifications, Design and Maintenance Guides and Technical Bulletins.
- Client Specific Requirements.
- Manufacturers' guidelines.

Any discrepancies identified by the contractor between the specification and the above documents shall be brought to the attention of the CA immediately.

System Descriptions

The Contractor shall employ a fire alarm specialist for the design, supply, installation, connection, testing, commissioning and setting to work of the complete Fire detection and alarm system for the building.

The fire alarm specialist shall be a competent contractor in accordance with BS5839. They shall be accredited to LPS 1014 and SP203-1 type schemes via a third party certification body such as LPCB or BAFE.

In accordance with the Fire Strategy report, a category L1 fire detection and alarm system will be provided in the building and shall be in accordance with BS5839 Part 1. The system shall be capable of upgrading to L1/P1 specification if so required by an incoming Tenant or their Insurers.

As indicated in the fire strategy report a two stage (double knock) alert cause and effect' being all out, shall be provided.

The Fire detection and alarm system will utilise analogue addressable technology.

The main fire alarm panel and repeat shall be located in the lower ground floor reception area as per the drawings.

All Control equipment shall be sited in a position which is easily accessible to both staff and firefighters.

The main fire alarm panel and functional repeat panels shall be complete with but not limited to the following main features:

- A user-friendly graphical interface to the operator;
- A system for the identification of function and location for all detectors and other devices;
- Provision to correctly identify and isolate faulty detectors, or detectors where work may cause a false

alarm;
- Status of smoke dampers & fire isolation dampers.

The main fire alarm panel, functional repeat panel and repeat panel shall be complete with integral battery with a standby autonomy of 72 hours and alarm autonomy of 30 minutes.

The fire detection and alarm system will incorporate automatic smoke and heat detection, manual call points, electronic sounders and visual alarm devices as indicated on the drawings.

The main fire alarm panel shall be 6 loop minimum. The system shall also be in future capable of, but not included within this scope, temporary isolation of smoke detection with a Deadman switch arrangement to facilitate pyrotechnic displays.

Visual alarm devices will supplement sounders where required to provide visual indication of a fire condition in accordance with Part M of the Building Regulations and BS5839.

For the avoidance of photosensitive epileptic seizures visual alarm devices shall be synchronised in accordance with the requirements of the standards.

In areas where it will be difficult to access traditional type point type detection devices for maintenance, beam type detection devices shall be provided, as indicated on the drawings.

Door hold open devices shall be provided on selected doors as indicated within the layout drawings. These devices shall be linked to the fire alarm system via fire alarm interfaces.

The main fire alarm panel shall be complete with DualCOM type communicator to provide a 24/7 remote monitoring system.

The Contractor shall liaise with a registered monitoring station to provide off-site monitoring for the fire alarm system, the contractor shall provide a 12 month contract for the 1st year of use, which shall be transferred to the client.

The Contractor shall develop a commissioning method statement prior to commissioning. All devices shall be tested under all operational conditions. The DualCOM system shall be fully tested and confirmed by the monitoring station for both methods of communications.

All cabling installations associated with the fire detection and alarm installation shall be fire rated. Enhanced fire rated soft skinned cables will be utilised in all areas.

Manual call points will be provided at all final exit doors from the building, and corridors to provide a means of raising the alarm in compliance with BS5839.

A combination of surface mounted and semi-recessed call points will be provided c/w with hinged protective covers in accordance with BS5839.

Regardless of the mounting type all call point front plates will be proud of the finished surface by no less than 15mm.

Manual call points shall have a minimum IP67 rating when located in external areas.

Sounders shall have a minimum IP66 rating when located in external areas.

The contractor shall coordinate the positioning of all equipment with the building layout, structure, building services and the fixed furniture and equipment layout.

All remote indicators are to include a description label; e.g. void detector, smoke damper lift etc.

The main fire alarm control panel power shall be derived from the main switchboard via a key switched fused connection unit.

Detection Zones

Detection zones shall be provided to enable the fire services to locate the fire as quickly as possible. Zones shall be provided in accordance with the requirements of BS5839 and the building fire strategy.

A zone diagram shall be provided adjacent to the fire alarm & repeat panels.

Interfaces

The Contractor shall design the cause and effect matrix in accordance with the fire strategy and the requirements of Building Control and the Fire Service.

Fire alarm interface units shall be provided as required to control operation of equipment in line with the fire strategy. The following shall be used as a guide to the proposed operation of plant:

- Front doors to building: power open and remain open.
- Access controlled doors: fail unlocked.
- Lifts: to ground floor and doors open.
- Mechanical panels; to stop.
- Disabled refuge system: Operational under fire condition.
- Fire Curtains: to close
- ATS: monitor for change in supply

The contractor shall ensure during the tender period that sufficient interface units, of the correct type and rating are included for all the services, as required.

Inspection and Testing

All equipment shall be tested and inspected to demonstrate compliance with the relevant specifications and standards.

The Fire alarm specialist shall be employed to carry out a full functional test on site and to further demonstrate the same to the Employer, and the employer's representative, on a separate occasion.

Note that a fully detailed schedule of all devices and operations shall be provided by the contractor to allow the client's representative to agree all system labelling with him, and all "cause and effect" scenarios.

The Contractor shall issue a certificate stating that the system has been commissioned and is fully operational.

Maintenance

The Contractor and specialist shall include within the returned tender for all costs associated with the first 12 months routine maintenance. The commencement of the 'first day' of this period shall coincide with the project completion date.

The specialist shall allow to attend site three additional times.

The fire alarm system shall be provided with an interface isolation facility, to allow a weekly fire alarm sounder test without any or the entire interface outputs being activated. However, the system must be designed such the system cannot be left in this status without the system giving a suitable audible warning.

The isolation facility shall be located above the main fire alarm panel, key operated and clearly marked.

Soak Test

The Contractor shall provide a soak test to BS 5839.

The soak test is to be carried out once the commissioning of the building has been finished and prior to the Client taking ownership of the building.

Allow attendance as necessary by the Specialist Contractor during the soak test period. During the soak test period each manual call point should bear an indication that it is not to be used.

Allow for all necessary insurances to be in place to cover the use of the building by the Contractors, Specialist Contractors.

A false alarm monitoring test shall be performed by the Contractor for 7 days, complete with 24-hour monitoring of all detection equipment to establish the system does not produce unwanted false alarms.

Should this test fail for any reason at any period during the 7-day test, then the soak test will be repeated from the start again, until the systems function accurately and correctly.

Completion will not be awarded until the soak test has been completed successfully.

The alarm system will be tested and commissioned including for full integrated performance testing carried out to verify the system performance with the agreed Cause and Effect Fire Strategy.

Wiring Systems

Cabling for the Fire Alarm system all other inter-related links shall be in accordance with BS 5839 and the fire alarm system manufacturer's recommendations.

All fire alarm cabling shall be carried out in red fire performance LSZH sheathed enhanced cable.

All cables shall be RED sheathed and BASEC approved and shall be clipped in full compliance with BS 5839.

Installation

Installation of the system will be in accordance with the recommendations set out in BS 5839 and BS7671.

Fire alarm cables shall be generally installed on cable tray where three or more cables are run together. Cabling shall be flush within walls and shall be contained within galvanised steel conduit.

Fire alarm cables shall be retained in position by a suitable fire-resistant method.

All detector/sounder/indicator bases will be securely fixed to BESA boxes and non-combustible supporting pattresses behind ceiling tiles, allowing for easy fitting and removal of devices. All control devices and associated modules will be securely fixed and if required, marked with appropriate notices, warnings, signs as applicable. They shall be easily accessible by staff and fire fighters.

All visual alarm devices shall be placed in a position that is likely to attract attention. The alarms shall be securely fixed in accordance with the mounting position and orientation as specified by the manufacturer.

Manual Call points shall be mounted at an easily accessible, well-illuminated and conspicuous positions free from potential obstruction.

Commissioning

The Contractor shall produce a draft cause and effect schedule for approval by the client.

This shall illustrate the proposals for activation of 'alert' and 'evacuate' signalling and the operation of fire alarm interfaces, during and upon receipt of a fire alarm activation. The alarm system will be tested and commissioned including for full integrated performance testing, carried out to verify the system performance with the agreed Cause and Effect Fire Strategy.

The integrated performance testing will include all co-ordinated interface testing with third party equipment/system providers such as lifts, mech plant, etc.

The following documents will be utilised to record test results and details of commissioning tests:

- Cable Test Sheets
- Installation Check Report-
- System Layout Drawing(s)-
- System Schematic Drawing(s)-
- Power supply tests-
- Audibility tests
- Product commissioning records
- System certification to LPS1014 including a schedule of agreed system qualifications.

The fire controller and associated devices and modules will be tested in accordance with the guidelines set out in BS 5839 and the testing instructions provided by the manufacturer.

The fire alarm system will be fully tested to ensure that it operates in accordance with the requirements of the design specification and relevant standards.

As fitted drawings shall be provided by the contractor indicating at least the following:

- The positions of all control, indicating and power supply equipment;
- The type, sizes and actual routes of cables.
- The cable routes shown need to comprise a reasonable representation of the route followed, such as to enable a competent person to locate the cable in the event of a fault or need for modification or extension of the system; a simple schematic showing the sequence in which devices are wired is unlikely to satisfy this recommendation, other than in small, simple systems.
- In the case of extensions or alterations, existing as-fitted drawings need to be updated.
- A record of any agreed variations from the original design specification.

Training

The Contractor will be responsible for demonstrating the complete system operation and training building / FM staff to operate the fire alarm system fully in accordance with the O&M manuals including the Cause & Effects strategy. The Contractor shall include for full time attendance throughout handover and training period.

Drawings:

See all relevant drawings in the drawing issue sheet.

Schematics:

See all relevant schematics in the drawing issue sheet.

2. System performance: [Ss_75_50_28/275 Alarm filtering](#);
[Ss_75_50_28/265 Interfaces to equipment](#);
[Ss_75_50_28/260 Integration with other alarm and security systems](#);
[Ss_75_50_28/285 Automatic transmission of alarm signals](#);
[Ss_75_50_28/230 Performance of fire detection and alarm systems](#);
[Ss_75_50_28/250 Alarm zones](#);
[Ss_75_50_28/280 External alarm signalling](#);
[Ss_75_50_28/270 Interface isolation for testing purposes](#);
[Ss_75_50_28/255 Actuation of fire protection systems](#);
and [Ss_75_50_28/245 Detection zones](#). [Ss_75_50_28/210 Design of fire detection and alarm systems in non-domestic premises](#)
3. System manufacturer: Gent or equal and approved.
4. System type: Analogue addressable system.
5. Detection devices
 - 5.1. Atmosphere: Normal atmospheric conditions.
 - 5.2. Types: [Pr_75_75_30_50 Manual call points](#);
[Pr_75_75_30_64 Point heat detectors](#);
[Pr_75_75_30_65 Point smoke detectors](#);
[Pr_75_75_30_03 Aspirating smoke detectors](#)
6. Equipment interconnectivity: [Pr_65_70_48_29 Fire-resistant screened \(LSHF\) cables](#).
7. Cable accessories: [Pr_65_70_11_15 Cable ties](#);
8. Cable containment: [Pr_65_70_11_12 Cable baskets](#);
[Pr_65_70_11_17 Cable trays](#);
[Pr_65_70_11_71 Rigid conduit](#);
[Pr_65_70_11_18 Cable trunking](#);
9. Containment accessories: [Pr_20_29_03_83 Stainless steel chemical anchor rods](#);
[Pr_65_70_11_20 Conduit fittings](#);
and [Pr_65_70_11_19 Channel cable supports](#).
10. Rewireable installation: Required.
11. Concealed installation: Required.
12. Internal alarms
 - 12.1. Primary: PAVA System
 - 12.2. Secondary: [Pr_75_75_30_97 Visual alarm signal devices](#).
13. External alarms: Fire Control Centre
14. Controls: [Pr_75_75_30_29 Fire alarm panels](#);
[Pr_75_75_30_52 Mimic alarm panels](#);
and [Pr_75_75_30_28 Fire alarm input and output modules](#).
15. System accessories: [Pr_75_75_30_71 Remote indicators](#);
[Ss_75_50_28/560 Zone diagrams](#);
and [Pr_75_75_27_28 Emergency door release mechanisms](#).
16. Execution: [Ss_75_50_28/630 Installing cabling for fire detection and alarm systems in non-domestic premises](#);
[Ss_75_50_28/700 Installing all zone evacuation controls](#);
[Ss_75_50_28/610 Installing fire detection and alarm systems in non-domestic premises](#);
and [Ss_75_50_28/695 Installing interfaces to other equipment and systems](#).
17. System completion: [Ss_75_50_28/807 Standby battery testing](#);
[Ss_75_50_28/810 Testing and commissioning fire detection and alarm systems in non-domestic premises](#);
[Ss_75_50_28/809 Measurement of sound pressure levels](#);

Ss_75_50_28/820 Documentation for fire detection and alarm systems in non-domestic premises;
 Ss_75_50_28/840 Maintenance;
 Ss_75_50_28/808 System soak testing;
 Ss_75_50_28/830 Spares and consumables;
 and Ss_75_50_28/850 Verification certificate for fire detection and alarm systems in non-domestic premises. Ss_75_50_28/805 System information; Ss_75_50_28/806 Device identification and testing

System performance

Ss_75_50_28/210 Design of fire detection and alarm systems in non-domestic premises

1. System designer: Specialist Contractor
2. Standards: Complete the design of the fire detection and alarm system in accordance with BS 5839-1.
3. Category: L2.
4. Requirement: Submit proposals including detailed design drawings, technical information, calculations and manufacturers' literature.
5. System design certificate: Submit with design proposals.

Ss_75_50_28/230 Performance of fire detection and alarm systems

1. Areas to be protected: As per fire alarm layout drawings.
2. System objectives: To provide a fire detection and alarm system in compliance with all relevant standards.
3. Spare system capacity: 10% of installed alarm devices and 10% loop loading.
4. Number of devices per zone (maximum): As per the manufacturers instructions.
5. Spare system capacity:
6. Number of devices per zone (maximum):

Ss_75_50_28/245 Detection zones

1. Zoning: As per fire alarm layout drawings and fire strategy.

Ss_75_50_28/250 Alarm zones

1. Alarm zoning: As per fire alarm layout drawings and fire strategy.
2. Mode of operation: Refer to the specification system description and the fire strategy information.
3. All zone evacuate control: Refer to the specification system description and the fire strategy information.

Ss_75_50_28/255 Actuation of fire protection systems

1. Standard: In accordance with BS 7273-1;
 In accordance with BS 7273-3;
 and In accordance with BS 7273-4.
2. Objectives:

Ss_75_50_28/260 Integration with other alarm and security systems

1. Objectives: Refer to the specification system description.
2. Systems to be integrated: Refer to the specification system description.

Ss_75_50_28/265 Interfaces to equipment

1. Interfaces to equipment not forming part of the fire detection and alarm system: Refer to the specification system description.
2. Equipment and mode of operation: Refer to the specification system description.

Ss_75_50_28/270 Interface isolation for testing purposes

1. Isolation of systems and equipment: Design system so that the actuation, integration and interfacing can be isolated during fire alarm testing.
2. Means of isolation: Single isolate key switch via the main control panel.

Ss_75_50_28/275 Alarm filtering

1. Objective: Refer to the specification system description.

2. Arrangement: Refer to the specification system description.

Ss_75_50_28/280 External alarm signalling

1. Objective: External alarm signalling shall be provided to direct the fire fighters to the building in alarm or the appropriate entrance. External alarm devices should be clearly labelled 'FIRE ALARM' using durable, fade-resistant material.

Alarm signals should not silence automatically (i.e. after a predetermined time period), other than in the following circumstances:

- 1) any external fire alarm sounders in Category L and P systems should silence automatically after 30 min, unless the premises are continuously occupied so enabling manual silencing by occupants. After silencing, the sounders might (or might not) restart if, before the system is reset, a further alarm condition occurs;
- 2) where a radio linked Category L or P system incorporates battery powered fire alarm sounders, the sounders should silence automatically after 30 min, unless the premises are continuously occupied so enabling manual silencing by occupants. The sounders should restart if, before the system is reset, a further alarm condition occurs. Where a period longer than 30 min is required, e.g. for phased evacuation, to meet the requirements of the system specification;
- 3) in a two (or more) stage alarm system, alert signals may be silenced automatically after a predetermined period, subject to compliance with 19.2.3d) in BS5839.

Ss_75_50_28/285 Automatic transmission of alarm signals

1. Means of signal transmission
 - 1.1. Primary: Manual via public call system.
 - 1.2. Secondary: The main fire alarm panel shall be provided with a DualCOM system can be connected to a remote alarm monitoring centre.
2. Transmission path monitoring: Refer to the specification system description.
3. Signals to be transmitted to ARC: Separately identifiable signals for pre-alarm, alarm, fault, device isolated and zone isolated.

Products

See [90-55-10/320 Cable bands](#) in [Ss_70_30_45_45 Low-voltage distribution systems](#)

See [Pr_20_29_03_83 Stainless steel chemical anchor rods](#) in [Ss_70_30_45_45 Low-voltage distribution systems](#)

See [Pr_65_70_11_12 Cable baskets](#) in [Ss_70_30_45_45 Low-voltage distribution systems](#)

See [Pr_65_70_11_13 Cable cleats](#) in [Ss_70_30_45_45 Low-voltage distribution systems](#)

See [Pr_65_70_11_15 Cable ties](#) in [Ss_70_30_45_45 Low-voltage distribution systems](#)

See [Pr_65_70_11_17 Cable trays](#) in [Ss_70_30_45_45 Low-voltage distribution systems](#)

See [Pr_65_70_11_18 Cable trunking](#) in [Ss_70_30_80_35 Hardwired voltage small power systems](#)

See [Pr_65_70_11_19 Channel cable supports](#) in [Ss_70_30_45_45 Low-voltage distribution systems](#)

See [Pr_65_70_11_20 Conduit fittings](#) in [Ss_70_30_45_45 Low-voltage distribution systems](#)

See [Pr_65_70_11_71 Rigid conduit](#) in [Ss_70_30_45_45 Low-voltage distribution systems](#)

See [Pr_65_70_48_29 Fire-resistant screened \(LSHF\) cables](#) in [Ss_70_30_45_45 Low-voltage distribution systems](#)

Pr_75_75_27_28 Emergency door release mechanisms

1. Description:
2. Manufacturer: Gent or equal and approved.
3. Standard: To BS EN 1155.
4. Mounting type: Floor mounted;
Overhead;
and Wall mounted.

5. Power: 24 V d.c.
6. Durability: Grade 8.
7. Hold-open power size: Submit proposals .
8. Corrosion resistance: Submit proposals .
9. Integral manual release button: Required.
10. Execution: [Pr_75_75_27/661 Installing electrically powered hold-open devices.](#)

[Pr_75_75_30_03](#) Aspirating smoke detectors

1. Description:
2. Manufacturer: Gent or equal and approved
3. Standard: To BS EN 54-20.
4. Sensitivity class: Class C – Normal Sensitivity (5% obs./mtr) ASD designed to give equivalent performance to standard point detection systems meeting the requirements of BS EN 54-7.
5. Sampling pipe
 - 5.1. Arrangement: Single pipe;
Double pipe;
and H configuration.
 - 5.2. Length (maximum): 100m of single pipe length.
 - 5.3. Air inlet holes (maximum): 18 (per channel)
6. Coverage (minimum): Up to 2000 m².
7. Enclosure
 - 7.1. Material: Polycarbonate
 - 7.2. Ingress protection (minimum): To suit the location and environmental conditions in accordance with BS EN 60529.
8. Power supply: 230 V a.c.
9. Controls
 - 9.1. Display type: Light emitting diode display (LED).
 - 9.2. Functions: Three alarm thresholds;
On board memory capable of recording 500 events;
and Communication port suitable for connection to RJ45 connection to provide remote monitoring.
 - 9.3. Display the following information: Power on via green LED;
Fault via amber LED;
Alarm via red LED;
Visual indication of smoke level via bar graph;
and Visual indication of smoke level by individual amber LEDs.
 - 9.4. Relay contacts: 3 (1 Alarm, 1 Fault, 1 Pre-Alarm) x per channel.
Ratings - 2.0 A @ 30 VDC, 0.5A @ 30 VAC)

[Pr_75_75_30_28](#) Fire alarm input and output modules

1. Manufacturer: Gent or equal and approved.
2. Standards: To BS EN 54-18. To BS EN 54-17.
3. Device type: Four channel output module. Single output module. Dual input module. Single input module.
4. Mounting arrangement: Suitable for mounting within fire detection and alarm control and indicating equipment (C.I.E.) .
5. Enclosure
 - 5.1. Ingress protection (minimum): To BS EN 60529, IP 30.
 - 5.2. Material: Polycarbonate.
 - 5.3. Colour: White.

[Pr_75_75_30_29](#) Fire alarm panels

1. Description:
2. Manufacturer: Gent or equal and approved.
3. Standard: To BS EN 54-2 and To BS EN 54-25.
4. Third party certification: LPCB approved.

5. Standby power supply
 - 5.1. Standard: To BS EN 54-4.
 - 5.2. Capacity: Rechargeable battery sufficient to maintain the system in operation for a minimum of 24 h and to provide an 'Evacuate' signal in all alarm zones for a further 30 minutes.
6. Main display: 8-line x 40 character, backlit, alphanumeric colour display.
7. Zone indication: Individual LED status indicators and Separate LED mimic diagram.
8. Installed capacity: Each fire alarm detection loop being capable of supporting up to 200 devices over a length of up to 1000 m. The required number of fire detection loops shall be confirmed by the specialist fire alarm contractor.
9. Monitored sounder circuits (minimum): The required number of monitored sounder circuits shall be confirmed by the specialist fire alarm contractor.
10. Printer: 80 column printer.
11. Indications : Alarm counter;
Fault signals from points;
and Total loss of power supply.
12. Controls: Delays to the activation of outputs;
Dependencies on more than one alarm signal;
Disablement of addressable points;
and Test condition facilities.
13. Outputs: Manufacturer's standard .
14. Input device: Alphanumeric keypad and Qwerty keyboard.
15. Features: Automatic device address setup via control and indicating equipment (CIE);
Manual device address setup via a portable programmer;
and End of line devices for each detection and alarm circuit.
16. Enclosure
 - 16.1. Ingress protection (minimum): To suit the location and environmental conditions.
 - 16.2. Material: To suit the location and environmental conditions.
 - 16.3. Finish: Powder coated and Stove enamel.
 - 16.4. Colour: Black and Grey.
 - 16.5. Mounting: Recessed;
Semi-recessed;
and Surface.
17. Execution: [Pr_75_75_30/610 Installing main control and indicating equipment \(CIE\)](#).

[Pr_75_75_30_50](#) Manual call points

1. Description:
2. Manufacturer: Gent or equal and approved.
3. Standard: To BS EN 54-11;
To BS EN 54-17;
and To BS EN 54-25.
4. Third party certification: LPCB approved.
5. Designation: A Type 'A' device that requires breaking or disablement of a frangible element
6. Frangible element: Non-resettable.
7. Integral red visual indicator: Required.
8. Environmental category: Indoor and Outdoor. A minimum Ingress protection rating of IP67 is required in external locations.
9. Mounting: Semi-recessed and Surface.
10. Protective covers: Protective lid is required.
11. Power source: Fire alarm system loop powered device.
12. Execution: [Pr_75_75_30/630 Installing manual call points](#).

[Pr_75_75_30_52](#) Mimic alarm panels

1. Description:
2. Manufacturer: Gent or equal and approved.
3. Standard: To BS EN 54-2.
4. Third party certification: LPCB approved.

5. Standby power supply
 - 5.1. Standard: To BS EN 54-4. An external power supply shall also be provided.
 - 5.2. Capacity: Rechargeable battery sufficient to maintain the system in operation for a minimum of 24 h and to provide an 'Evacuate' signal in all alarm zones for a further 30 minutes.
6. Enclosure
 - 6.1. Ingress protection (minimum): To suit the location and environmental conditions.
 - 6.2. Material: To suit the location and environmental conditions.
 - 6.3. Finish: Powder coated and Stove enamel.
 - 6.4. Colour: Black and Grey.
 - 6.5. Mounting: Recessed;
Semi-recessed;
and Surface.
7. Display: A3 full colour floor plan providing geographical indication of fire alarm activation.
8. Controls:
9. Execution: [Pr_75_75_30/610 Installing main control and indicating equipment \(CIE\)](#).

Pr_75_75_30_64 Point heat detectors

1. Description:
2. Manufacturer: Gent or equal and approved.
3. Standard: To BS EN 54-5;
To BS EN 54-17;
and To BS EN 54-25.
4. Third party certification: LPCB approved.
5. Classification: The classification of the detector shall be in accordance with the maximum and minimum ambient temperatures where the device is installed.
6. Suffix: Suffix 'S' detectors shall be provided in rooms such as boiler rooms and kitchens where high rates of temperature rise may be sustained for long periods, for example.

Suffix 'R' detectors shall be provided for unheated buildings where the ambient temperature can vary considerably, and high rates of temperature rise are not sustained for long periods, for example.
7. Power source: Fire alarm panel system loop.
8. Execution: [Pr_75_50_76/620 Installing point detectors](#).

Pr_75_75_30_65 Point smoke detectors

1. Description:
2. Manufacturer: Gent or equal and approved.
3. Standard: To BS EN 54-7;
To BS EN 54-17;
and To BS EN 54-25.
4. Third party certification: LPCB approved.
5. Detector type: Optical.
6. Power source: Fire alarm panel system loop.
7. Execution: [Pr_75_50_76/620 Installing point detectors](#).

Pr_75_75_30_71 Remote indicators

1. Description:
2. Manufacturer: Gent or equal and approved.
3. Enclosure
 - 3.1. Material: Polycarbonate.
 - 3.2. Colour: White.
4. Ingress protection (minimum): To suit the location and environmental conditions.
5. Lamp: High intensity LED.
6. Lens
 - 6.1. Material: Polycarbonate.
 - 6.2. Colour: Clear.

7. Execution: [Pr_75_75_30/670 Installing remote indicators.](#)

Pr_75_75_30_97 Visual alarm signal devices

1. Description:
2. Manufacturer: Gent or equal and approved.
3. Standard: To BS EN 54-23 and To BS EN 54-25.
4. Device type: LED and Xenon beacon.
5. Enclosure protection: To suit the location and environmental conditions.
6. Category: C-x-y;
W-x-y;
and O.
7. Body colour: Red.
8. Lens colour: White.
9. Execution: [Pr_75_75_30/650 Installing visual alarm devices.](#)

Ss_75_50_28/560 Zone diagrams

1. Style: Paper print mounted in a glazed frame.
2. Size: A3.
3. Layout: Submit proposals .

Execution

See [90-55-15/640 Extra low and low voltage cable routes](#) in [Ss_70_30_45_45 Low-voltage distribution systems](#)

See [90-55-15/645 Low voltage cables concealed in walls and partitions](#) in [Ss_70_30_45_45 Low-voltage distribution systems](#)

See [90-55-15/655 Extra low and low voltage surface mounted cables](#) in [Ss_70_30_45_45 Low-voltage distribution systems](#)

See [Pr_20_29_03/611 Fixing anchors using cartridge-applied adhesive](#) in [Ss_70_30_45_45 Low-voltage distribution systems](#)

See [Pr_20_29_03/620 Fixing anchors using chemical anchor capsules](#) in [Ss_70_30_45_45 Low-voltage distribution systems](#)

See [Pr_65_70_11/621 Installing cable tray and cable ladder](#) in [Ss_70_30_45_45 Low-voltage distribution systems](#)

See [Pr_65_70_11/630 Installing cable basket](#) in [Ss_70_30_45_45 Low-voltage distribution systems](#)

See [Pr_65_70_11/640 Installing cable supports on roofs](#) in [Ss_70_30_45_45 Low-voltage distribution systems](#)

See [Pr_65_70_11/650 Multiple cable runs](#) in [Ss_70_30_45_45 Low-voltage distribution systems](#)

See [Pr_65_70_11/661 Cable support zones](#) in [Ss_70_30_45_45 Low-voltage distribution systems](#)

See [Pr_65_70_11/700 Installing conduit, trunking and ducting](#) in [Ss_70_30_45_45 Low-voltage distribution systems](#)

See [Pr_65_70_11/710 Installing conduit generally](#) in [Ss_70_30_45_45 Low-voltage distribution systems](#)

See [Pr_65_70_11/720 Installing rigid metallic conduit](#) in [Ss_70_30_45_45 Low-voltage distribution systems](#)

See [Pr_65_70_11/725 Installing rigid non metallic conduit](#) in [Ss_70_30_45_45 Low-voltage distribution systems](#)

See [Pr_65_70_11/740 Installing trunking generally](#) in [Ss_70_30_80_35 Hardwired voltage small power systems](#)

See [Pr_65_70_11/765 Conduit, trunking and ducting zones](#) in [Ss_70_30_45_45 Low-voltage distribution systems](#)

See [Pr_65_70_48/635 Installing low voltage cables in Ss_70_30_45_45 Low-voltage distribution systems](#)

See [Pr_65_70_48/660 Installing low voltage cables in conduit and trunking in Ss_70_30_45_45 Low-voltage distribution systems](#)

See [Pr_65_70_48/735 Cable installation on channel cable supports, cable tray, cable ladder and cable basket in Ss_70_30_45_45 Low-voltage distribution systems](#)

Pr_75_50_76/620 Installing point detectors

1. Protective cage: As per contractors installation drawings.

Pr_75_75_27/661 Installing electrically powered hold-open devices

1. Method of operation:

Pr_75_75_30/610 Installing main control and indicating equipment (CIE)

1. Position: As per contractors installation drawings.
2. Power supply: As per contractors installation drawings and connect to CIE via key switched fused connection units.

Pr_75_75_30/630 Installing manual call points

1. Position: As per contractors installation drawings.
2. Mounting height: 1.4 m affl.
3. Test key: Locate to allow easy test operation.
4. Labelling
 - 4.1. Type: Face engraved rigid plastic laminate.
 - 4.2. Background: White.
 - 4.3. Lettering: Red, identifying the manual call point address.

Pr_75_75_30/650 Installing visual alarm devices

1. Position: As per contractors fire alarm installation drawings.
2. Mounting height: 2.3 m above finished floor level.
3. Protective cage: The contractor shall provide protective cage where equipment is likely to receive mechanical impact.

Pr_75_75_30/670 Installing remote indicators

1. Concealed detection devices: Install individual LED indicators.

Ss_75_50_28/610 Installing fire detection and alarm systems in non-domestic premises

1. Standard: In accordance with BS 5839-1.

Ss_75_50_28/630 Installing cabling for fire detection and alarm systems in non-domestic premises

1. General requirements: [Ss_75_50_28/610 Installing fire detection and alarm systems in non-domestic premises](#) .
2. Standard: In accordance with BS 7671.
3. Cable route: Segregate from other cabling. Where installed in trunking or basket, locate in a segregated fire cabling compartment.
4. Cable topology: Loop circuits without spurs or tees and radial circuits without spurs or tees.
5. Cable pulling: The contractor shall Submit proposals.
6. Timing: Do not start internal cabling until building enclosure provides permanently dry conditions.
7. Mechanical protection: Cables should be mechanically protected in areas where physical damage or rodent attack could occur. BS 5839-1 recognises that mechanical protection might not be necessary in relatively benign environments such as offices and shops where the cables are fixed directly to robust construction, e.g. structural columns. Insert, e.g. To cabling mounted below 2 m.
8. Fastening cables
 - 8.1. To building fabric: Metal P-clips with red plastic coating.
 - 8.2. To cable supports: Metal bands with red plastic coating.
9. Cables passing through the building fabric: Sleeve and seal to prevent transmission of gas and dust.

10. Jointing: At equipment and terminal fittings only.
11. Cable terminals: Use ceramic equipment only.
12. Maximum circuit resistance: The contractor shall measure before concealment and submit results.

Ss_75_50_28/695 Installing interfaces to other equipment and systems

1. General requirements: [Ss_75_50_28/610 Installing fire detection and alarm systems in non-domestic premises](#) .
2. Connection to equipment: Install interconnecting wiring between interface unit and equipment controlled.
3. Interface units: Label, describing their function.

Ss_75_50_28/700 Installing all zone evacuation controls

1. General requirements: [Ss_75_50_28/610 Installing fire detection and alarm systems in non-domestic premises](#) .
2. Position: Integral within CIE.

System completion

Ss_75_50_28/805 System information

1. Device list: Before commissioning, submit proposals, including proposed device, zone and group names.
2. Zone diagram: Before commissioning submit proposals.

Ss_75_50_28/806 Device identification and testing

1. Device identification: Label devices with a unique address corresponding to that used by the CIE. Label non-addressable devices with a unique reference corresponding to that shown on the record drawings.
2. Device testing: Verify the operation of each device. Submit a schedule of devices, including the device test methods and results.

Ss_75_50_28/807 Standby battery testing

1. Mains power supply: Isolate.
2. Quiescent mode: Measure current supplied by standby source when fire detection and alarm system is operating in the quiescent mode. Submit results.
3. Alarm mode: Measure current supplied by standby source when fire detection and alarm system is operating in the alarm mode. Submit results.

Ss_75_50_28/808 System soak testing

1. Soak test: Undertake when construction works are complete, but before handover.
2. Period: 14 days.
3. Re-test after remedial works: Required.

Ss_75_50_28/809 Measurement of sound pressure levels

1. Sound pressure levels: Measure throughout the building.
2. Test instrument
 - 2.1. Standard: To BS EN 61672-1.
 - 2.2. Setting: Slow response, weighting A.
3. Doors: Close before measuring sound pressure levels.
4. Results: The contractor shall submit electronic layout drawing showing location of measurements with results.

Ss_75_50_28/810 Testing and commissioning fire detection and alarm systems in non-domestic premises

1. Standard: In accordance with BS 5839-1.
2. System commissioning agent: System manufacturer.
3. Notice before commencing tests (minimum): Two weeks.

Ss_75_50_28/820 Documentation for fire detection and alarm systems in non-domestic premises

1. Standard: In accordance with BS 5839-1.
2. Operating and maintenance instructions
 - 2.1. Scope: Submit for the system giving optimum settings for controls.
 - 2.2. Product information: Include product description, date of purchase, performance characteristics, application (suitability for use), method of operation and control, and cleaning and maintenance requirements.
 - 2.3. Format: Paper and electronic copy.
 - 2.4. Number of copies: Two.
3. Log book: Submit one copy in accordance with BS 5839-1.
4. Logbook:
5. Record drawings
 - 5.1. Content: General arrangement drawings showing the location of all control and indicating equipment, manual call points, detectors, radio transmitters and aerials, sounders, visual alarm signal devices, short circuit isolators, end of line devices, remote indicators, interface units connecting to other equipment, and automatic door hold open devices and Schematic diagram showing all control cabling, the cable origin, device addresses, route from control and indicating equipment to manual call points, detectors, radio transmitters and aerials, sounders, visual alarm signal devices, short circuit isolators, end of line devices, remote indicators, interface units connecting to other equipment, and automatic door hold open devices. Include conductor material and c.s.a, insulation type and colour, number of cores per cable, number of cables in ducts, on tray or ladder.
 - 5.2. Drawing format: Full size paper print drawing and Electronic drawing.
 - 5.3. Number of copies: Two.
 - 5.4. Submittal date:
6. Fire evacuation plan: Submit electronic colour CAD layout.
7. Certification
 - 7.1. Design certificate: Submit two copies in accordance with BS 5839-1 Annex G.1.
 - 7.2. Installation certificate: Submit two copies in accordance with BS 5839-1 Annex G.2.
 - 7.3. Commissioning certificate: Submit two copies in accordance with BS 5839-1 Annex G.3.

Ss_75_50_28/830 Spares and consumables

1. Supply the following spares
 - 1.1. Frangible elements for manual call points: Six.
 - 1.2. Detectors: Two of each type.
2. Printer ink and paper roll: Replace immediately before handover.

Ss_75_50_28/840 Maintenance

1. Standard: In accordance with BS 5839-1.
2. Duration: Until 12 months after Practical Completion.

Ss_75_50_28/850 Verification certificate for fire detection and alarm systems in non-domestic premises

1. System verification agent: The system manufacturer.
2. Verification certificate: Submit two copies in accordance with BS 5839-1, Annex G.5.

Ω End of System

Ss_75_50_45_45 Lightning protection systems

Systems

Ss_75_50_45_45 Lightning protection systems

Description: **Contractors Responsibilities**

The Contractor shall develop the tender design to completion, supply, install, co-ordinate with other contractors, test, commission and set to work the complete lightning protection system. This shall include all necessary tools, labour, materials and equipment required to provide a complete working installation that fully meets the functional and performance criteria specified within this specification.

The Contractor shall include for provision of maintenance to the system, seasonal commissioning activities and rectification as required by the Contract and the Mechanical & Electrical Specification.

Function/Objectives

A complete and fully operational lightning protection installation shall be provided.

Applicable Standards

In addition to this specification, the lightning protection installation shall comply with the following standards and guidelines current at the time of tender:

- Building Regulations
- British Standards
- The requirements of the local Building Control Authority
- Relevant HSE Guidance
- BSRIA Standards & Guidance notes
- CIBSE Guides & Notes.
- MoD Specifications, Design and Maintenance Guides and Technical Bulletins.
- Client Specific Requirements.

Any discrepancies identified by the contractor between the specification and the above documents shall be brought to the attention of the CA immediately.

System Descriptions

The Lightning Protection Specialist shall design, supply, install, test and commission a complete lightning protection system in accordance with the following clauses, and details.

The Contractor shall first carry out a detailed risk assessment in accordance with the requirements of BS EN 62305 to determine class of protection required and to influence protection system design.

The building shall be provided with a lightning protection scheme in accordance with BSEN 62305, including the provision of surge protection devices on the incoming electrical and communication services.

The specialist contractor shall be responsible to model and verify the lightning protection level of the building. The building has been designed for a Level system.

The installed lightning protection system shall be sympathetic to the architecture of the building and shall be agreed with the Architect prior to installation.

The contractor shall coordinate the location of the down conductors, with the Architect and façade designer.

Above ground test links shall be installed at a minimum of 300mm above ground level.

Lockable Earth inspection access pits shall be provided and positioned adjacent to the structure complete with purpose made covers and identified as 'lightning protection'.

Where the tape is exposed on walls PVC covering shall be provided in a colour selected to suit the material finish to which it is fixed and approved by the Architect before installation.

Earth electrodes or earth mats of suitable depth shall be provided and installed as dictated by the soil resistance levels taken at the site at the time of the installation.

The system will be designed such that the system will utilise as much as the building fabric as possible and be interconnected into the main building equipotential earthing system.

The system will comprise a combination of roof-mounted tape, bonds to the roof and the building structure, down conductors and low level bonds to external earth pits. A mesh bonding air termination network will be provided to the roof in certain places, as shown on the drawing.

The resistance of the earth termination network shall not exceed 10 ohms. If upon soil resistivity testing the quality of the soil is determined to be detrimental to the design, the contractor shall review the addition of a type B lightning protection system with all earth electrodes interconnected to form a ring.

Drawings:

See all relevant drawings in the drawing issue sheet.

1. System performance:

To reliably, safely and substantially reduce the risk of damage to property and to people within the building(s), and of disruption to essential services in the event of a strike by lightning.

To ensure that the system(s) is (are) effective by having its (their) design, installation, testing and commissioning completely carried out by a single lightning protection system specialist.

To robustly fix the system(s) to the building(s) and ensure that the system(s) is(are) capable of operating without itself (themselves) being damaged by lightning.

The system will be arranged to prevent fixed metallic components of the building including rainwater disposal systems, roof mounted equipment, rainscreen structure, feature metal fins, etc. from defeating the function of the lightning protection system.

To use in the system(s) materials that are resistant to atmospheric corrosion and thus minimise the risk of staining of the external fabric of the building(s).

To ensure that the system(s) does not/do not undermine the weatherproofing and waterproofing systems of roofs nor any other part of a building's fabric.

[Ss_75_50_45/210 Design of lightning protection systems](#) and [Ss_75_50_45/220 Building construction for information](#).

2. System manufacturer: A member of the Association of Technical Lightning and Access Specialists.
3. Air-termination system: [Pr_65_70_46_14 Copper earth tapes](#).
4. Down-conductor system: [Pr_65_70_46_14 Copper earth tapes](#).
5. Earth-termination system: [Pr_65_70_46_25 Earth plates](#);
[Pr_65_70_46_27 Earth rods](#);
[Ss_75_50_45/640 Installing ring earth electrodes](#);
Ring earth electrodes;
and use of reinforcing steel in concrete foundations.
6. Accessories: [Pr_65_72_27_50 Mains power supply transient overvoltage suppression devices](#);
[Pr_70_75_88_21 Data and telecom transient overvoltage surge suppression devices](#);
[Pr_65_70_46_26 Earth rod inspection pits](#);
[Pr_65_70_46_46 Lightning protection conductor clamps](#);
[Pr_65_70_12_04 Anti-vandal cable guards](#);
[Pr_65_70_46_47 Lightning protection conductor metallic direct contact clips](#);
[Pr_65_70_46_48 Lightning protection conductor non-metallic direct contact clips](#);
and [Pr_65_70_46_80 Soil conditioning conductive agents](#).
7. Electrical identification: [Pr_40_10_57_24 Electrical identification labels](#) and [Pr_40_10_57_29 Equipment labels and warning notices type B](#).
8. Execution: [Ss_75_50_45/630 Installing lightning protection systems](#);
[Ss_75_50_45/640 Installing ring earth electrodes](#);
[Ss_75_50_45/650 Installing test joints](#);
[Ss_75_50_45/660 Lightning equipotential bonding](#);
[Ss_75_50_45/670 Dissimilar metals](#);
and [Ss_75_50_45/680 Installing notices and labels](#).
9. System completion: [Ss_75_50_45/810 Inspection and testing of lightning protection systems](#);
[Ss_75_50_45/820 Documentation](#);
and [Ss_75_50_45/840 Maintenance](#).

System performance

[Ss_75_50_45/210](#) Design of lightning protection systems

1. Design: Develop the design of the lightning protection system.
2. System designer: A member of the Association of Technical Lightning and Access Specialists.
3. Standards: Lightning protection risk assessment to be undertaken by contractor in accordance with BS EN 62305.
4. Class of LPS: Shall be determined by Lightning specialist via a risk assessment in accordance with BS EN 62305.
5. External LPS type: Attached to the structure (non-isolated).
6. Earth-termination system: To BS EN 62305-3, Type A and To BS EN 62305-3, Type B (if the soil resistivity prevents a Type A system). To be confirmed by the lightning specialist.
7. Internal LPS type: Lightning equipotential bonding by direct connections, surge protective devices, and electrical insulation.
8. Requirement: The contractor shall Submit proposals including detailed design drawings, technical information, calculations and manufacturers' literature.

[Ss_75_50_45/220](#) Building construction for information

1. Substructure: The contractor shall refer to the architectural and structural information for details of the substructure.
2. Superstructure: The contractor shall refer to the architectural and structural information for details of the superstructure.
3. Roof structure: The contractor shall refer to the architectural and structural information for details of the roof structure.
4. Roof coverings: The contractor shall refer to the architectural and structural information for details of the roof coverings.

Products

[Pr_40_10_57_24](#) Electrical identification labels

1. Description:
2. Manufacturer:
3. Standards: In accordance with BS 7671;
To BS ISO 3864-1;
and To BS EN ISO 7010.

See [Pr_40_10_57_29](#) Equipment labels and warning notices type B in [Ss_70_30_25_25](#) Earthing and bonding systems

See [Pr_65_70_12_04](#) Anti-vandal cable guards in [Ss_70_30_25_25](#) Earthing and bonding systems

[Pr_65_70_46_14](#) Copper earth tapes

1. Description:
2. Manufacturer: Furse or equal and approved.
3. Standards: To BS EN 13601.
4. Finish: Bare.
5. Size: 25 x 3 mm.
6. Cover: Down conductors shall be PVC sheathed with a colour to match the building material and shall be agreed with the contractor administrator and architect.
7. Execution: [Pr_65_70_46/660](#) Installing earth conductor tapes.

[Pr_65_70_46_25](#) Earth plates

1. Description:
2. Manufacturer: Furse or equal and approved.
3. Standards: To BS EN 50164-2;
To BS EN 12163;
and To BS EN 13601.
4. Material: Copper.

5. Size: Manufacturer's standard and to suit the proposed roof arrangement.
6. Execution: [Pr_65_70_46/620 Installing earth plates and mats.](#)

[Pr_65_70_46_26](#) Earth rod inspection pits

1. Description:
2. Manufacturer: Furse or equal and approved.
3. Standard: To BS EN 62561-5.
4. Material: Concrete;
Lightweight plastics;
and Lightweight plastics with concrete lid.
5. Colour: Grey.
6. Load rating (minimum): 1200 kg.
7. Identification: Permanently identify with the wording 'EARTH ROD'.
8. Features: Complete with testing connection point
9. Accessories: Earth bar.
10. Execution: [Pr_65_70_46/640 Installing earth rod inspection pits.](#)

[Pr_65_70_46_27](#) Earth rods

1. Description:
2. Manufacturer: Furse or equal and approved.
3. Standards: To BS EN 62561-2 and In accordance with BS 7430.
4. Material: Solid copper rods to BS EN 13601. Stainless steel rods shall be provided within corrosive soil conditions.
5. Coupling type: Externally threaded and Internally threaded.
6. Size
 - 6.1. Diameter: To suit project requirements. A minimum of 12.5mm shall be provided and shall be confirmed by the lightning specialist.
 - 6.2. Length: To be determined by specialist lightning protection contractor in order to achieve the required resistance values in accordance with BS EN 62305.
7. Earth rod clamps: Rod to cable;
Rod to cable lug;
Rod to tape;
and 'U' bolt.
8. Accessories: Threaded driving heads and Threaded driving spikes.
9. Execution: [Pr_65_70_46/630 Installing earth rods.](#)

[Pr_65_70_46_46](#) Lightning protection conductor clamps

1. Description:
2. Manufacturer: Furse or equal and approved.
3. Standard: To BS EN 62561-1.
4. Lightning current withstand classification: Class N (50kA). Class H (100kA) shall be provided where applicable.
5. Material: To match lightning conductor material.
6. Clamp type: Jointing clamp;
Pipe clamp;
Rebar connecting clamps;
Rebar to cable clamp;
Square tape clamp;
Structural steelwork bonding clamp;
Tee clamp;
and Test clamp.

[Pr_65_70_46_47](#) Lightning protection conductor metallic direct contact clips

1. Description:
2. Manufacturer: Furse or equal and approved.
3. Standards: To BS EN 62561-1 and To BS EN 62561-4.

4. Lightning current withstand classification: Class N (50kA). Class H (100kA) shall be provided where applicable.
5. Material: Aluminium and Copper (to match lightning conductor)
6. Clip type: Type to suit the lightning conductor.
7. Accessories: Back plate holdfast;
Glazing holdfast;
and Standing seam roof fixing.

Pr_65_70_46_48 Lightning protection conductor non-metallic direct contact clips

1. Description:
2. Manufacturer: Furse or equal and approved.
3. Standard: To BS EN 62561-4.
4. Material: Non-brittle, UV stabilized high grade polypropylene.
5. Colour: To match building materials
6. Clip type: Type to suit the lightning conductor.
7. Accessories: Back plate holdfast;
Glazing holdfast;
and Standing seam roof fixing.

See [Pr_65_70_46_80 Soil conditioning conductive agents](#) in [Ss_70_30_25_25 Earthing and bonding systems](#)

See [Pr_65_72_27_50 Mains power supply transient overvoltage suppression devices](#) in [Ss_70_30_45_45 Low-voltage distribution systems](#)

Pr_70_75_88_21 Data and telecom transient overvoltage surge suppression devices

1. Description:
2. Manufacturer: Furse or equal and approved
3. Standard: To BS EN 61643-21.
4. Category: In accordance with the lightning protection system category as assessed by the specialist contractor within their risk assessment.
5. Maximum continuous operating voltage (Uc): 6 V;
10 V;
16 V;
30 V;
and 50 V.
6. Mode of protection: Lines to earth, lines to lines.
7. Rated current: 4 A.
8. Voltage protection level (Up): 190 V.
9. Bandwidth: 20 MHz.
10. Mounting method: Suitable for 18 mm DIN rail and Suitable for 35 mm DIN rail.
11. Execution: [Pr_70_75_88/620 Installing surge protective devices for telecommunications and signalling networks](#).

Execution

See [Pr_65_70_12/745 Installing anti-vandal capping](#) in [Ss_70_30_25_25 Earthing and bonding systems](#)

Pr_65_70_46/620 Installing earth plates and mats

1. Standards:
2. Position: Contractor's choice .
3. Arrangement: Install vertically. Backfill immediately following installation.
4. Depth of plate top (minimum): 1000 mm below finished ground level.
5. Separation distances:

Pr_65_70_46/630 Installing earth rods

1. Standards:

2. Position: In undisturbed ground, at least 1m from building and metal fencing, avoiding communications cabling.
3. Rod separation
 - 3.1. General earth installations: Space the rods apart by at least 1.25 times the depth of the longest rod.
 - 3.2. Clean earth installations: Space rods apart by at least 6 times the depth of the longest rod.
4. Rod alignment: Vertical.
5. Couplings: Apply corrosion inhibiting paste to the threads and enclose so that rods meet at centre of coupling.
6. Earth rod heads
 - 6.1. Location: Position within 100 mm of ground level.
 - 6.2. Enclosure: Concrete inspection pit;
Lightweight plastics inspection pit;
and Lightweight plastics inspection pit with concrete lid.
7. Earth rods
 - 7.1. Arrangement: Interconnect between earth rods using bare copper tape.
 - 7.2. Tape depth: 750 mm below ground.
 - 7.3. Jointing method: Bolts;
Compression;
and Exothermic, as required to meet the required fault ratings and local soil conditions.
8. Internal earth rods: Provide seals.

Pr_65_70_46/640 Installing earth rod inspection pits

1. Inspection pit lid: Install flush with the finished ground surface. Orientate to align with any angular surface finishes.

Pr_65_70_46/660 Installing earth conductor tapes

1. Position: As per contractors installation information.
2. Number of joints: The contractor shall minimise the number of joints.
3. Contact surfaces: Clean. Coat with corrosion inhibitor.
4. Bimetallic joints: Do not cross-contaminate.
5. Conductors passing through roofs: Provide puddle flanges.
6. Fasteners: Spaced at a maximum of 600 mm apart.

See [Pr_65_70_46/670](#) Installing soil conditioning agents in [Ss_70_30_25_25](#) Earthing and bonding systems

See [Pr_65_72_27/610](#) Installing surge protective devices for low voltage power supplies in [Ss_70_30_45_45](#) Low-voltage distribution systems

See [Pr_70_75_88/620](#) Installing surge protective devices for telecommunications and signalling networks in [Ss_70_30_45_45](#) Low-voltage distribution systems

Ss_75_50_45/630 Installing lightning protection systems

1. Standards: In accordance with BS EN 62305-3 and BS EN 62305-4.
2. Position
 - 2.1. Air-termination components: As per contractors installation information.
 - 2.2. Down-conductors: As per contractors installation information.
3. Substructure: When used as the earth terminal network measure its resistance to earth during the construction period and the contractor shall ensure that the overall resistance is achieved in accordance with the standards.
4. Results: The contractor shall submit the results of the lightning protection system as part of the operation and maintenance documentation.

Ss_75_50_45/640 Installing ring earth electrodes

1. Standards: To BS EN 62305-3 and BS EN 62305-4
2. Ring earth electrodes
 - 2.1. Depth (minimum): The contractor shall install the Type B earth electrode a minimum of 600 mm below ground at 1 m from the external wall.

- 2.2. Mesh size: This shall be determined by the specialist contractor in order to achieve the required resistance values with the local soil conditions.
- 2.3. Arrangement: This shall be determined by the specialist contractor in order to achieve the required resistance values with the local soil conditions.
3. Jointing method: This shall be determined by the specialist contractor in order to achieve the required fault ratings and local soil conditions.

Ss_75_50_45/650 Installing test joints

1. Standard: To BS EN 62305-3.
2. Position: Within earth rod inspection pits installed at ground level adjacent to each down conductor and Exposed on wall at a height of 900 mm adjacent to each down conductor.

Ss_75_50_45/660 Lightning equipotential bonding

1. Standards: To BS EN 62305-3 and BS EN 62305-4.
2. Bond the following to the lightning protection system: Generally all exposed metallic materials and equipment shall be bonded to the lightning protection system where it is not protected by the air termination network in accordance with BS EN 62305.
3. Bonding conductor sizes: To BS EN 62305-3, Tables 8 and 9.
4. Location of bonds: As per contractors installation information.

Ss_75_50_45/670 Dissimilar metals

1. Connecting dissimilar metals: Prevent electrolytic action with the use of a bi-metallic connector.

Ss_75_50_45/680 Installing notices and labels

1. Warning notices: As per the contractors installation information.

System completion

Ss_75_50_45/810 Inspection and testing of lightning protection systems

1. Standards: To BS EN 62305-3 and BS EN 62305-4.
2. Results: Include within inspection guide.

Ss_75_50_45/820 Documentation

1. Standards: To BS EN 62305-3, Annex E and to BS EN 62305-4.
2. Inspection guide
 - 2.1. Submit including the following information: Levels of corrosion and condition of corrosion protection;
Presence and condition of fixings of LPS components to the structural fabric;
Earth resistance measurements of the earth termination system;
Any deviation from the technical documentation;
Evidence of any modification carried out to the LPS or the structure since the last inspection;
and The result of any measurements performed.
 - 2.2. Format: Electronic and paper format.
 - 2.3. Number of copies: Two.
3. Record drawings
 - 3.1. Content: General arrangement drawings showing the location of all air terminals, tapes, earth rods, plates and electrodes, test joints, and plates, route of protective bonding conductors from the lightning protection system to other services and to the main earthing terminal.
 - 3.2. Format: Full size paper and electronic drawing
 - 3.3. New clause item 1: Two.
 - 3.4. Number of copies:
4. Submittal date: Upon practical completion.

Ss_75_50_45/840 Maintenance

1. Servicing and maintenance: The contractor shall undertake the full servicing and maintenance in accordance with BS EN 62305-3 and BS EN 62305-4.
2. Duration: Until 12 months after completion.

Ω End of System

Artin.

Creative Lighting Design

Architectural

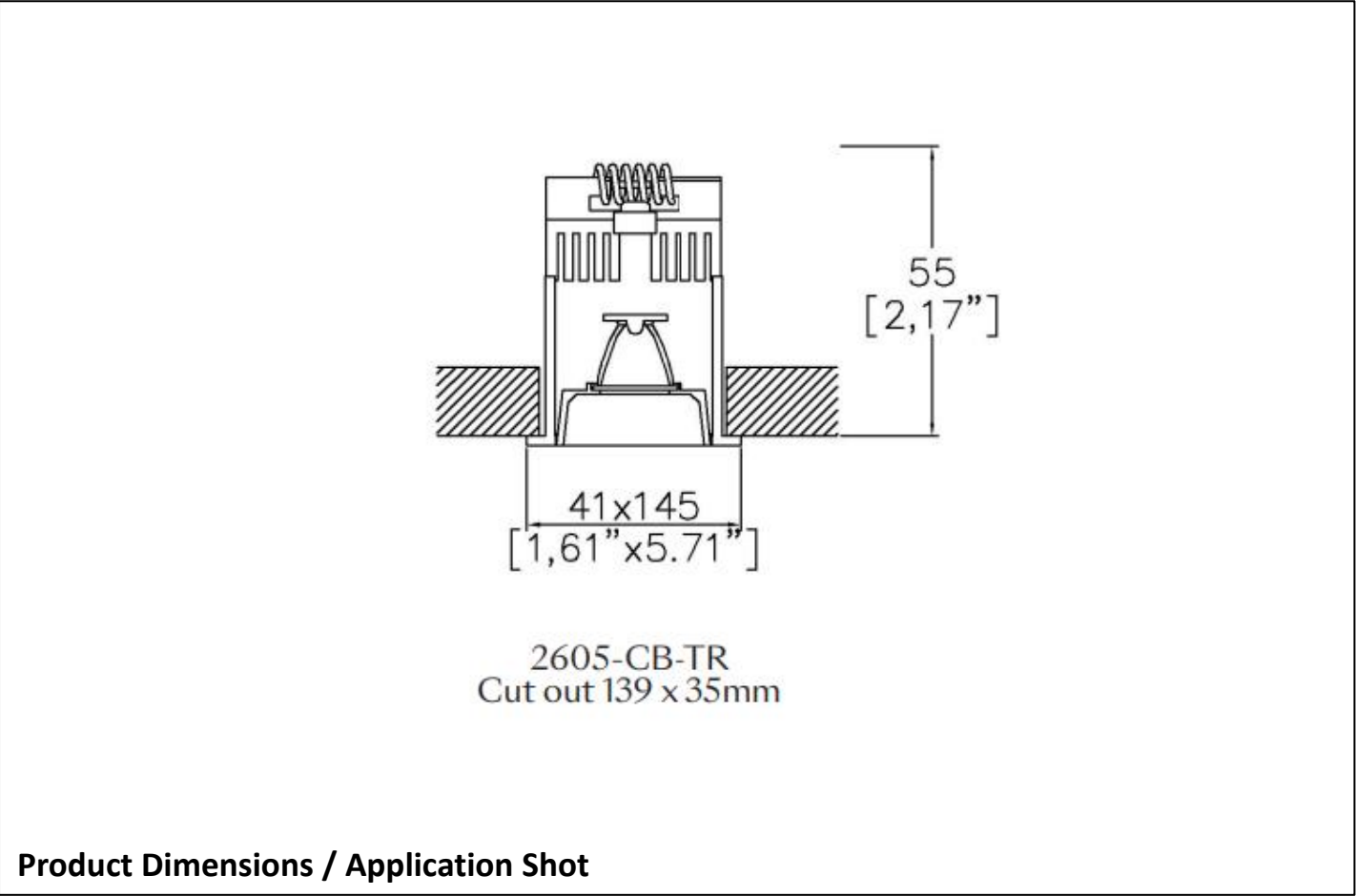
L2

Description	Recessed LED module luminaire
Fixing Type	Recessed
Finish	Black
Attachments / Spec	48 degree beam
Colour Temperature	2700K
Colour Rendering Index	>90
Light Source	LED
Dimming Protocol	DALI
Wattage	13 w
Lumen Output	850 lm
Lumens per Watt	65 lm/w
IP Rating	20
Notes	Include for all drivers, connections and fixing details necessary for complete working installation
Manufacturer	Lucent Lighting
Reference	Fine Line System – Line 5LED Cube
Contact	Alex Hay E: Alex@lucent-lighting.com T: (0) 7971663060

Artin.



Product Image



Product Dimensions / Application Shot

L3-(N,M,W)

Description	Adjustable LED downlight with inset LED light source
Fixing Type	Ceiling Recessed
Finish	Black
Attachments / Spec	Glare Louvre
Colour Temperature	2700K
Colour Rendering Index	>90
Light Source	LED
Dimming Protocol	DALI
Wattage	13.6 w
Lumen Output	1086 lm
Lumens per Watt	80 lm/w
IP Rating	20
Notes	Include for all drivers, connections and fixing details necessary for complete working installation
Manufacturer	Lucent Lighting
Reference	Soft70 Accent Trim
Contact	Alex Hay E: Alex@lucent-lighting.com T: (0) 7971663060

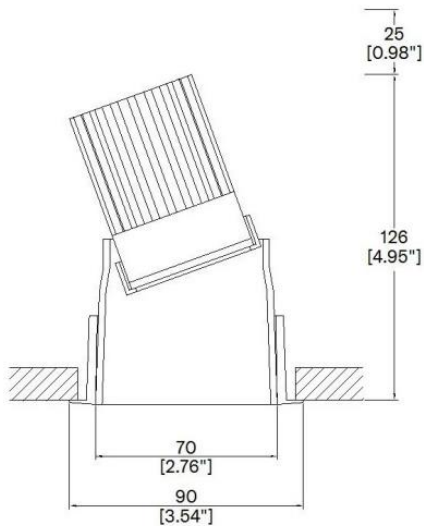
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MANUFACTURER / CONTRACTOR NOTES

‘N’ Denotes 15 degree optic
‘M’ Denotes 24 degree optic
‘W’ Denotes 36 degree optic



Product Image



073-LED-TR
Cut-out 79mm Ø

Product Dimensions / Application Shot

L4-(N,M,W)

Description	Fixed LED downlight with inset LED light source
Fixing Type	Ceiling Recessed
Finish	Black
Attachments / Spec	Glare Louvre
Colour Temperature	2700K
Colour Rendering Index	>90
Light Source	LED
Dimming Protocol	DALI
Wattage	7.4 w
Lumen Output	505 lm
Lumens per Watt	67 lm/w
IP Rating	20
Notes	Include for all drivers, connections and fixing details necessary for complete working installation
Manufacturer	Lucent Lighting
Reference	Soft50 Fixed Trim
Contact	Alex Hay E: Alex@lucent-lighting.com T: (0) 7971663060

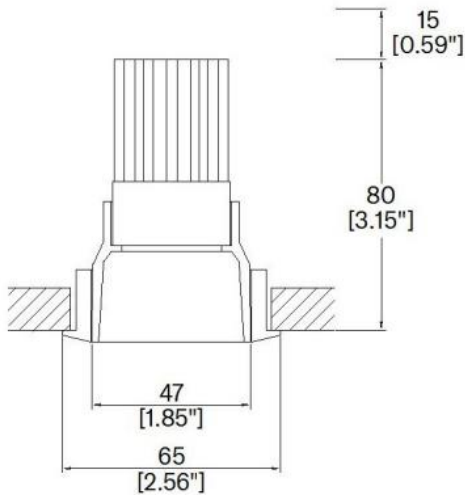
Artin.

MANUFACTURER / CONTRACTOR NOTES

‘N’ Denotes 15 degree optic
‘M’ Denotes 24 degree optic
‘W’ Denotes 36 degree optic



Product Image



050-LED-TR
Cut-out 61mm Ø

Product Dimensions / Application Shot

L4IP-(N,M,W)

Description	Fixed LED downlight with inset LED light source
Fixing Type	Ceiling Recessed
Finish	Black
Attachments / Spec	Glare Louvre
Colour Temperature	2700K
Colour Rendering Index	>90
Light Source	LED
Dimming Protocol	DALI
Wattage	7.4 w
Lumen Output	505 lm
Lumens per Watt	67 lm/w
IP Rating	44
Notes	Include for all drivers, connections and fixing details necessary for complete working installation
Manufacturer	Lucent Lighting
Reference	Soft50 Fixed Trim
Contact	Alex Hay E: Alex@lucent-lighting.com T: (0) 7971663060

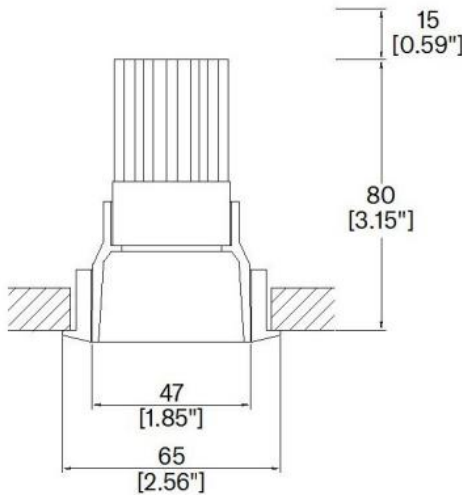
Artin.

MANUFACTURER / CONTRACTOR NOTES

‘N’ Denotes 15 degree optic
‘M’ Denotes 24 degree optic
‘W’ Denotes 36 degree optic



Product Image



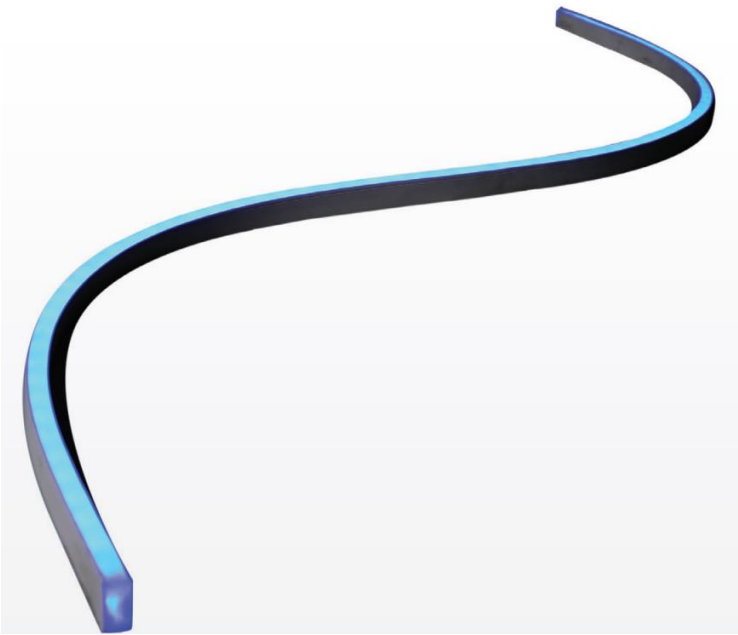
050-LED-TR
Cut-out 61mm Ø

Product Dimensions / Application Shot

L5

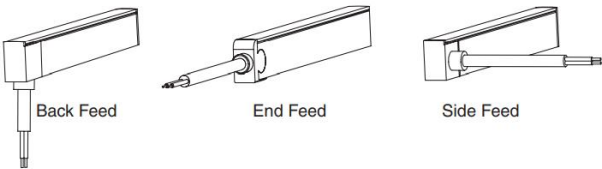
Description	Flexible LED profile with homogenous lighting effect
Fixing Type	Recessed into joinery details
Finish	NA
Attachments / Spec	Fixing channel as required Main Contractor to confirm preferred cable entry position and exact linear lengths onsite before ordering equipment
Colour Temperature	2700K
Colour Rendering Index	>90
Light Source	LED
Dimming Protocol	DALI
Wattage	12 w/m
Lumen Output	580 lm/m
Lumens per Watt	48 lm/w
IP Rating	67
Notes	Include for all drivers, connections and fixing details necessary for complete working installation
Manufacturer	Tryka
Reference	Continuity S – Made to measure
Contact	Colin Gawne E: Colin.Gawne@tryka.com T: 07890110951

Artin.

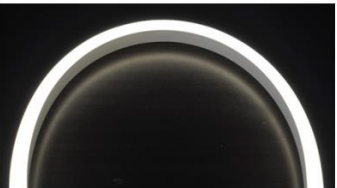


Product Image

Molded Cable Entry Options

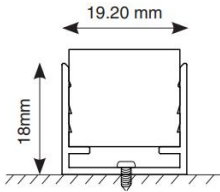
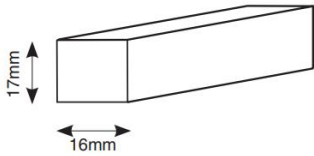


Bending Direction



CONTINUITY S can be bent sideways

Cross Section with extrusion



Product Dimensions / Application Shot

L6

Description	Low profile LED unit with opal diffuser
Fixing Type	Recessed flush into joinery rebate detail
Finish	NA
Attachments / Spec	Aluminum channel Opal diffuser
Colour Temperature	2700K
Colour Rendering Index	>90
Light Source	LED
Dimming Protocol	DALI
Wattage	14.5w/m
Lumen Output	1275 lm/m
Lumens per Watt	87 lm/w
IP Rating	20
Notes	Include for all drivers, connections and fixing details necessary for complete working installation
Manufacturer	Tryka
Reference	Adder 180 LED
Contact	Colin Gawne E: Colin.Gawne@tryka.com T: 07890110951

Artin.

PRO004
Standard Surface Mount
Aluminium Profile



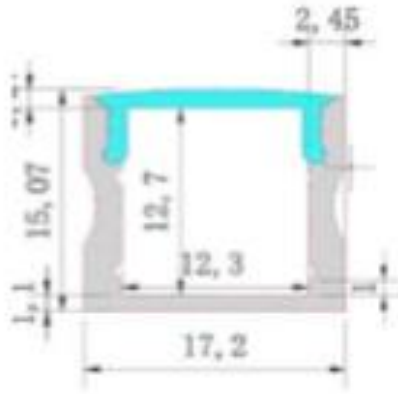
TRY-FLEX-MK-PRO004-AP-YY

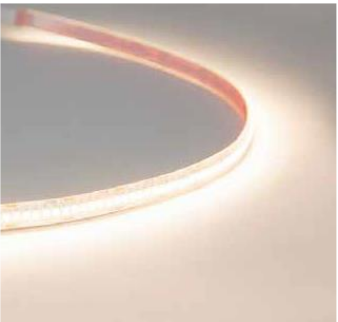
Opal Cover
TRY-FLEX-MK-PRO004-OC-YY

Clear Cover
TRY-FLEX-MK-PRO004-CC-YY

End Cap Set
TRY-FLEX-MK-PRO004-EC-SET

Fixing Clip - Pair
TRY-FLEX-MK-PRO004-FC-PAIR





Product Image

Product Dimensions / Application Shot

L6IP

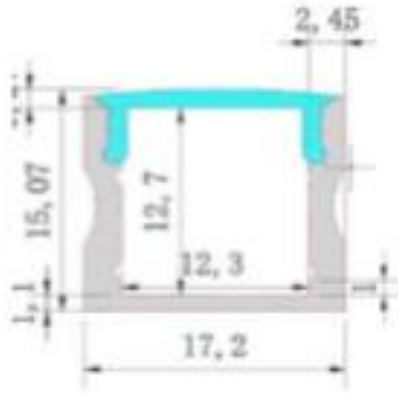
Description	Low profile LED unit with opal diffuser
Fixing Type	Recessed flush into joinery rebate detail
Finish	NA
Attachments / Spec	Aluminum channel Opal diffuser
Colour Temperature	2700K
Colour Rendering Index	>90
Light Source	LED
Dimming Protocol	DALI
Wattage	14.5w/m
Lumen Output	1275 lm/m
Lumens per Watt	87 lm/w
IP Rating	47
Notes	Include for all drivers, connections and fixing details necessary for complete working installation
Manufacturer	Tryka
Reference	Adder 180 LED
Contact	Colin Gawne E: Colin.Gawne@tryka.com T: 07890110951

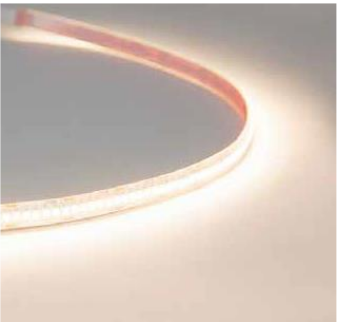
Artin.

PRO004
Standard Surface Mount
Aluminium Profile



TRY-FLEX-MK-PRO004-AP-YY
Opal Cover
TRY-FLEX-MK-PRO004-OC-YY
Clear Cover
TRY-FLEX-MK-PRO004-CC-YY
End Cap Set
TRY-FLEX-MK-PRO004-EC-SET
Fixing Clip - Pair
TRY-FLEX-MK-PRO004-FC-PAIR





Product Image

Product Dimensions / Application Shot

L7

Description	Low profile LED unit with opal diffuser
Fixing Type	Recessed into joinery detail
Finish	NA
Attachments / Spec	Aluminum channel Opal diffuser
Colour Temperature	2700K
Colour Rendering Index	>90
Light Source	LED
Dimming Protocol	DALI
Wattage	14.5w/m
Lumen Output	1275 lm/m
Lumens per Watt	87 lm/w
IP Rating	20
Notes	Include for all drivers, connections and fixing details necessary for complete working installation
Manufacturer	Tryka
Reference	Adder 180 LED
Contact	Colin Gawne E: Colin.Gawne@tryka.com T: 07890110951

Artin.

PRO002S
Micro Surface Mount
Aluminium Profile



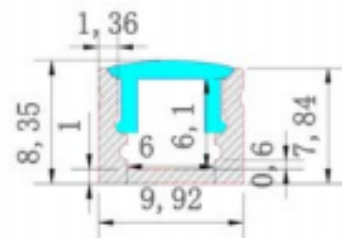
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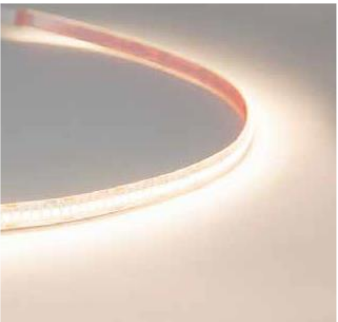
Opal Cover
TRY-FLEX-MK-PRO002S-OC-YY

Clear Cover
TRY-FLEX-MK-PRO002S-CC-YY

End Cap Set
TRY-FLEX-MK-PRO002S-EC-SET

Fixing Clip - Pair
TRY-FLEX-MK-PRO002S-FC-PAIR





Product Image



L8-(N,M,W,F)

Description	Fixed recessed LED downlight with deep recess light source
Fixing Type	Recessed
Finish	TBC
Attachments / Spec	Glare Louvre
Colour Temperature	2700K
Colour Rendering Index	>90
Light Source	LED
Dimming Protocol	DALI
Wattage	13.6 w
Lumen Output	907 lm
Lumens per Watt	67 lm/w
IP Rating	20
Notes	Include for all drivers, connections and fixing details necessary for complete working installation
Manufacturer	Lucent Lighting
Reference	MiniTRIM Fixed
Contact	Alex Hay E: Alex@lucent-lighting.com T: (0) 7971663060

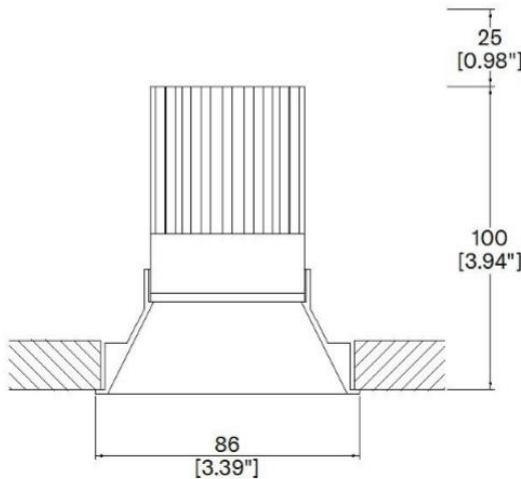
Artin.

MANUFACTURER / CONTRACTOR NOTES

‘N’ Denotes 15 degree optic
‘M’ Denotes 24 degree optic
‘W’ Denotes 36 degree optic
‘F’ Denotes 60 degree optic



Product Image



860-LED
Cut-out 81mm Ø

Product Dimensions / Application Shot

L9-(N,M,W)

Description	Adjustable LED downlight with inset LED light source
Fixing Type	Ceiling Recessed
Finish	Black
Attachments / Spec	Glare Louvre
Colour Temperature	2700K
Colour Rendering Index	>90
Light Source	LED
Dimming Protocol	DALI
Wattage	7.4 w
Lumen Output	505 lm
Lumens per Watt	67 lm/w
IP Rating	20
Notes	Include for all drivers, connections and fixing details necessary for complete working installation
Manufacturer	Lucent Lighting
Reference	Soft50 Accent Trim
Contact	Alex Hay E: Alex@lucent-lighting.com T: (0) 7971663060

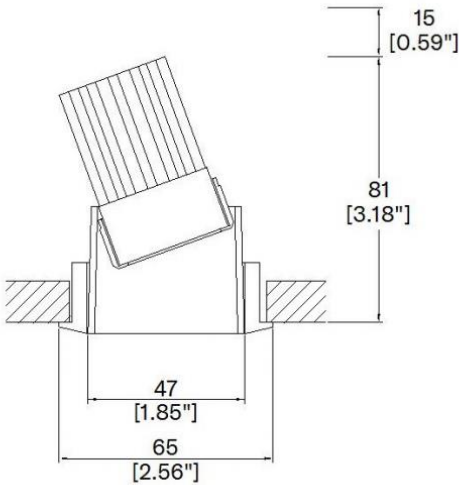
Artin.

MANUFACTURER / CONTRACTOR NOTES

‘N’ Denotes 15 degree optic
‘M’ Denotes 24 degree optic
‘W’ Denotes 36 degree optic



Product Image

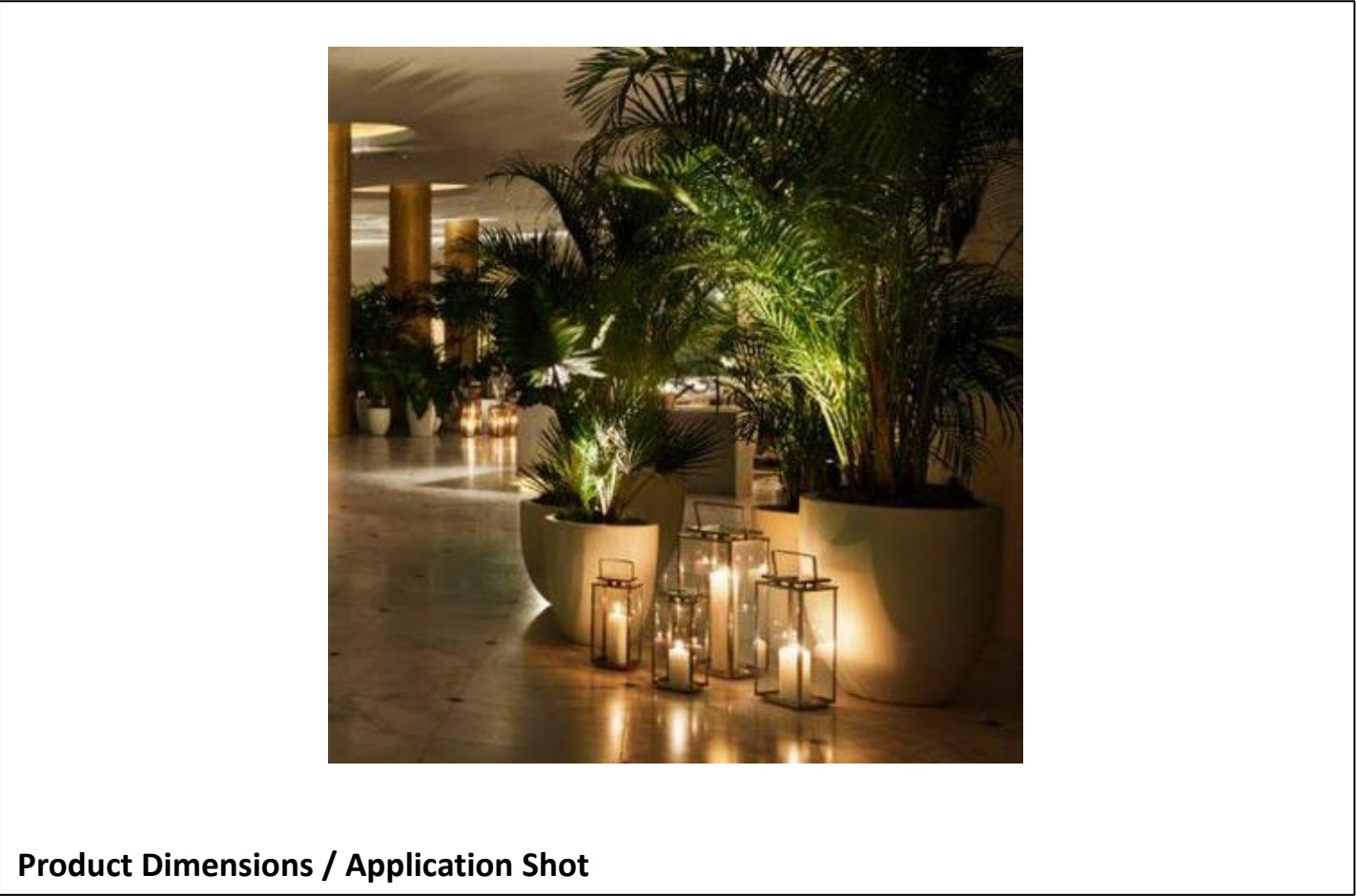


Product Dimensions / Application Shot

L11

Description	Spike mounted miniature uplight integrated into planters Various locations
Fixing Type	Spike mounted
Finish	Black
Attachments / Spec	10 degree beam Ground Spike Anti Glare Cowl
Colour Temperature	2700K
Colour Rendering Index	>93
Light Source	LED
Dimming Protocol	DALI
Wattage	7 w
Lumen Output	474 lm
Lumens per Watt	68 lm/w
IP Rating	67
Notes	Include for all drivers, connections and fixing details necessary for complete working installation
Manufacturer	Light Graphix
Reference	LD10238 – E2
Contact	Dylan Parry E: dylan@lightgraphix.biz M: 07340399180

Artin.



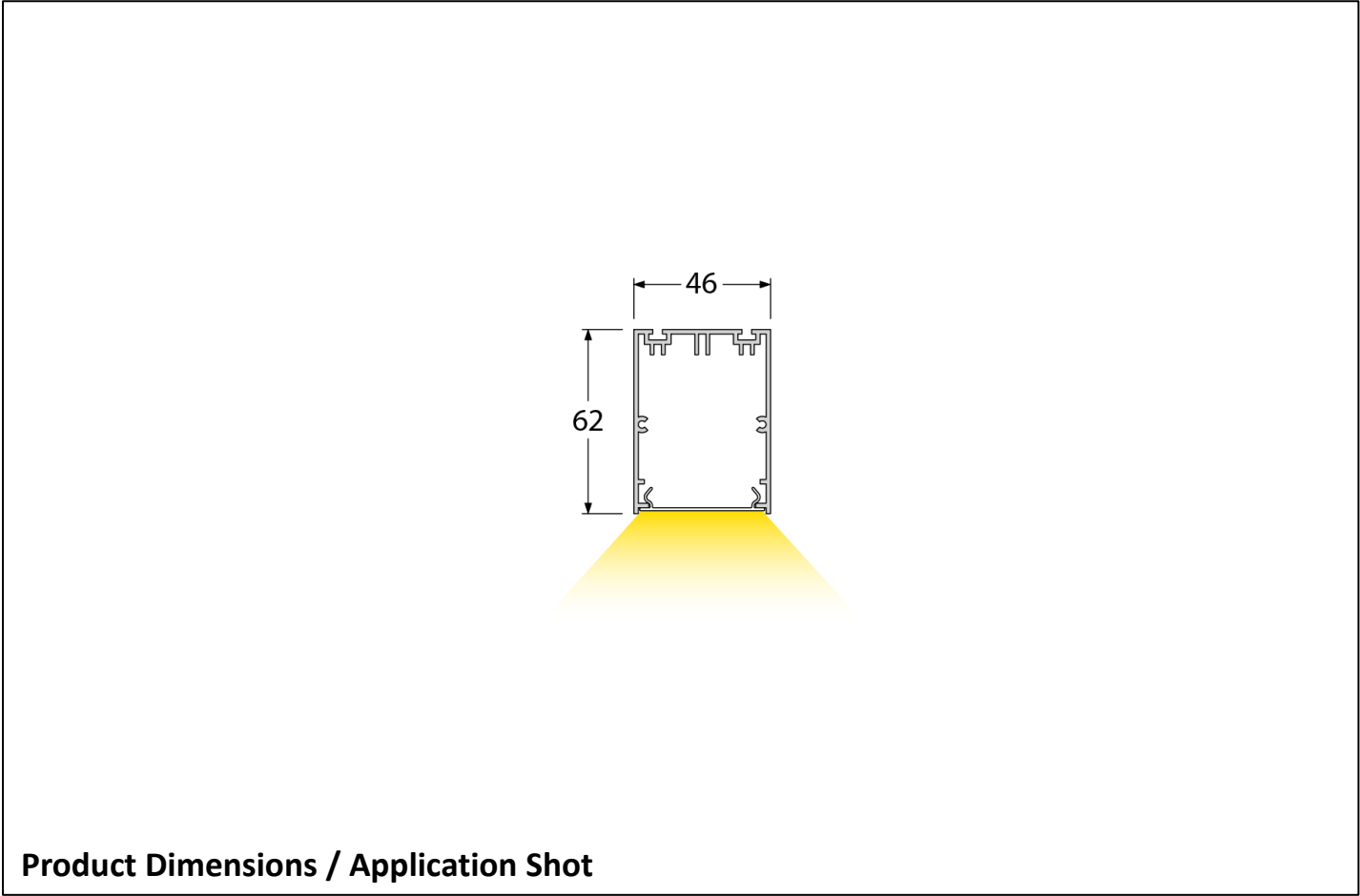
L12

Description	Surface mounted LED profile with opal diffuser
Fixing Type	Surface mounted – integrated into perimeter open cell ceiling detail in lift lobbies
Finish	Black
Attachments / Spec	
Colour Temperature	2700K
Colour Rendering Index	>90
Light Source	LED
Dimming Protocol	DALI
Wattage	21 w/m
Lumen Output	2861 lm/m
Lumens per Watt	136 lm/w
IP Rating	20
Notes	Include for all drivers, connections and fixing details necessary for complete working installation
Manufacturer	OptaLED
Reference	ICON 46 Surface – Allow for length as drawn
Contact	Neil Makin E: neil.makin@optaled.com T: 07908439300

Artin.



Product Image

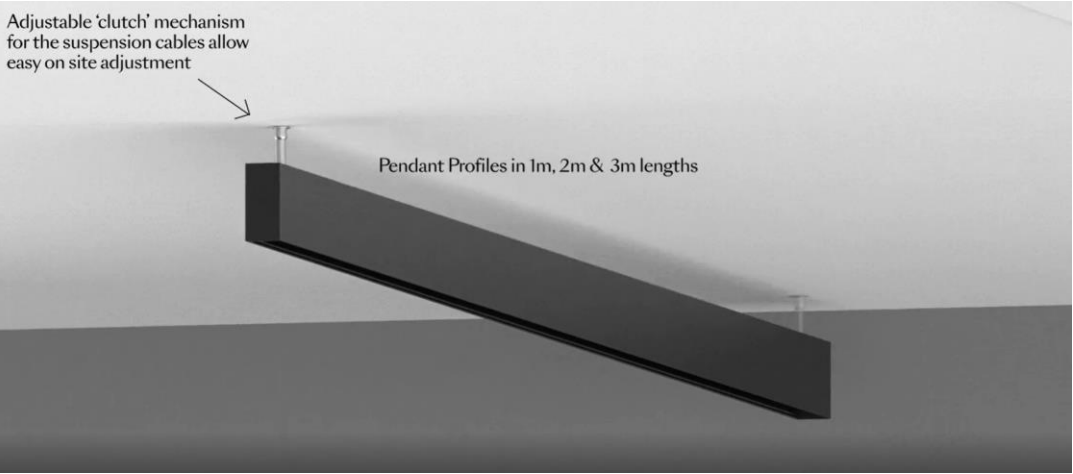


Product Dimensions / Application Shot

TR-48

Description	Suspended 48v track profile
Fixing Type	Suspended
Finish	TBC
Attachments / Spec	Allow for 48v track length as drawn
Colour Temperature	NA
Colour Rendering Index	NA
Light Source	LED
Dimming Protocol	DALI
Wattage	NA
Lumen Output	NA
Lumens per Watt	NA
IP Rating	20
Notes	Include for all drivers, connections and fixing details necessary for complete working installation
Manufacturer	Lucent Lighting
Reference	Fine Line System suspended
Contact	Alex Hay E: Alex@lucent-lighting.com T: (0) 7971663060

Artin.



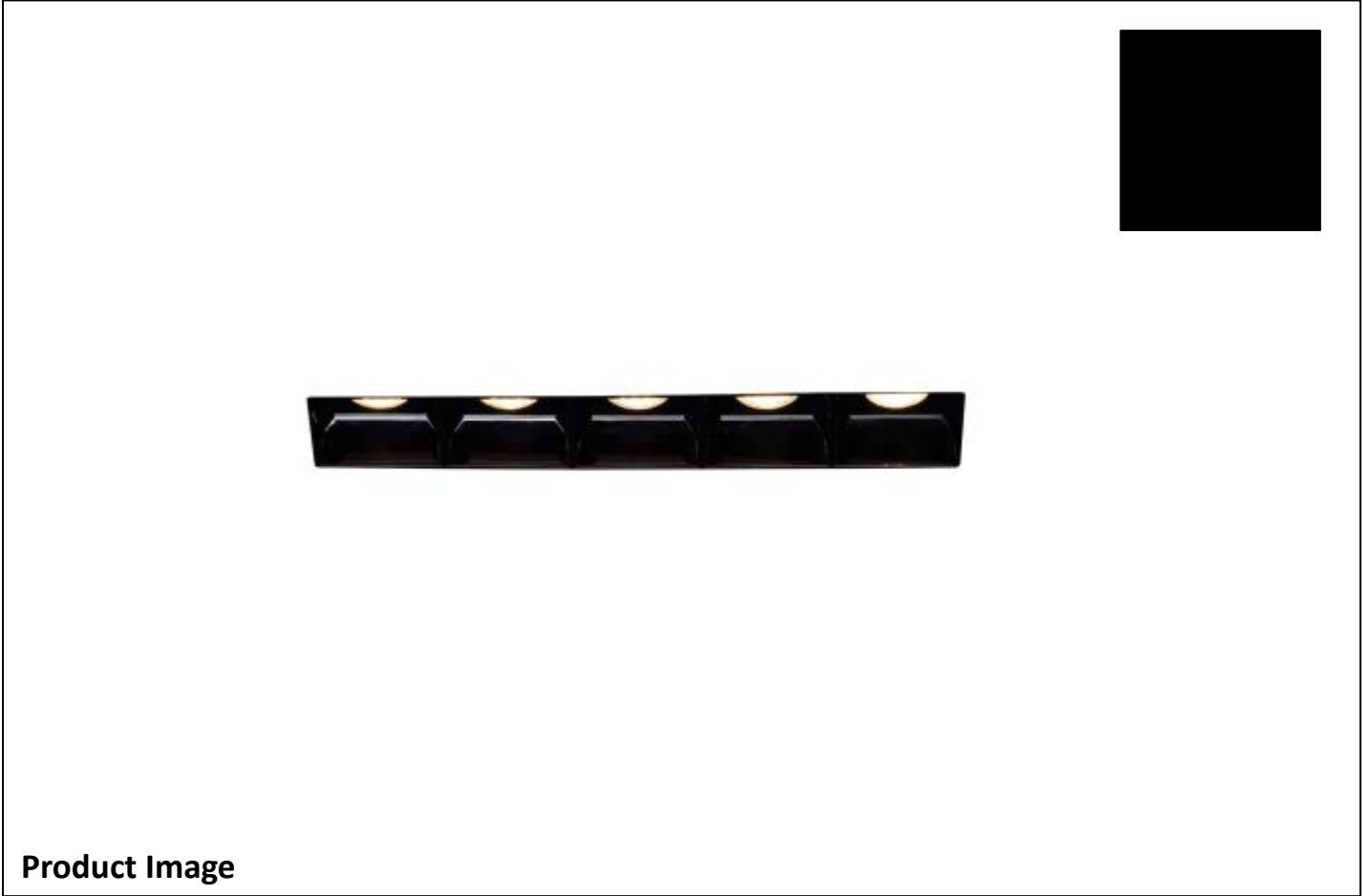
Product Image

Product Dimensions / Application Shot

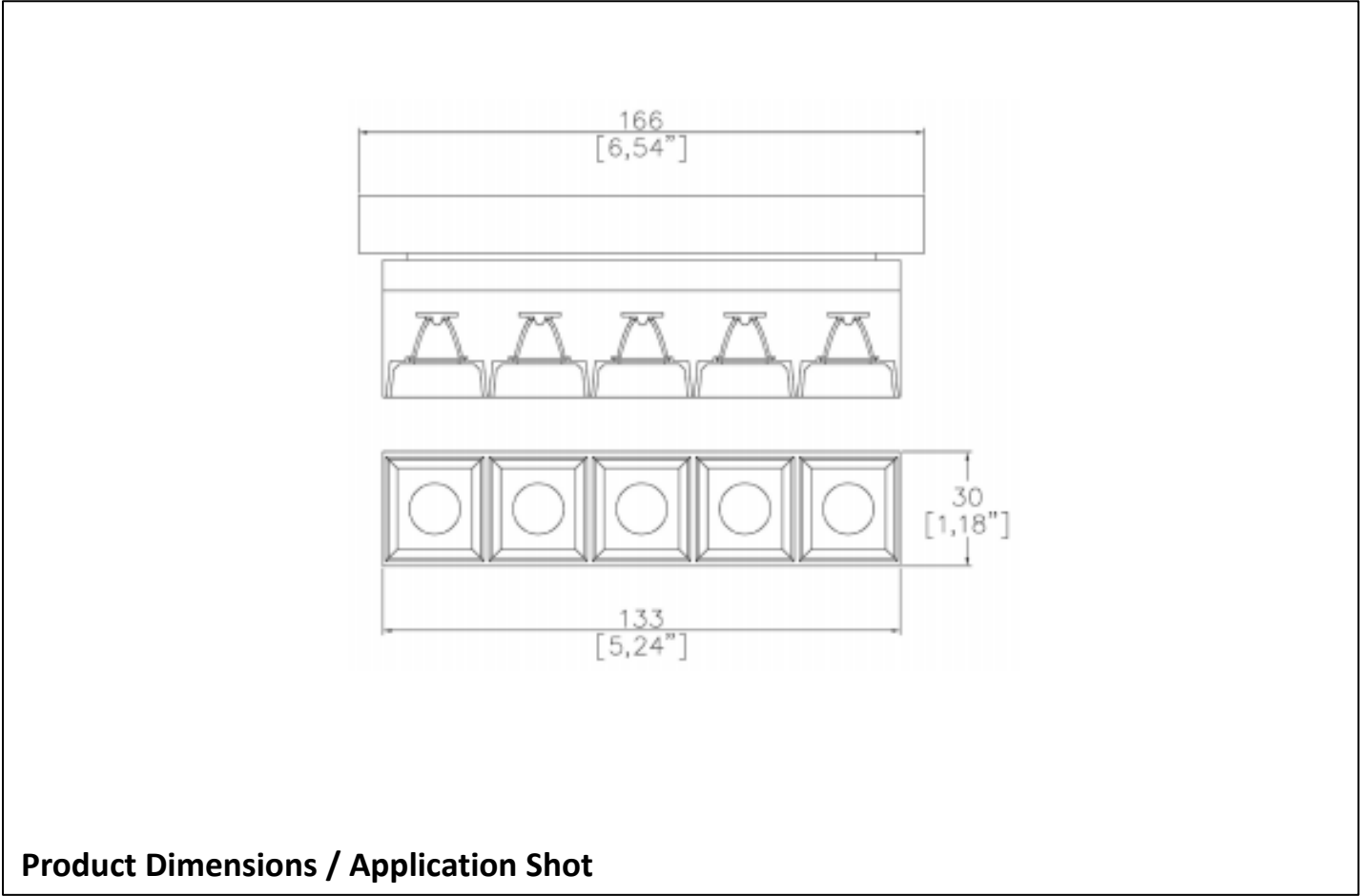
L13

Description	48V Magnetic track downlight
Fixing Type	Track mounted
Finish	TBC
Attachments / Spec	48 degree beam Allow for 48v track length as drawn
Colour Temperature	2700K
Colour Rendering Index	>90
Light Source	LED
Dimming Protocol	DALI
Wattage	13 w
Lumen Output	850 lm
Lumens per Watt	65 lm/w
IP Rating	20
Notes	Include for all drivers, connections and fixing details necessary for complete working installation
Manufacturer	Lucent Lighting
Reference	Fine Line System – Line 5LED Cube
Contact	Alex Hay E: Alex@lucent-lighting.com T: (0) 7971663060

Artin.



Product Image



Product Dimensions / Application Shot

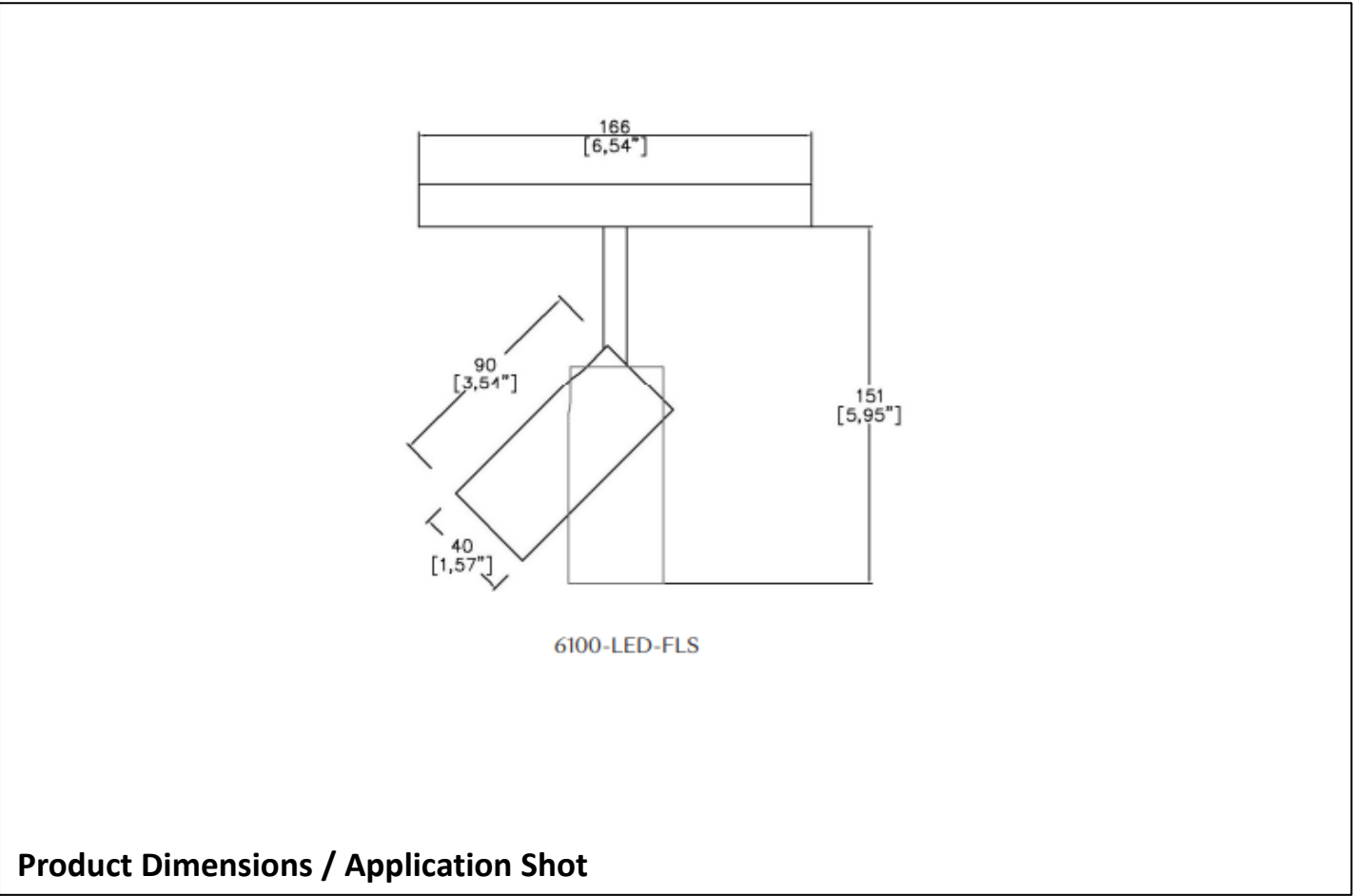
L14

Description	48V Magnetic track spotlight
Fixing Type	Track mounted
Finish	TBC
Attachments / Spec	24 degree beam Allow for 48v track length as drawn
Colour Temperature	2700K
Colour Rendering Index	>90
Light Source	LED
Dimming Protocol	DALI
Wattage	7.4 w
Lumen Output	478 lm
Lumens per Watt	64 lm/w
IP Rating	20
Notes	Include for all drivers, connections and fixing details necessary for complete working installation
Manufacturer	Lucent Lighting
Reference	Fine Line System – Tube LED Micro
Contact	Alex Hay E: Alex@lucent-lighting.com T: (0) 7971663060

Artin.



Product Image



Product Dimensions / Application Shot

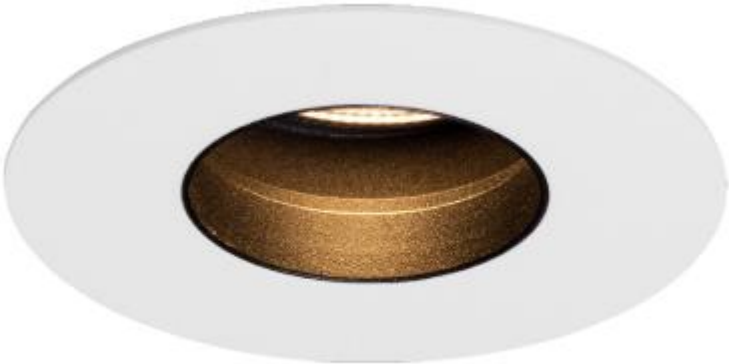
L15-(N,M,W,F)

Description	Adjustable LED downlight with inset LED light source
Fixing Type	Ceiling Recessed
Finish	TBC
Attachments / Spec	Glare Louvre
Colour Temperature	2700K
Colour Rendering Index	>90
Light Source	LED
Dimming Protocol	DALI
Wattage	13.6 w
Lumen Output	847 lm
Lumens per Watt	62 lm/w
IP Rating	20
Notes	Include for all drivers, connections and fixing details necessary for complete working installation
Manufacturer	Lucent Lighting
Reference	Edge 90 Accent
Contact	Alex Hay E: Alex@lucent-lighting.com T: (0) 7971663060

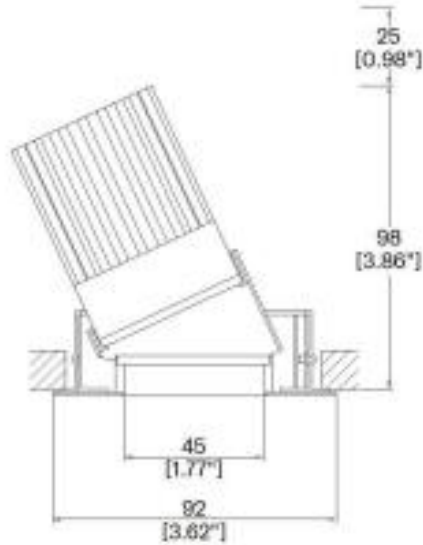
Artin.

MANUFACTURER / CONTRACTOR NOTES

‘N’ Denotes 12 degree optic
‘M’ Denotes 24 degree optic
‘W’ Denotes 38 degree optic
‘F’ Denotes 55 degree optic



Product Image



91413-A-LED + 9000-PBZ
Cut-out 83mm Ø

Product Dimensions / Application Shot

L16-(N,M,W,F)

Description	Adjustable LED downlight with inset LED light source
Fixing Type	Ceiling Recessed
Finish	TBC
Attachments / Spec	Glare Louvre
Colour Temperature	2700K
Colour Rendering Index	>90
Light Source	LED
Dimming Protocol	DALI
Wattage	2.6 w
Lumen Output	159 lm
Lumens per Watt	61 lm/w
IP Rating	20
Notes	Include for all drivers, connections and fixing details necessary for complete working installation
Manufacturer	Lucent Lighting
Reference	Micro 40 Focus Accent
Contact	Alex Hay E: Alex@lucent-lighting.com T: (0) 7971663060

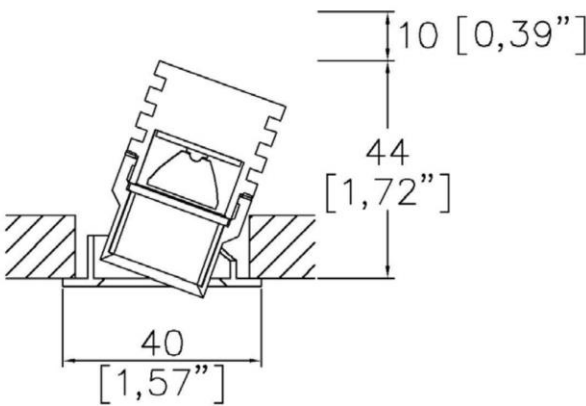
Artin.

MANUFACTURER / CONTRACTOR NOTES

‘N’ Denotes 15 degree optic
‘M’ Denotes 25 degree optic
‘W’ Denotes 30 degree optic



Product Image



043-FA-TR
Cut-out 36mm Ø

Product Dimensions / Application Shot

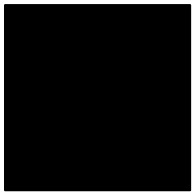
L17- (N,M,W,F)

Description	Adjustable LED spotlight with deep recess LED and honeycomb louvre
Fixing Type	Track mounted
Finish	Black
Attachments / Spec	Honeycomb louvre
Colour Temperature	2700K
Colour Rendering Index	>90
Light Source	LED
Dimming Protocol	DALI
Wattage	14.8 w
Lumen Output	936 lm
Lumens per Watt	66 lm/w
IP Rating	20
Notes	Include for all drivers, connections and fixing details necessary for complete working installation
Manufacturer	Lucent Lighting
Reference	TubeLED Mini Track
Contact	Alex Hay E: Alex@lucent-lighting.com T: (0) 7971663060

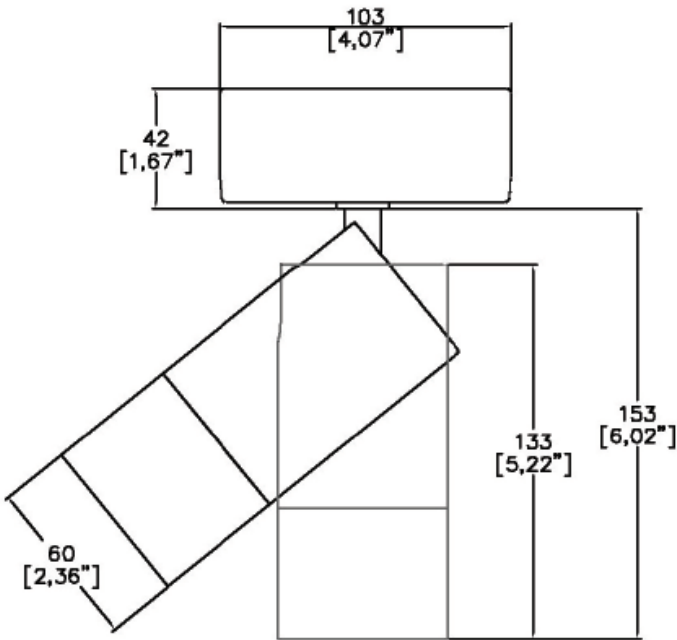
Artin.

MANUFACTURER / CONTRACTOR NOTES

‘N’ Denotes 12 degree optic
‘M’ Denotes 24 degree optic
‘W’ Denotes 36 degree optic
‘F’ Denotes 60 degree optic



Product Image



Product Dimensions / Application Shot

DT

Description	DALI track
Fixing Type	Suspended TBC
Finish	Black
Attachments / Spec	Suspension kit
Colour Temperature	NA
Colour Rendering Index	NA
Light Source	NA
Dimming Protocol	NA
Wattage	NA
Lumen Output	NA
Lumens per Watt	NA
IP Rating	NA
Notes	Include for all drivers, connections and fixing details necessary for complete working installation
Manufacturer	Lucent Lighting
Reference	DALI Track
Contact	Alex Hay E: Alex@lucent-lighting.com T: (0) 7971663060

Artin.



Product Image

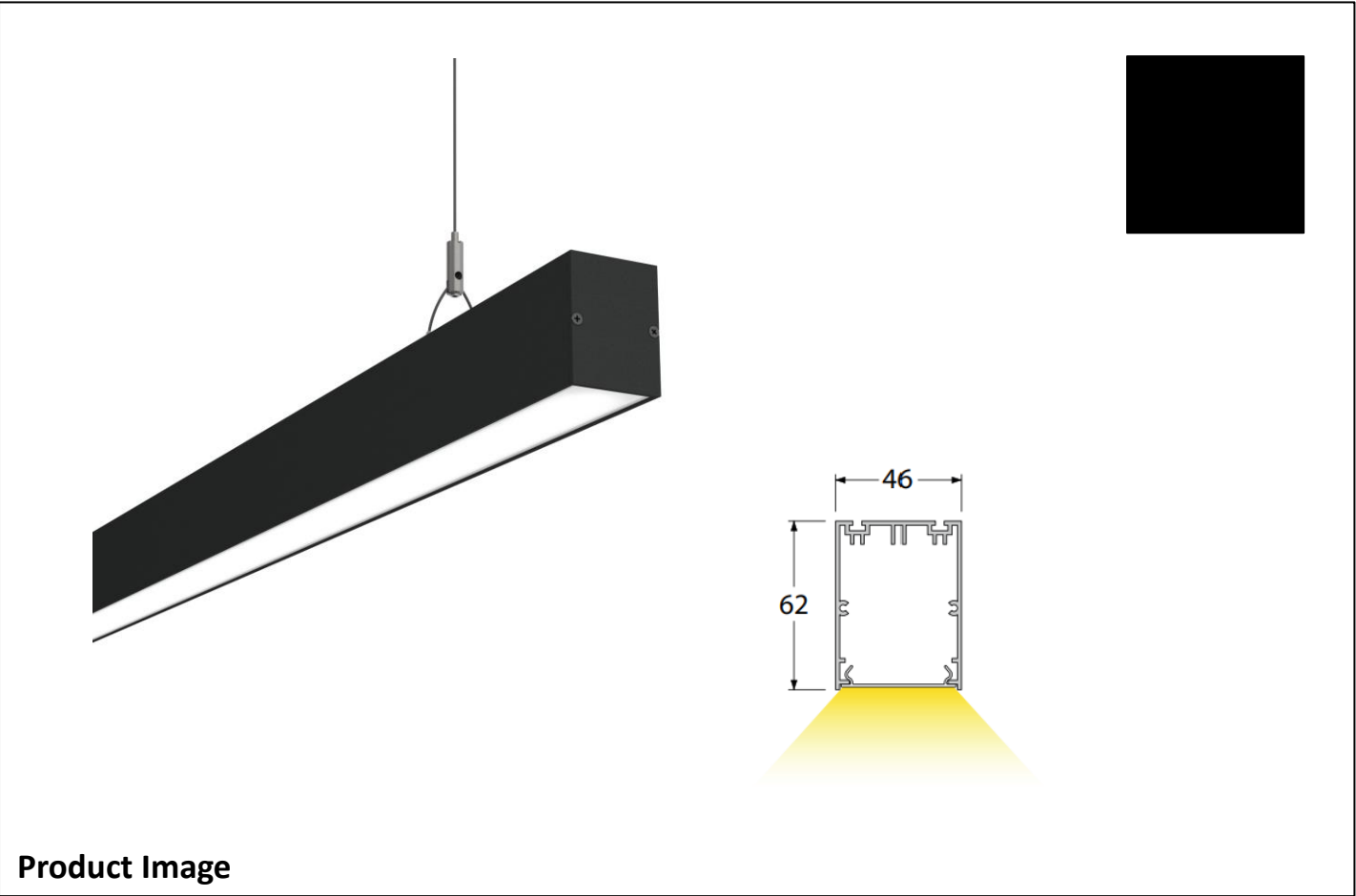


Product Dimensions / Application Shot

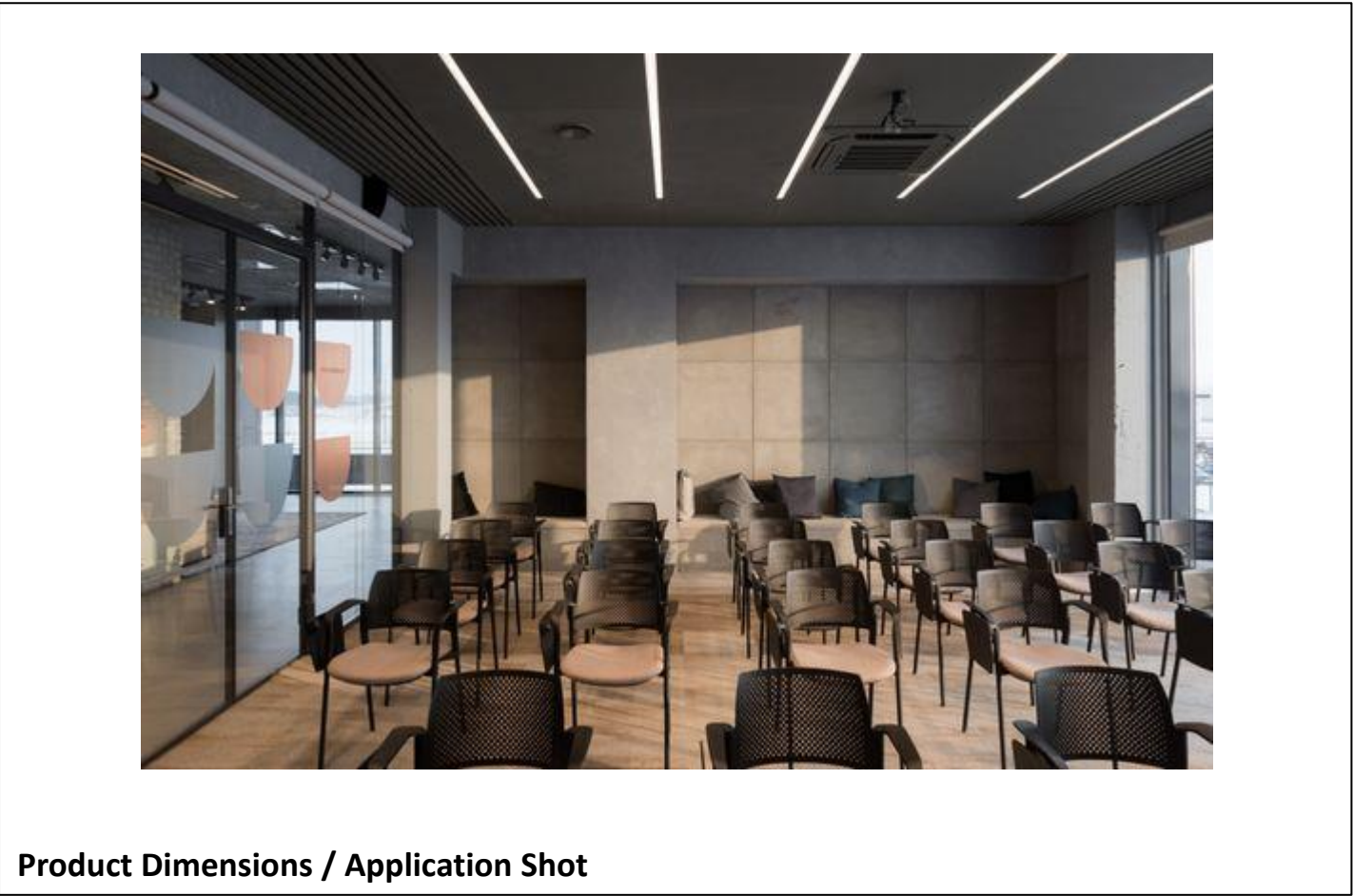
L18

Description	Suspended linear profile with MPO diffuser
Fixing Type	Suspended
Finish	Black
Attachments / Spec	Anti glare diffuser
Colour Temperature	2700K
Colour Rendering Index	>90
Light Source	LED
Dimming Protocol	DALI
Wattage	21 w/m
Lumen Output	2861 lm/m
Lumens per Watt	136 lm/w
IP Rating	20
Notes	Include for all drivers, connections and fixing details necessary for complete working installation
Manufacturer	OptaLED
Reference	Icon 46 - MPO
Contact	Neil Makin E: neil.makin@optaled.com T: 07908439300

Artin.



Product Image

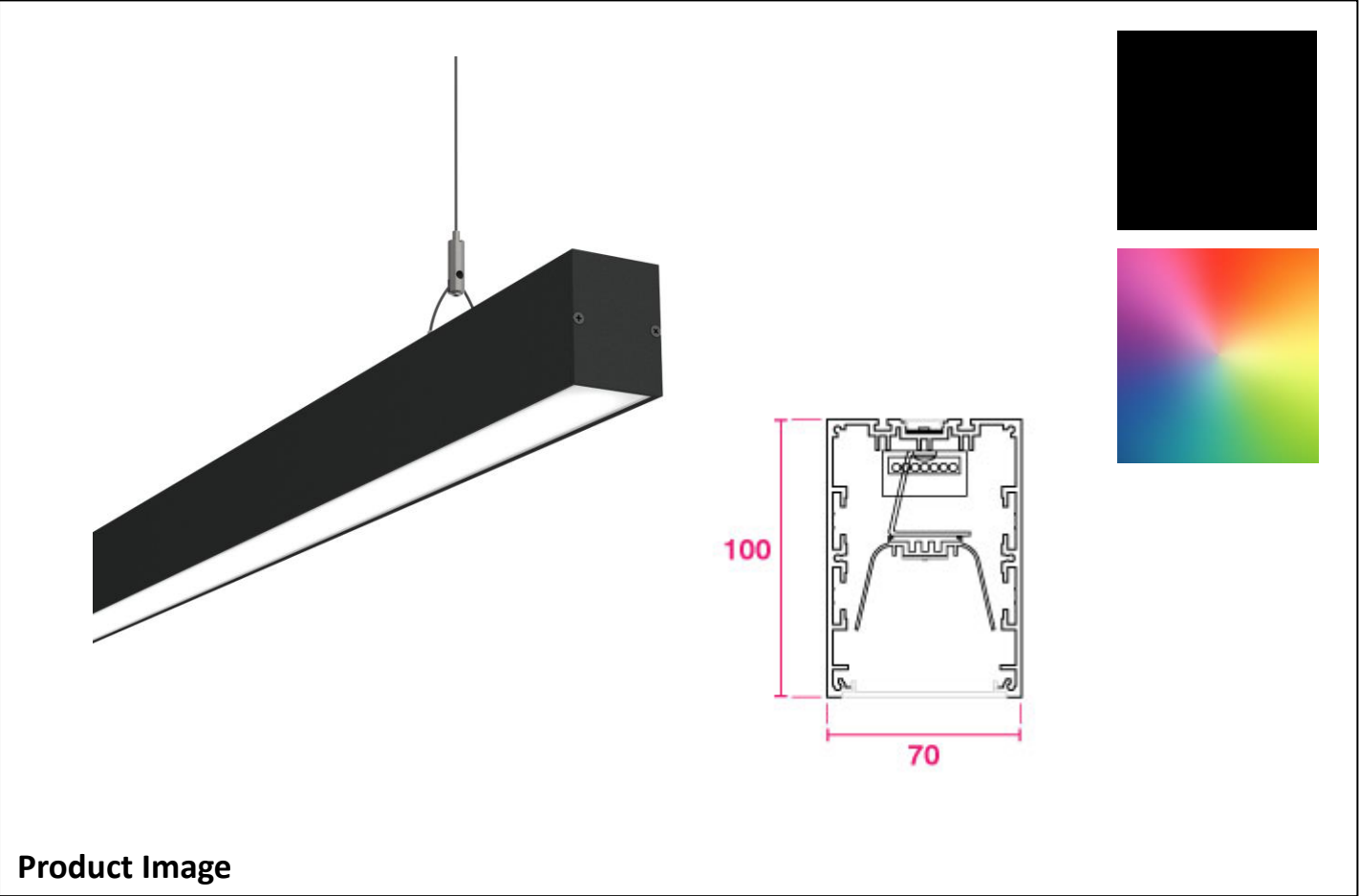


Product Dimensions / Application Shot

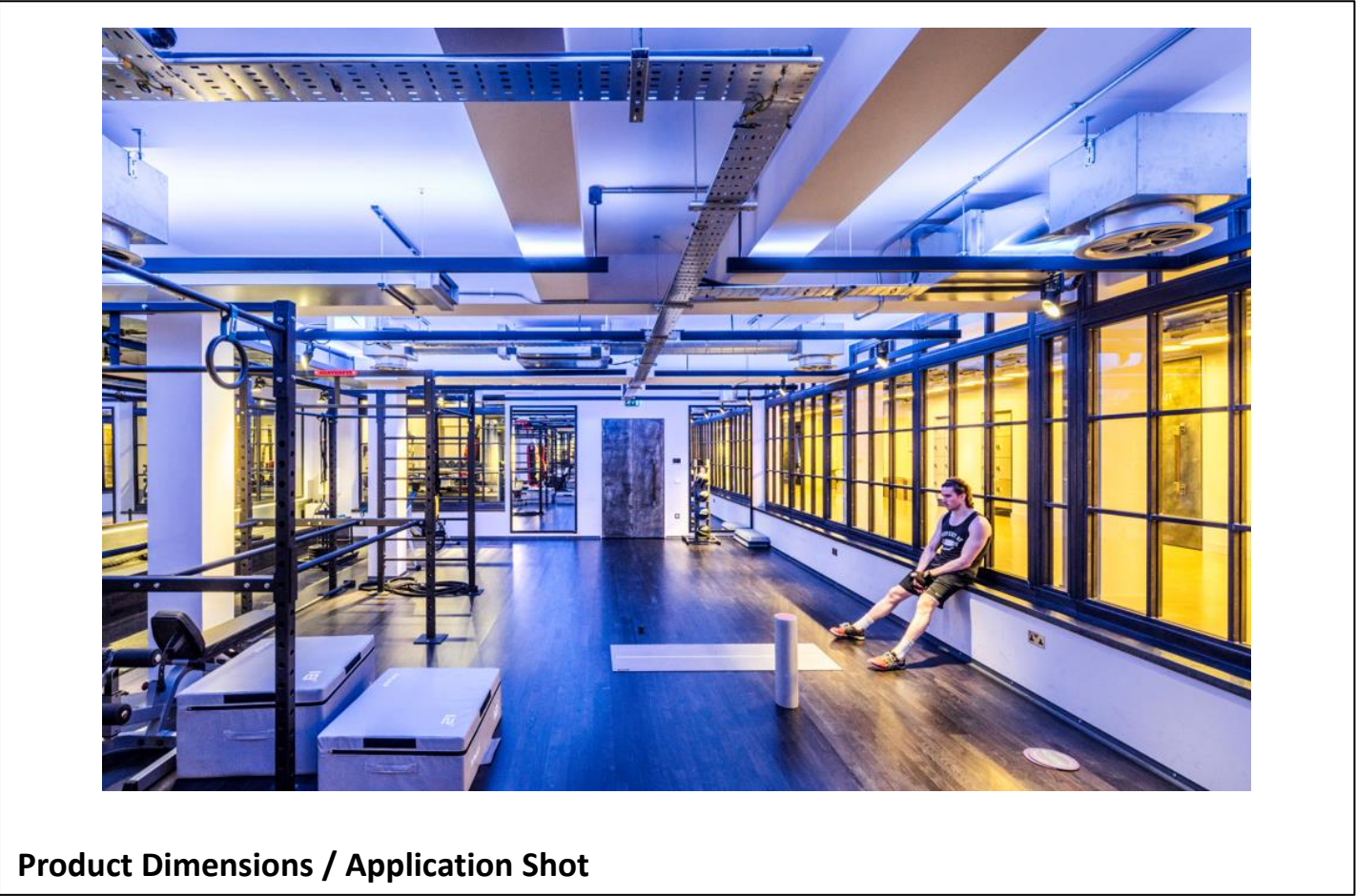
L19

Description	Direct and Indirect RGBW line of light
Fixing Type	Suspended
Finish	Black
Attachments / Spec	Suspension kit Allow high output RGBW LED within profile
Colour Temperature	RGBW (2700K)
Colour Rendering Index	>90
Light Source	LED
Dimming Protocol	DMX
Wattage	Indirect - 19 w/m Direct – 38 w/m
Lumen Output	Red up to 630 lm/m Green up to 530 lm/m Blue up to 475 lm/m White up to 850 lm/m
Lumens per Watt	NA
IP Rating	20
Notes	Include for all drivers, connections and fixing details necessary for complete working installation
Manufacturer	Optaled
Reference	Direct and Indirect Icon 50 – Allow for length as drawn
Contact	Neil Makin E: neil.makin@optaled.com T: (0) 7908 439 300

Artin.



Product Image



Product Dimensions / Application Shot

L20

Description	RGBW linear LED profile with opal diffuser Entrance Reception – Uplighting from columns - Ground Floor
Fixing Type	Surface Mounted
Finish	NA
Attachments / Spec	Surface mounted fixing clips
Colour Temperature	RGBW (2700K)
Colour Rendering Index	>80
Light Source	LED
Dimming Protocol	DMX
Wattage	19 w/m
Lumen Output	Red up to 630 lm/m Green up to 530 lm/m Blue up to 475 lm/m White up to 850 lm/m
Lumens per Watt	N/A
IP Rating	20
Notes	Include for all drivers, connections and fixing details necessary for complete working installation
Manufacturer	Optaled
Reference	Optos 1 + Microflex RGBW
Contact	Neil Makin E: neil.makin@optaled.com T: (0) 7908 439 300

Artin.

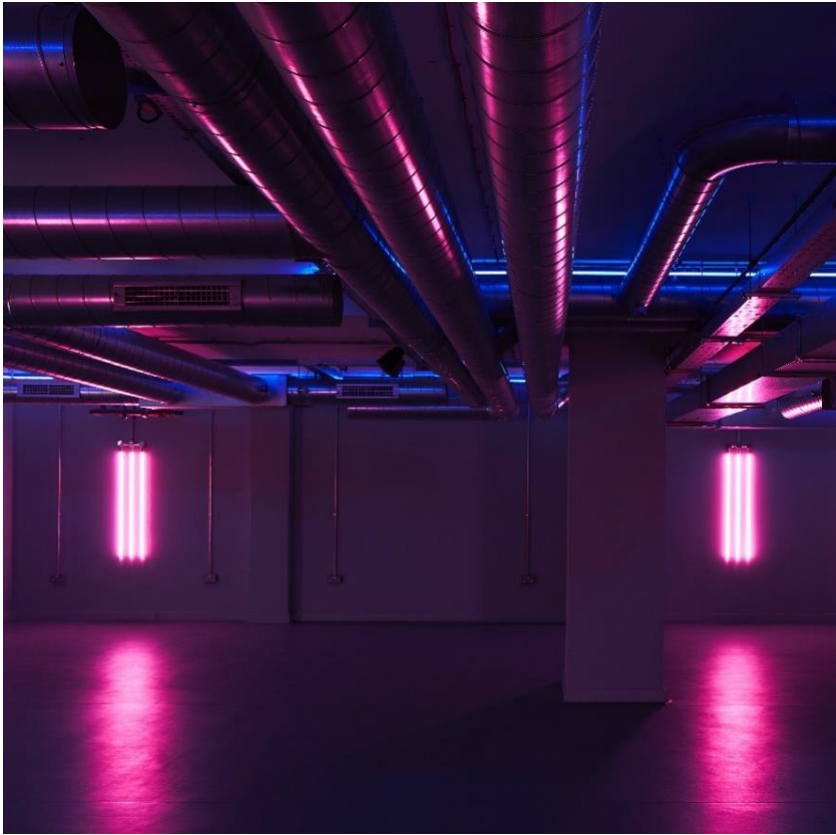


Allow for Length as drawn

Opal Diffuser

MINIMUM 75% LIGHT TRANSMITTANCE

Product Image



Product Dimensions / Application Shot

L21

Description	Low profile LED unit with opal diffuser
Fixing Type	Surface mounted within interior cove detail
Finish	NA
Attachments / Spec	Aluminum channel Clear diffuser
Colour Temperature	2700K
Colour Rendering Index	>90
Light Source	LED
Dimming Protocol	DALI
Wattage	19.2w/m
Lumen Output	1700 lm/m
Lumens per Watt	87 lm/w
IP Rating	20
Notes	Include for all drivers, connections and fixing details necessary for complete working installation
Manufacturer	Tryka
Reference	Adder 240 LED
Contact	Colin Gawne E: Colin.Gawne@tryka.com T: 07890110951

Artin.

PRO002

Slim Surface Mount

Aluminium Profile



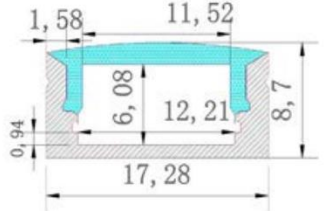
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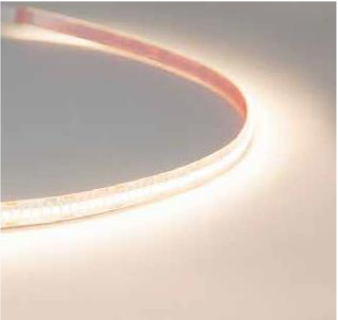
Opal Cover
TRY- FLEX-MK-PRO002-OC-YY

Clear Cover
TRY-FLEX-MK-PRO002-CC

End Cap Set
TRY-FLEX-MK-PRO002-EC-SET

Fixing Clip - Pair
TRY-FLEX-MK-PRO002-FC-PAIR





Product Image

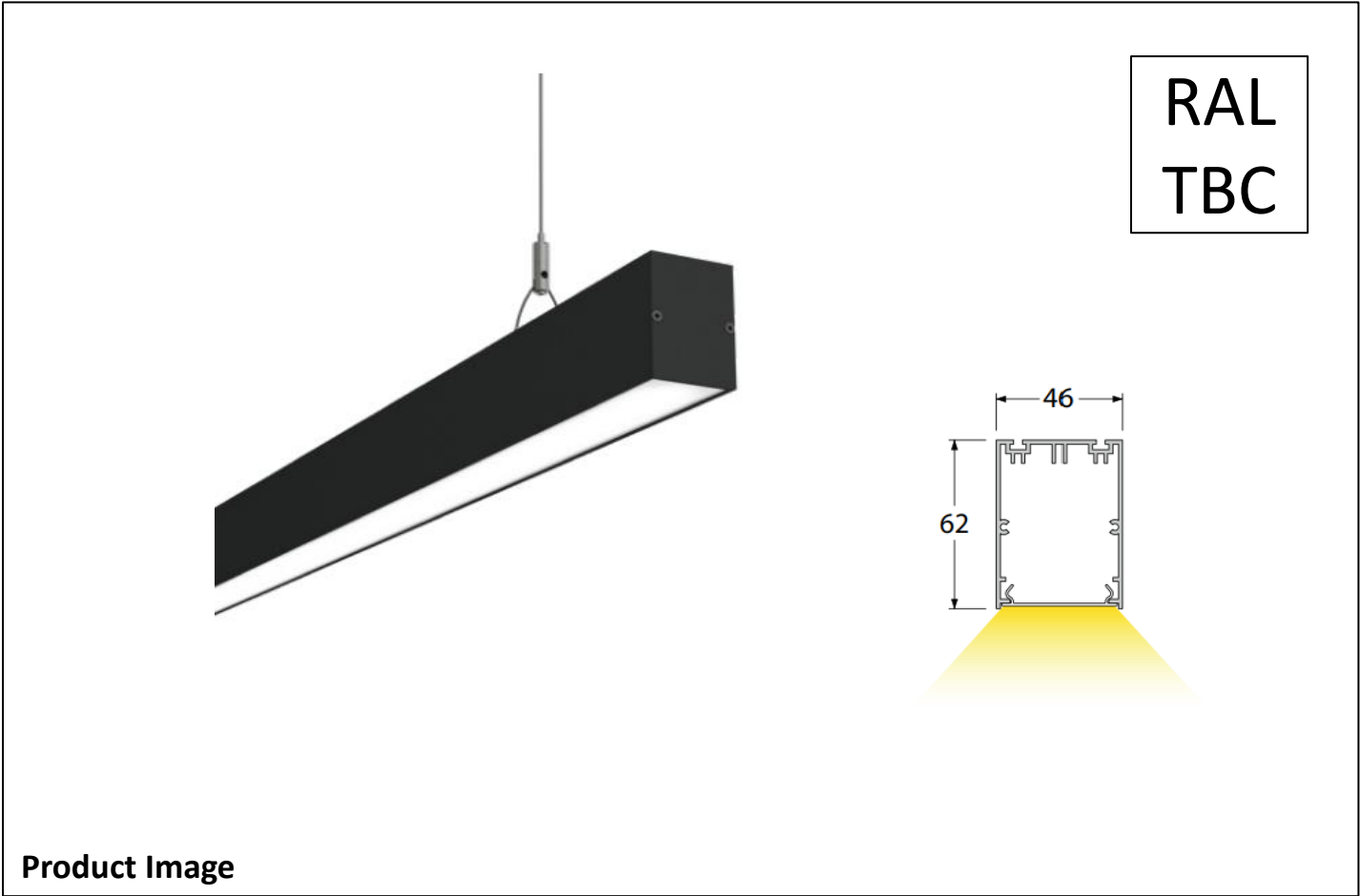


Product Dimensions / Application Shot

L22 (E)

Description	Surface fixed line of light with opal diffuser
Fixing Type	Surface
Finish	RAL TBC
Attachments / Spec	Allow for lengths / corner junctions as drawn on the lighting layout drawing. Allow for internal connection light spill shields 'E' denotes with 3 hr integral emergency battery pack
Colour Temperature	2700K
Colour Rendering Index	>90
Light Source	LED
Dimming Protocol	DALI
Wattage	14 w/m
Lumen Output	2600 lm/m
Lumens per Watt	186 lm/w
IP Rating	20
Notes	Include for all drivers, connections and fixing details necessary for complete working installation
Manufacturer	OptaLED
Reference	Icon 46 (High Efficiency / Opal)
Contact	Neil Makin E: neil.makin@optaled.com T: 07908439300

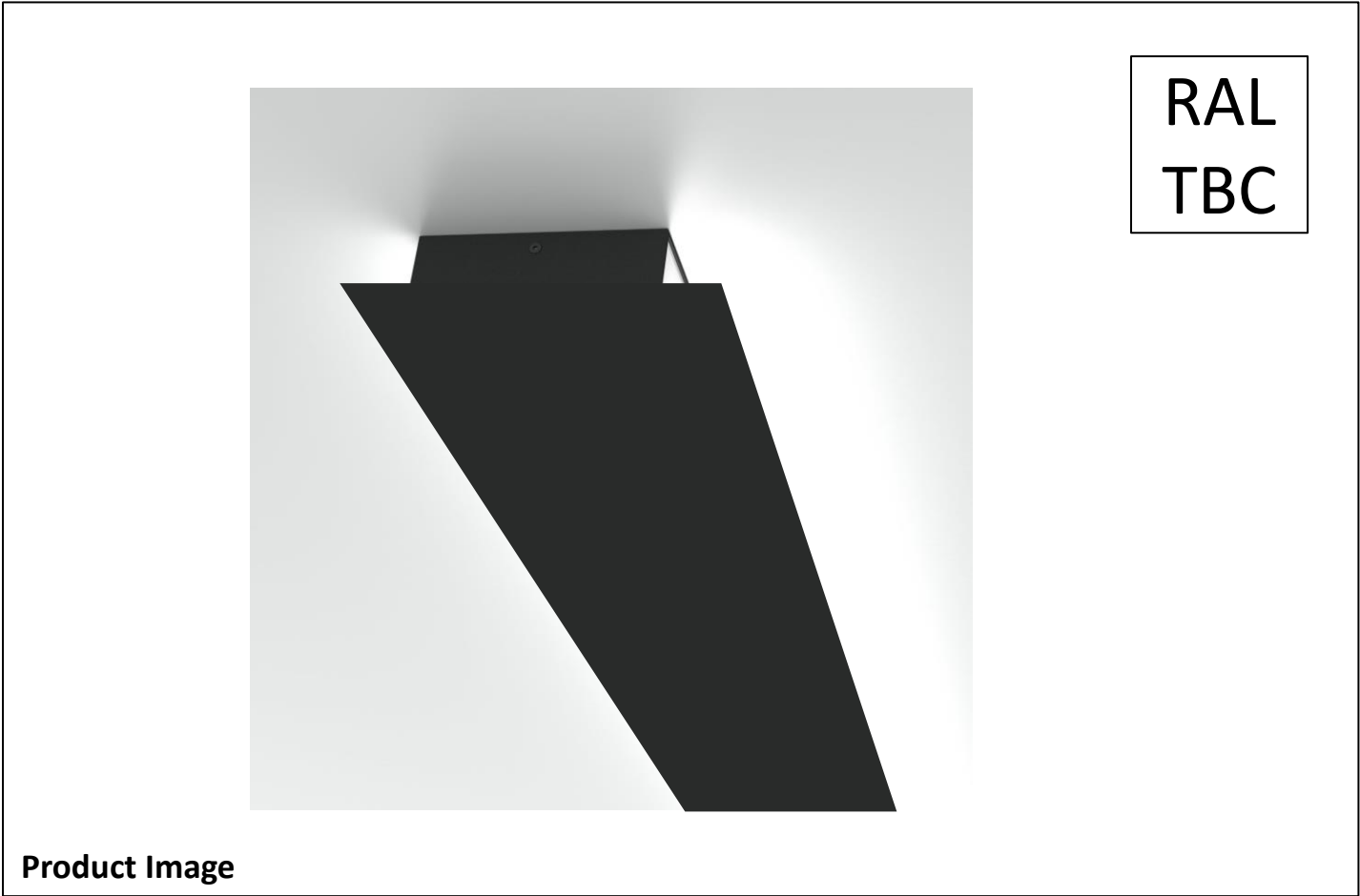
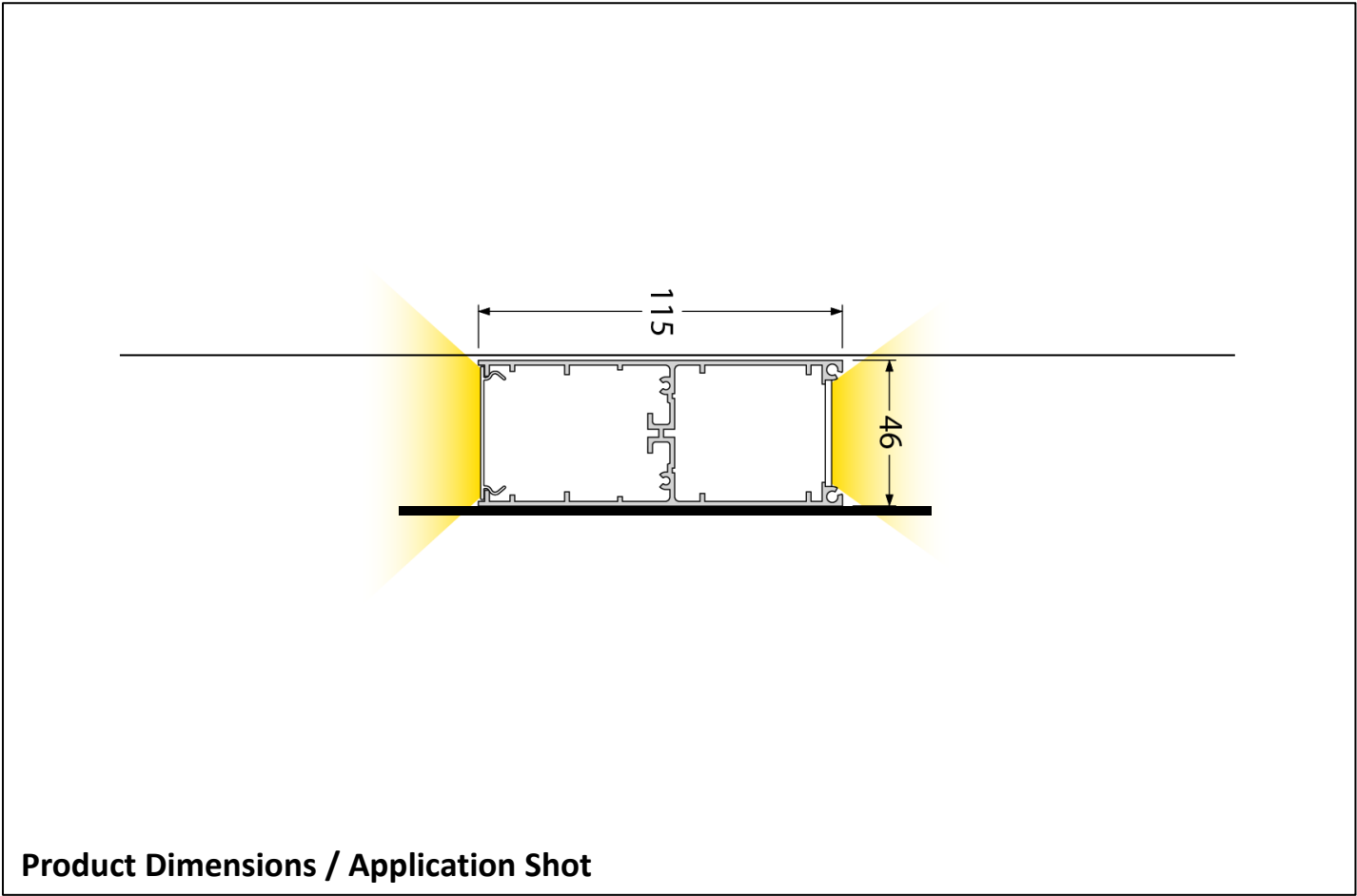
Artin.



L23

Description	Vertical wall mounted side light profile
Fixing Type	Wall mounted
Finish	RAL TBC
Attachments / Spec	
Colour Temperature	2700K
Colour Rendering Index	>90
Light Source	LED
Dimming Protocol	DALI
Wattage	24 w/m
Lumen Output	2785 lm/m
Lumens per Watt	116 lm/w
IP Rating	20
Notes	Include for all drivers, connections and fixing details necessary for complete working installation
Manufacturer	OptaLED
Reference	Nova 46 – bespoke – 1500mm H
Contact	Neil Makin E: neil.makin@optaled.com T: 07908439300

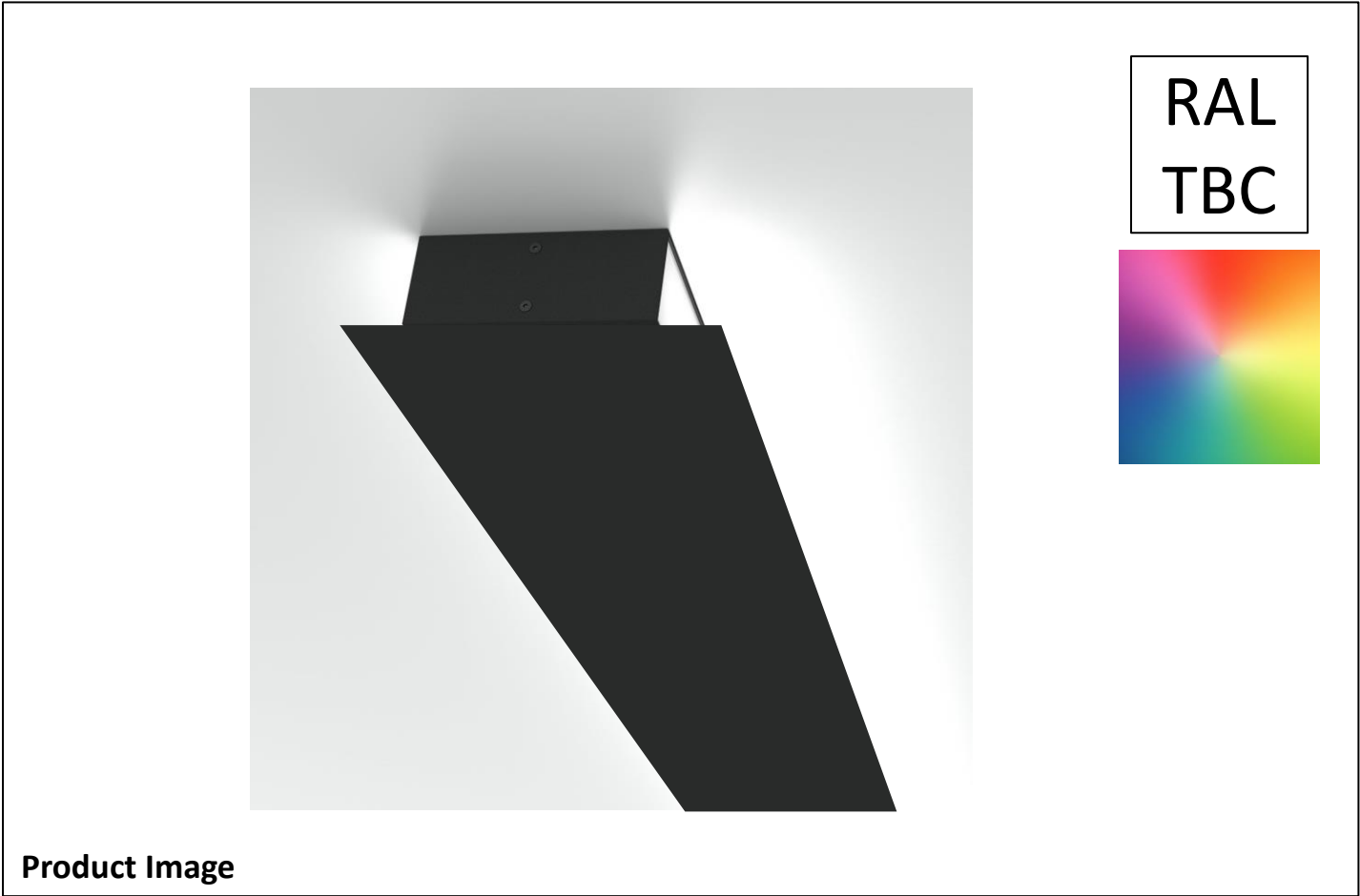
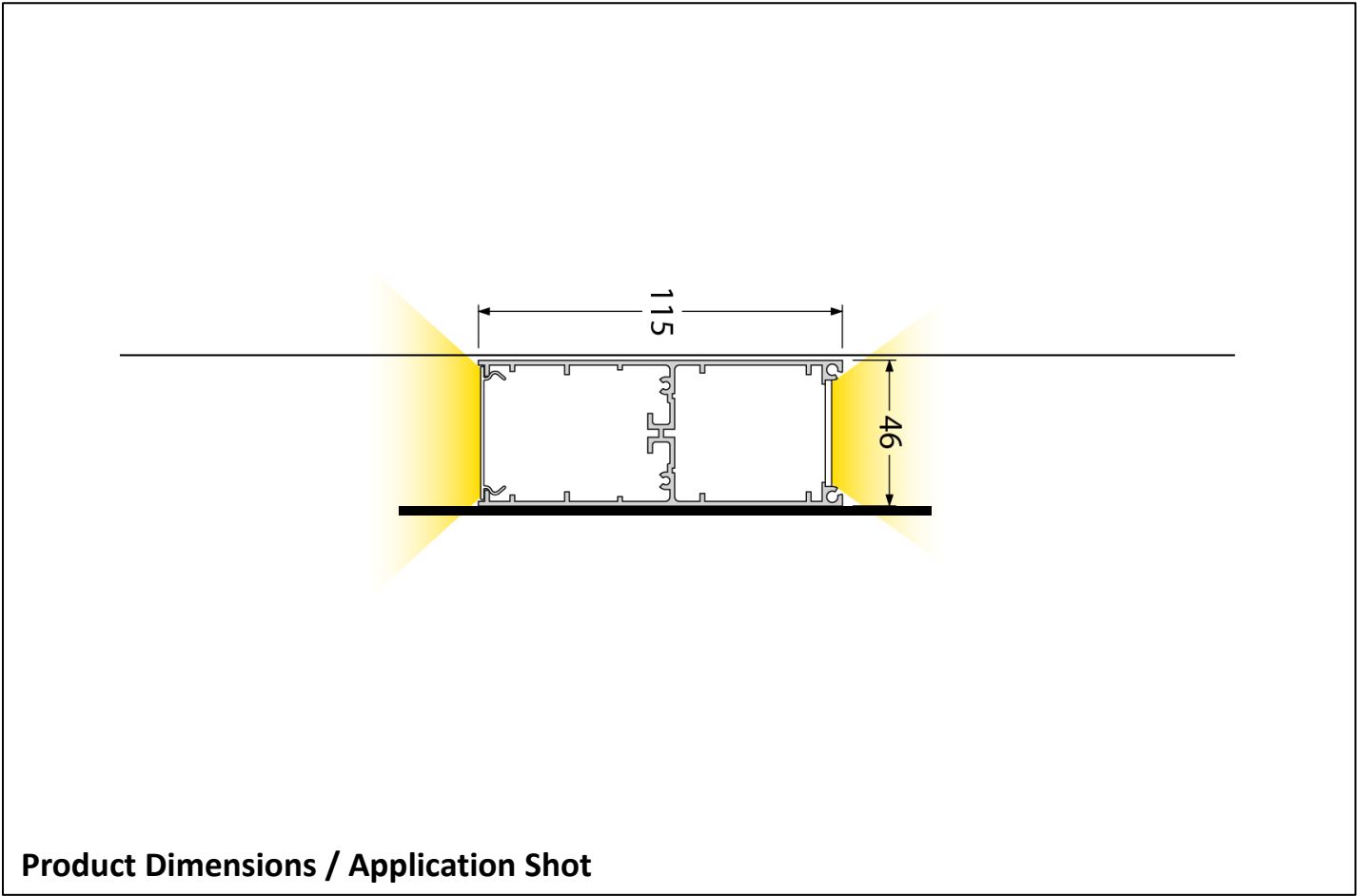
Artin.



L23C

Description	Vertical wall mounted side light profile
Fixing Type	Wall mounted
Finish	RAL TBC
Attachments / Spec	
Colour Temperature	RGBW (2700K)
Colour Rendering Index	>90
Light Source	LED
Dimming Protocol	19 w/m
Wattage	Red up to 630 lm/m Green up to 530 lm/m Blue up to 475 lm/m White up to 850 lm/m
Lumen Output	N/A
Lumens per Watt	19 w/m
IP Rating	20
Notes	Include for all drivers, connections and fixing details necessary for complete working installation
Manufacturer	OptaLED
Reference	Nova 46 – bespoke – 1500mm H
Contact	Neil Makin E: neil.makin@optaled.com T: 07908439300

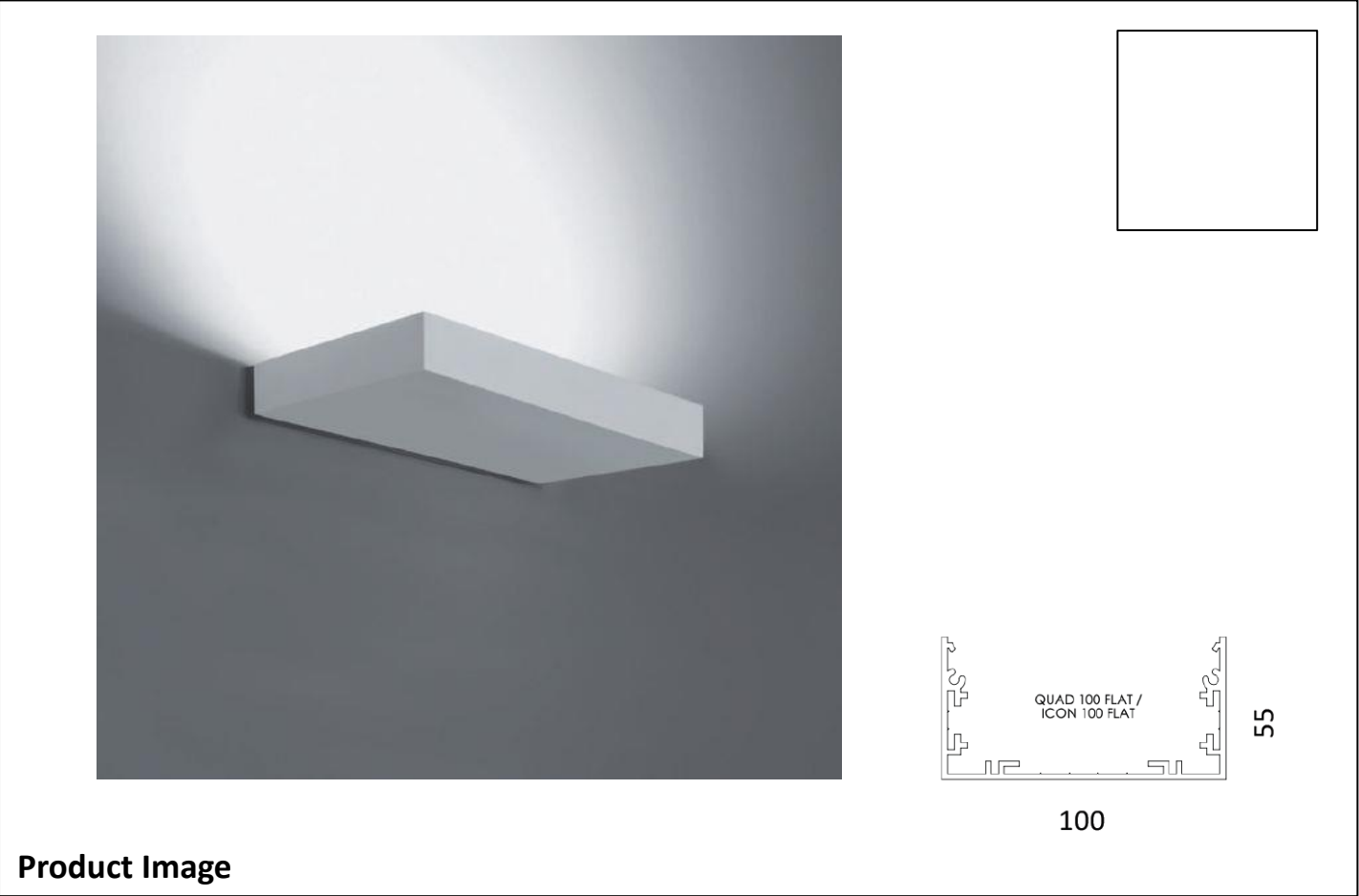
Artin.



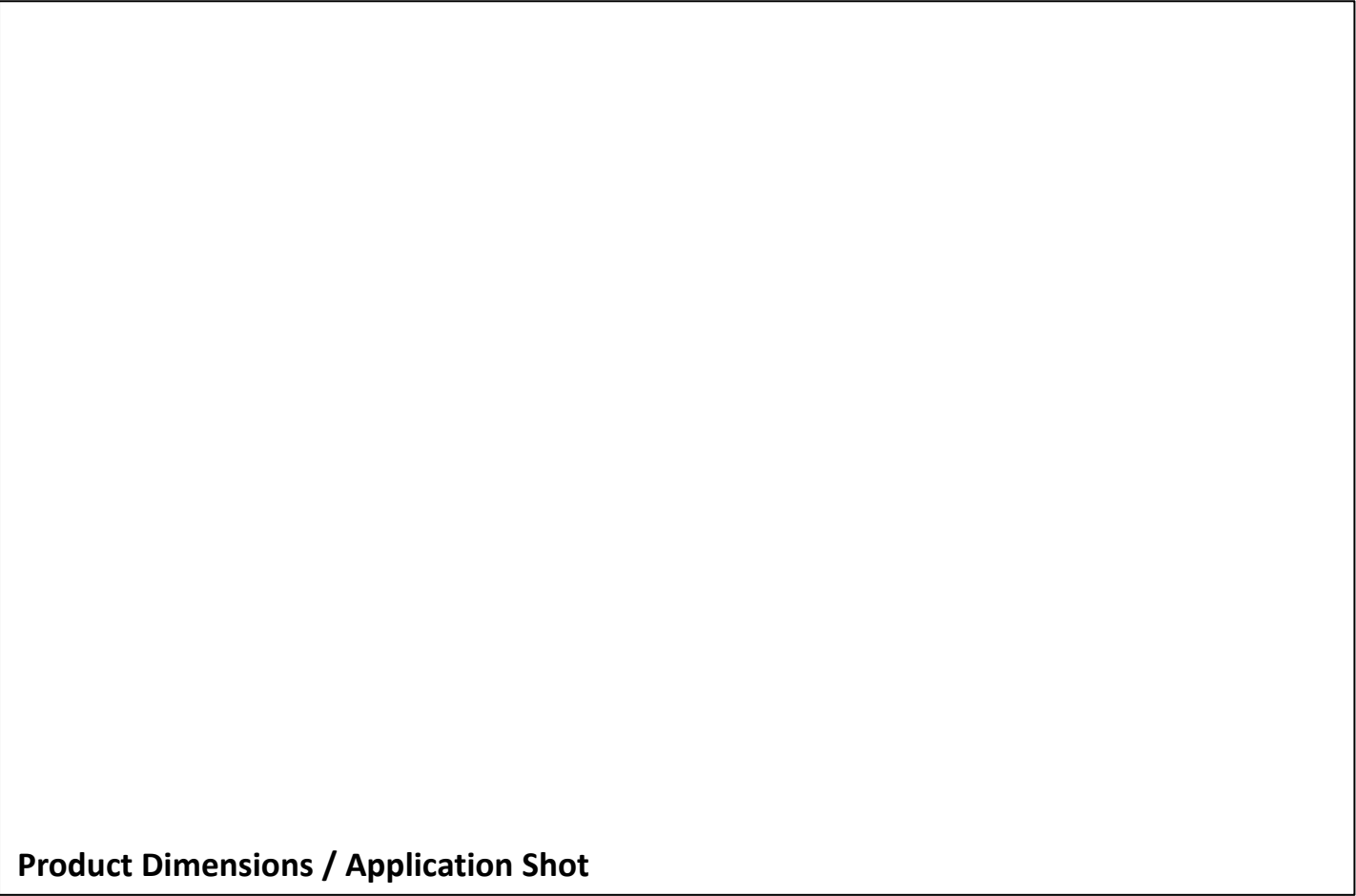
L24

Description	Indirect RGBW line of light with clear diffuser – Circular formation
Fixing Type	Suspended
Finish	Black
Attachments / Spec	Suspension kit Allow 3no runs of high output RGBW LED within profile
Colour Temperature	2700K
Colour Rendering Index	>90
Light Source	LED
Dimming Protocol	DALI
Wattage	24 w/m
Lumen Output	2785 lm/m
Lumens per Watt	116 lm/w
IP Rating	20
Notes	Include for all drivers, connections and fixing details necessary for complete working installation
Manufacturer	Optaled
Reference	Indirect Icon 100 Flat– Allow for length as drawn
Contact	Neil Makin E: neil.makin@optaled.com T: (0) 7908 439 300

Artin.



Product Image

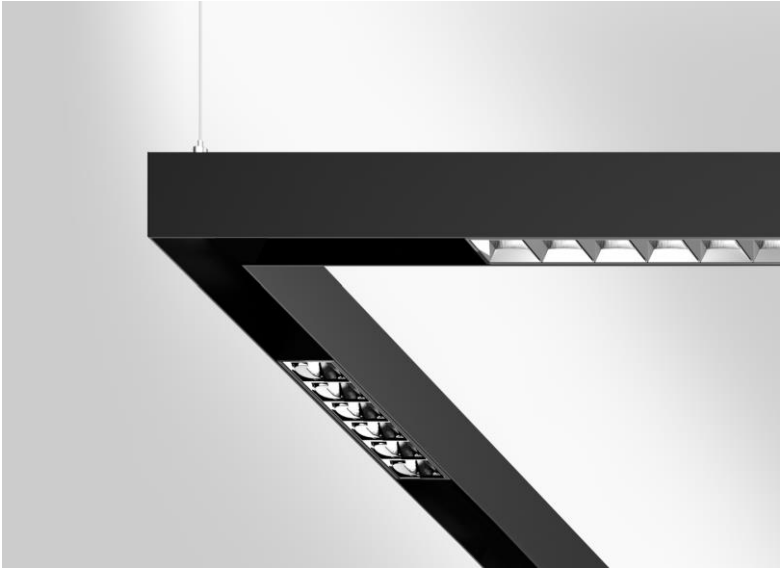


Product Dimensions / Application Shot

TR1-X – (A,B,C)

Description	Suspended profile luminaire with indirect linear LED optic and direct track mounted luminaires.
Fixing Type	Suspended
Finish	Black
Attachments / Spec	Suspension kits All kit required for complete installation
Colour Temperature	NA
Colour Rendering Index	>90
Light Source	NA
Dimming Protocol	DALI
Wattage	NA
Lumen Output	NA
Lumens per Watt	NA
IP Rating	20
Notes	Include for all drivers, connections and fixing details necessary for complete working installation
Manufacturer	XAL
Reference	Move It 45 – allow for length as drawn
Contact	Mathew Inett mathew.inett@xal.com T: 07498326439

Artin.



MANUFACTURER / CONTRACTOR NOTES

'A' Denotes 2420mm
'B' Denotes 1220mm
'C' Denotes 620mm

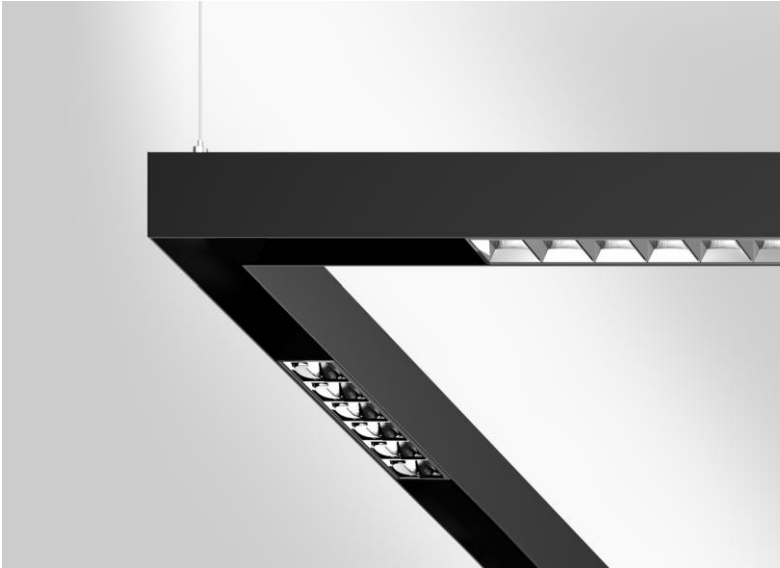
Product Image

Product Dimensions / Application Shot

L25 – (A,B,C)

Description	Indirect linear LED optic and direct track mounted luminaires.
Fixing Type	Suspended
Finish	Black
Attachments / Spec	Suspension kits All kit required for complete installation
Colour Temperature	2700K
Colour Rendering Index	>90
Light Source	LED
Dimming Protocol	DALI
Wattage	33 w/ 2420mm / 15.2 w/1200mm / 6.2 w/620mm
Lumen Output	3380 lm/ 2420mm / 1790 lm/1200mm / 1310 lm/620mm
Lumens per Watt	117 lm/w
IP Rating	20
Notes	Include for all drivers, connections and fixing details necessary for complete working installation
Manufacturer	XAL
Reference	Move It 45 – Indirect – allow for length as drawn
Contact	Mathew Inett mathew.inett@xal.com T: 07498326439

Artin.



MANUFACTURER / CONTRACTOR NOTES

'A' Denotes 2420mm
'B' Denotes 1220mm
'C' Denotes 620mm

Product Image

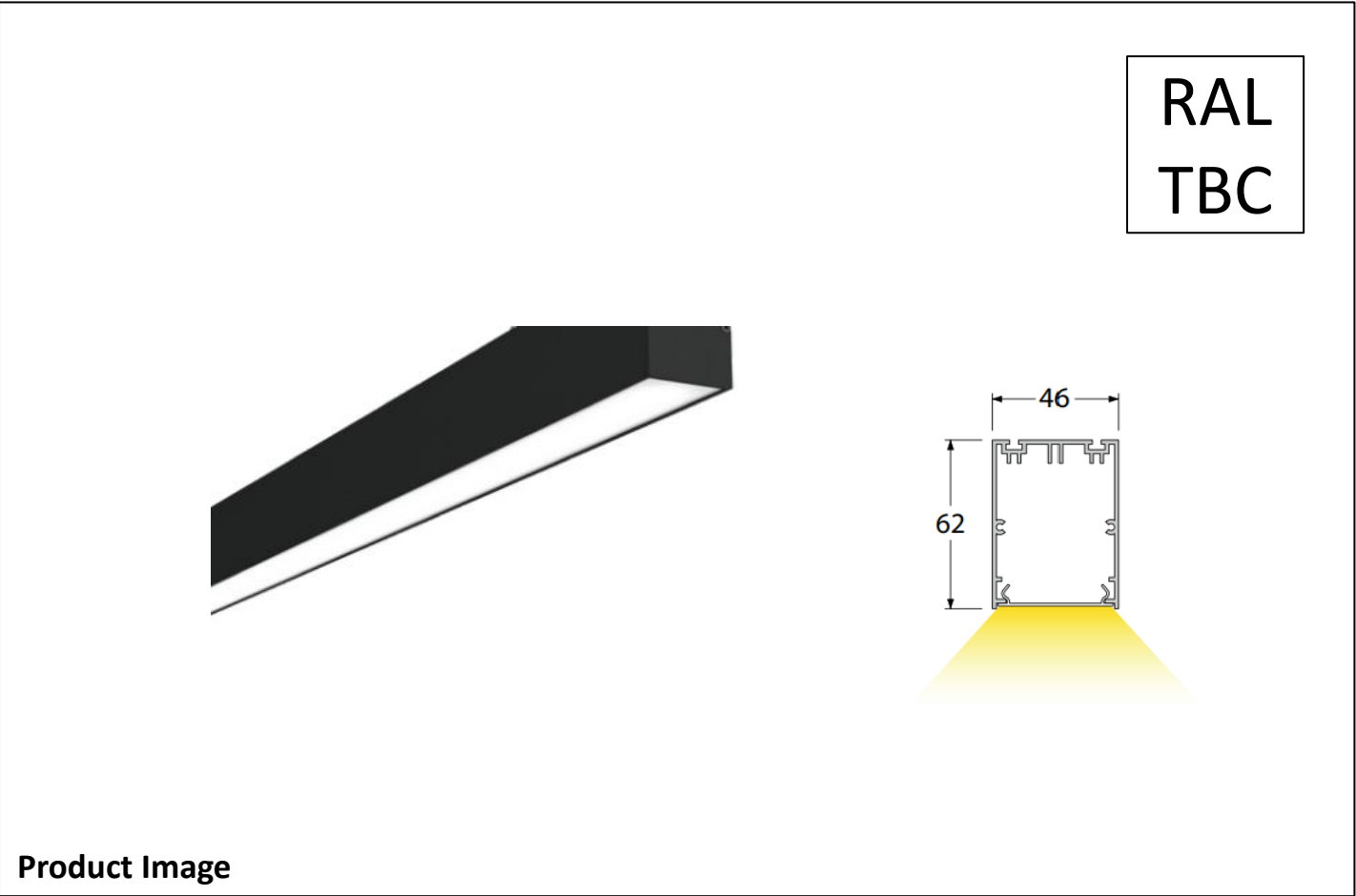
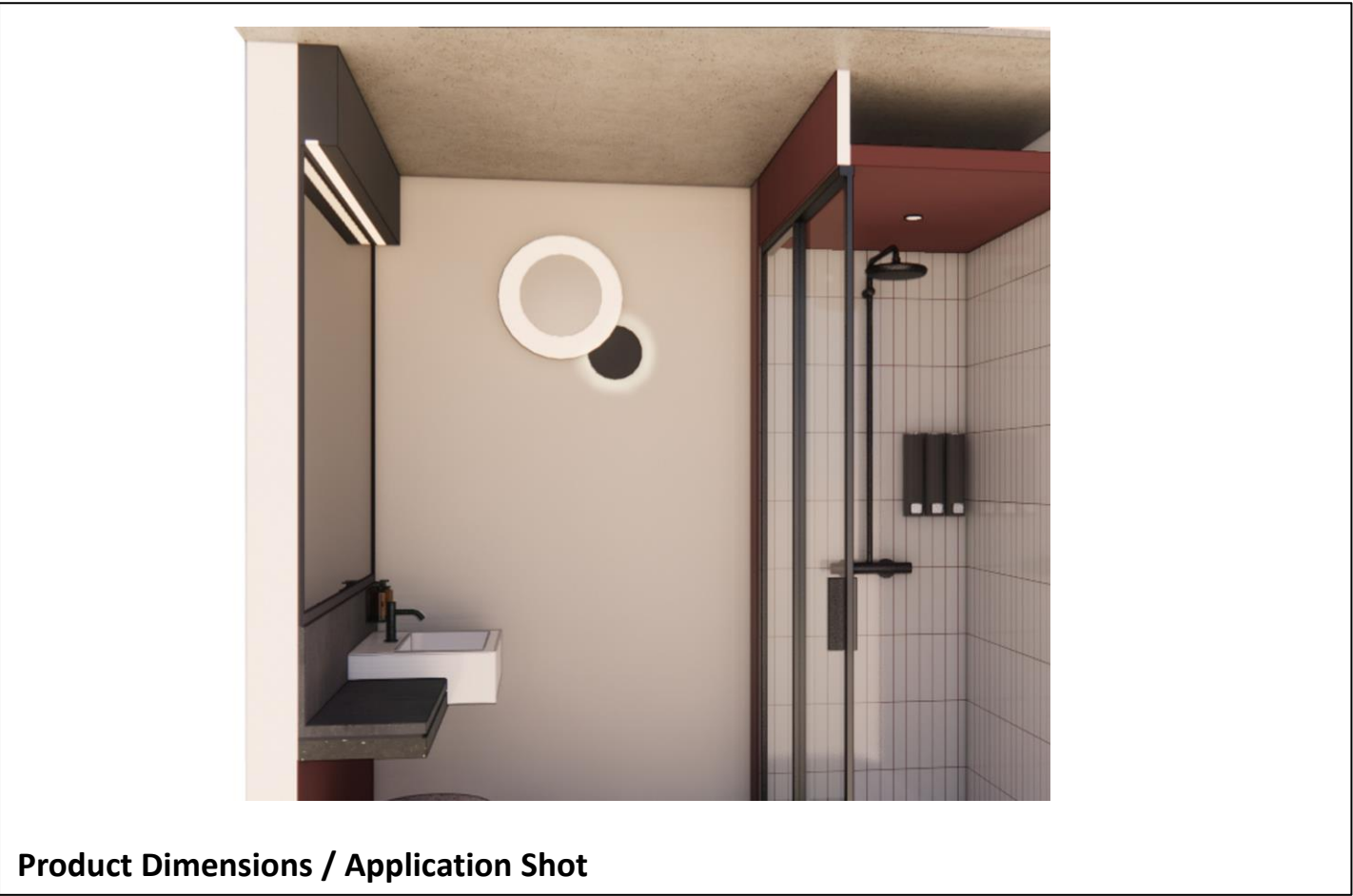


Product Dimensions / Application Shot

L26IP(E)

Description	Surface mounted line of light to shower room vanity units
Fixing Type	Surface Mounted
Finish	RAL TBC
Attachments / Spec	Allow for lengths / corner junctions as drawn on the lighting layout drawing. Allow for internal connection light spill shields 'E' denotes with 3 hr integral emergency battery pack
Colour Temperature	2700K
Colour Rendering Index	>90
Light Source	LED
Dimming Protocol	DALI
Wattage	14 w/m
Lumen Output	2600 lm/m
Lumens per Watt	186 lm/w
IP Rating	44
Notes	Include for all drivers, connections and fixing details necessary for complete working installation
Manufacturer	OptaLED
Reference	Icon 46 – IP (High Efficiency / Opal)
Contact	Neil Makin E: neil.makin@optaled.com T: 07908439300

Artin.



L28

Description	Magnetic track inset
Fixing Type	Track mounted
Finish	Black
Attachments / Spec	Suspension kits All kit required for complete installation
Colour Temperature	2700K
Colour Rendering Index	>90
Light Source	LED
Dimming Protocol	DALI
Wattage	11.2 w
Lumen Output	987 lm
Lumens per Watt	88 lm/w
IP Rating	20
Notes	Include for all drivers, connections and fixing details necessary for complete working installation
Manufacturer	XAL
Reference	Move It 45 – L3 Flood Round Optic
Contact	Mathew Inett mathew.inett@xal.com T: 07498326439

Artin.



Product Image



Product Dimensions / Application Shot

TR – X – (A,B,C)

Description	Suspended magnetic track system
Fixing Type	Suspended
Finish	Black
Attachments / Spec	Suspension kits All kit required for complete installation
Colour Temperature	NA
Colour Rendering Index	NA
Light Source	NA
Dimming Protocol	DALI
Wattage	NA
Lumen Output	NA
Lumens per Watt	NA
IP Rating	20
Notes	Include for all drivers, connections and fixing details necessary for complete working installation
Manufacturer	XAL
Reference	Move It 25 – allow for length as drawn
Contact	Mathew Inett mathew.inett@xal.com T: 07498326439

Artin.



MANUFACTURER / CONTRACTOR NOTES

'A' Denotes 2420mm
'B' Denotes 1220mm
'C' Denotes 620mm

Product Image



Product Dimensions / Application Shot

L29 – (A,B,C)

Description	Suspended profile luminaire with indirect linear LED optic and direct track mounted luminaires.
Fixing Type	Suspended
Finish	Black
Attachments / Spec	Suspension kits All kit required for complete installation
Colour Temperature	2700K
Colour Rendering Index	>90
Light Source	LED
Dimming Protocol	DALI
Wattage	33 w/ 2420mm / 15.2 w/1200mm / 6.2 w/620mm
Lumen Output	3380 lm/ 2420mm / 1790 lm/1200mm / 1310 lm/620mm
Lumens per Watt	117 lm/w
IP Rating	20
Notes	Include for all drivers, connections and fixing details necessary for complete working installation
Manufacturer	XAL
Reference	Move It 25 – Indirect – allow for length as drawn
Contact	Mathew Inett mathew.inett@xal.com T: 07498326439

Artin.



MANUFACTURER / CONTRACTOR NOTES

'A' Denotes 2420mm
'B' Denotes 1220mm
'C' Denotes 620mm

Product Image



Product Dimensions / Application Shot

L30 -(N,M,W)

Description	Magnetic track spotlight
Fixing Type	Ceiling Recessed
Finish	Black
Attachments / Spec	Glare Louvre
Colour Temperature	2700K
Colour Rendering Index	>90
Light Source	LED
Dimming Protocol	DALI
Wattage	11 w
Lumen Output	743 lm
Lumens per Watt	68 lm/w
IP Rating	20
Notes	Include for all drivers, connections and fixing details necessary for complete working installation
Manufacturer	XAL
Reference	Just 45 Move It Spot
Contact	Mathew Inett mathew.inett@xal.com T: 07498326439

Artin.



MANUFACTURER / CONTRACTOR NOTES

‘N’ Denotes 8 degree optic
‘M’ Denotes 21 degree optic
‘W’ Denotes 42 degree optic

Product Image

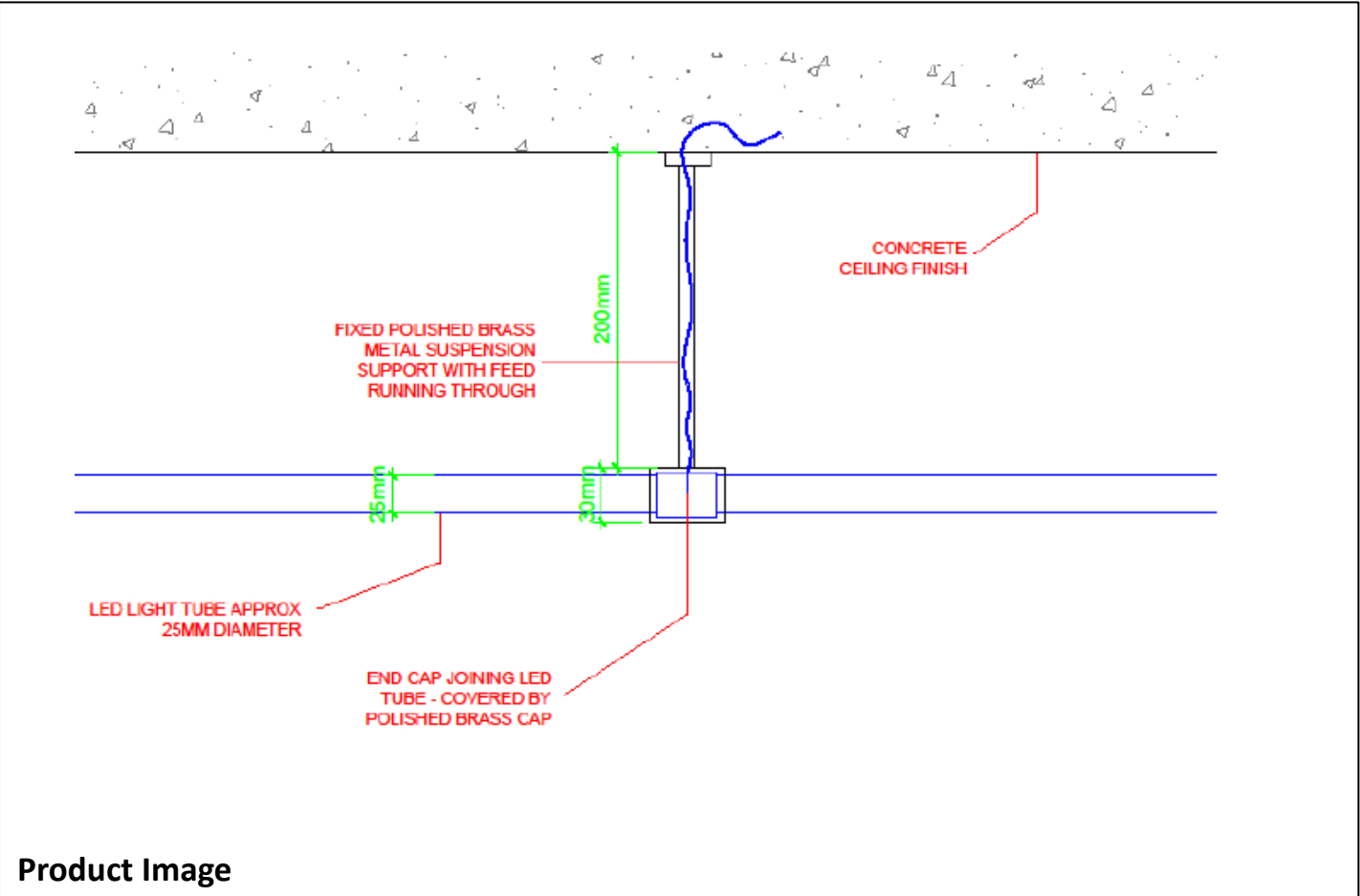
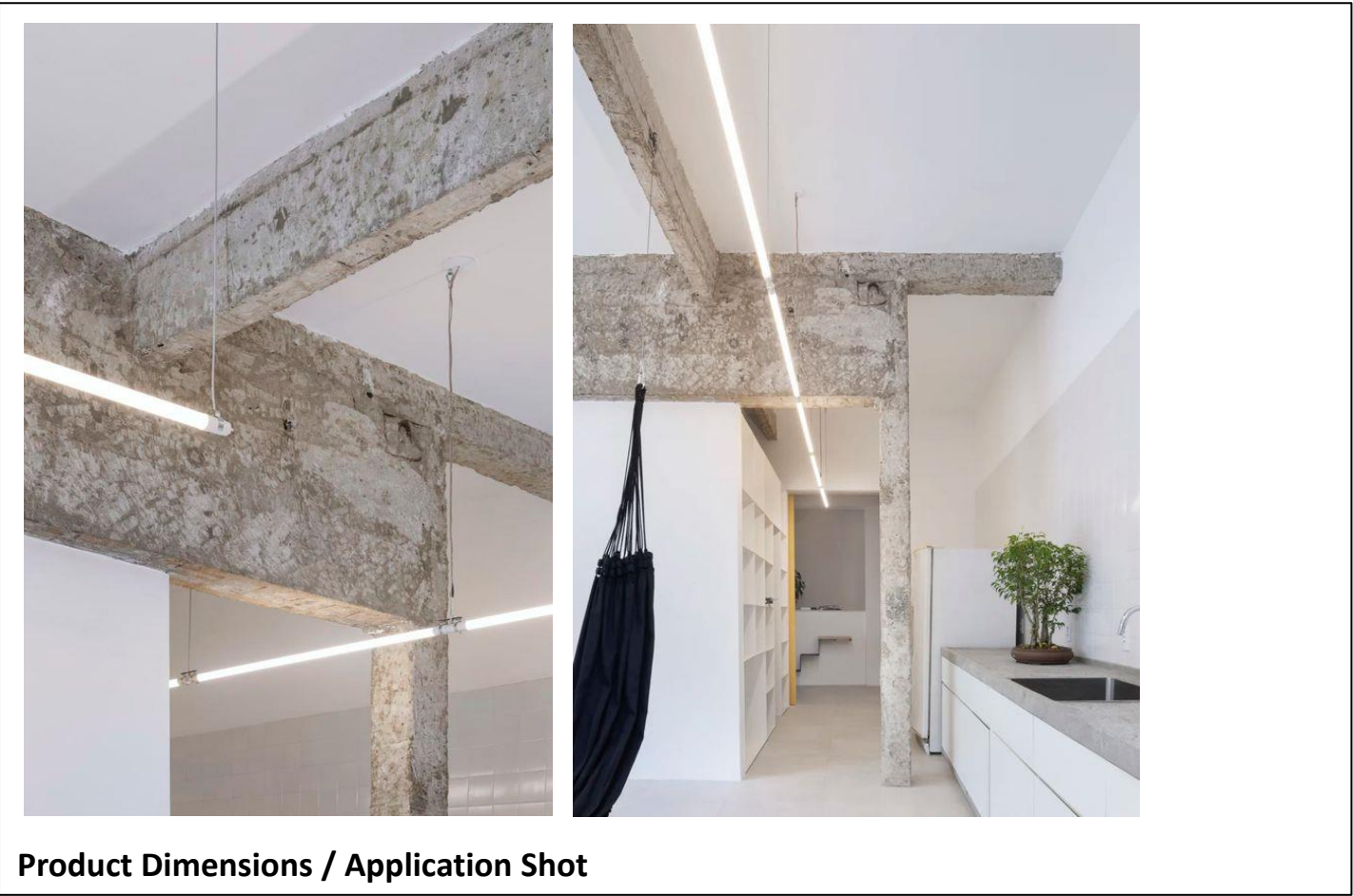


Product Dimensions / Application Shot

L31A

Description	Ceiling suspended impact resistant linear fitting Basement - Circulation, Changing Rooms
Fixing Type	Suspended. Ceiling rod fixed
Finish	Fixing details in a polished brass finish
Attachments / Spec	Allow for 1no colour sleeve per unit Fixing details TBC Northern Lights
Colour Temperature	2700K – With colour sleeve
Colour Rendering Index	>80
Light Source	LED
Dimming Protocol	DALI (Remote LED Driver)
Wattage	27 w
Lumen Output	2015 lm
Lumens per Watt	75lm/w
IP Rating	64
Notes	Include for all drivers, connections and fixing details necessary for complete working installation
Manufacturer	Luminaire - Encapsulite UK Fixing – Northern Lights
Reference	Luminaire – 24V RD Twin Stick LED – 1525mm - with colour sleeve Fixing – Custom
Contact	Lee Grieve E:lee.grieve@northern-lights.co.uk T: 0789650682

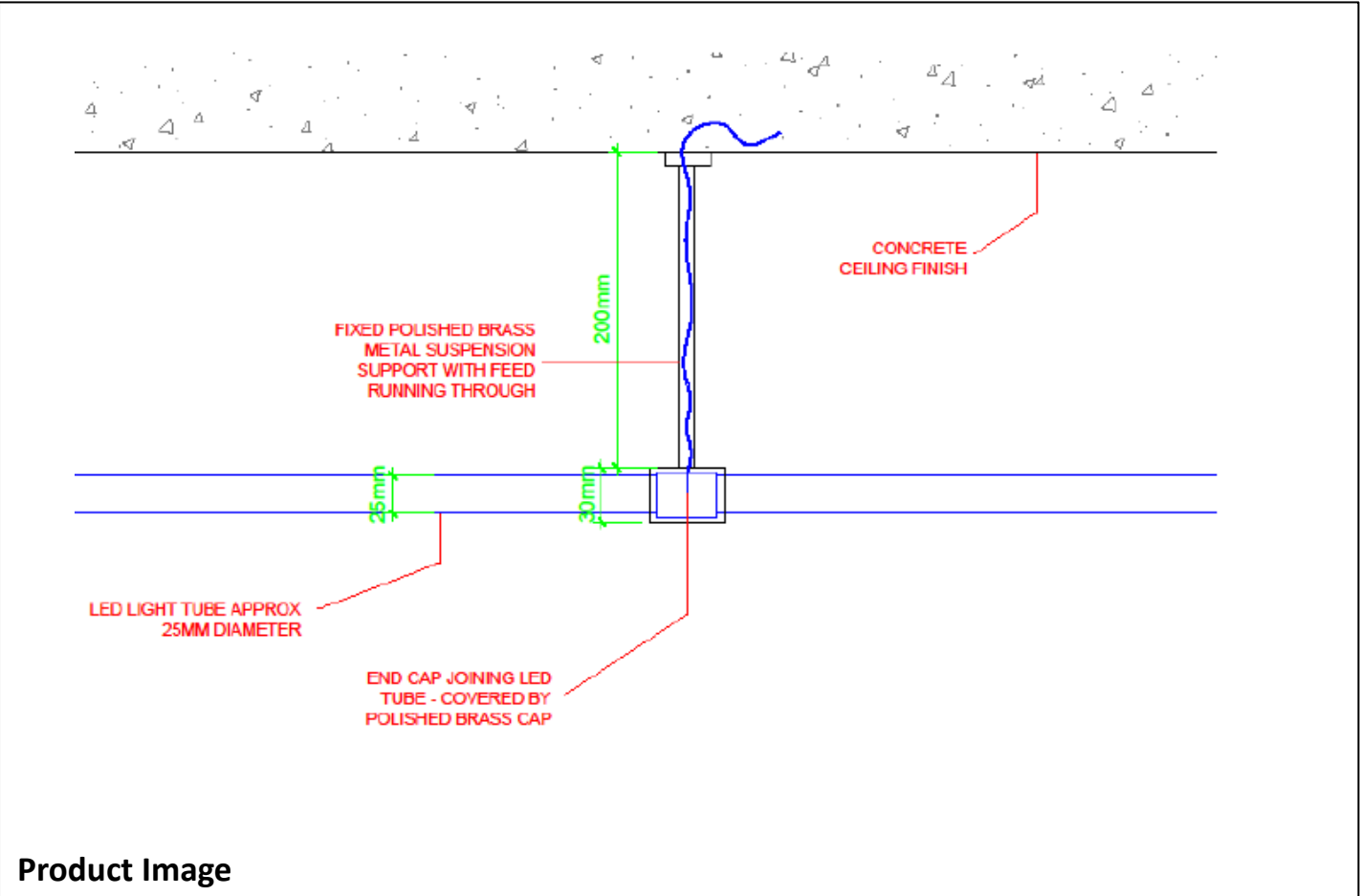
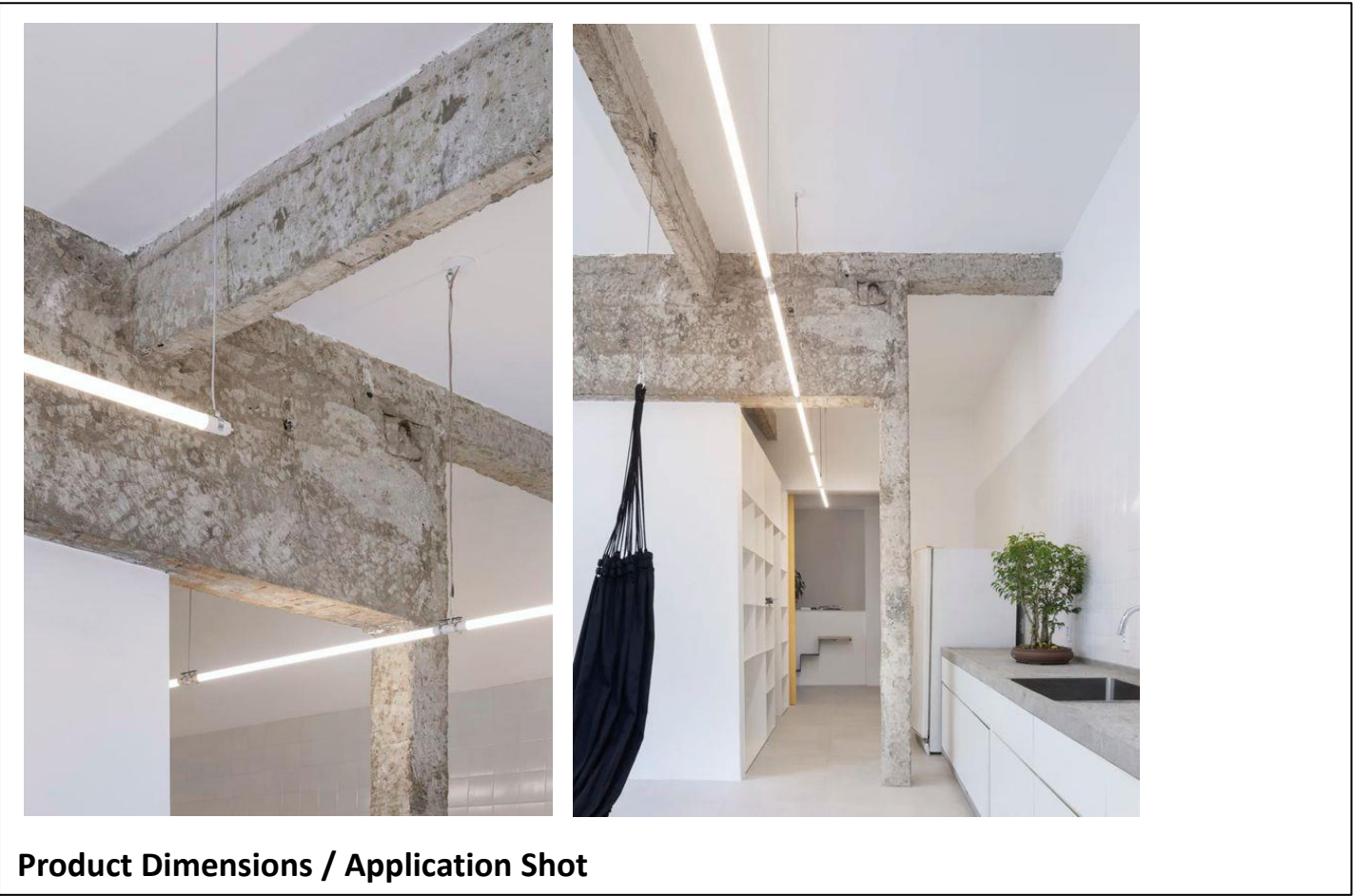
Artin.



L31B

Description	Ceiling suspended impact resistant linear fitting Basement - Circulation, Changing Rooms
Fixing Type	Suspended. Ceiling rod fixed
Finish	Fixing details in a polished brass finish
Attachments / Spec	Allow for 1no colour sleeve per unit Fixing details TBC Northern Lights
Colour Temperature	2700K – With colour sleeve
Colour Rendering Index	>80
Light Source	LED
Dimming Protocol	DALI (Remote LED Driver)
Wattage	19 w
Lumen Output	1380 lm
Lumens per Watt	73lm/w
IP Rating	64
Notes	Include for all drivers, connections and fixing details necessary for complete working installation
Manufacturer	Luminaire - Encapsulite UK Fixing – Northern Lights
Reference	Luminaire – 24V RD Twin Stick LED – 1025mm - with colour sleeve Fixing – Custom
Contact	Lee Grieve E:lee.grieve@northern-lights.co.uk T: 0789650682

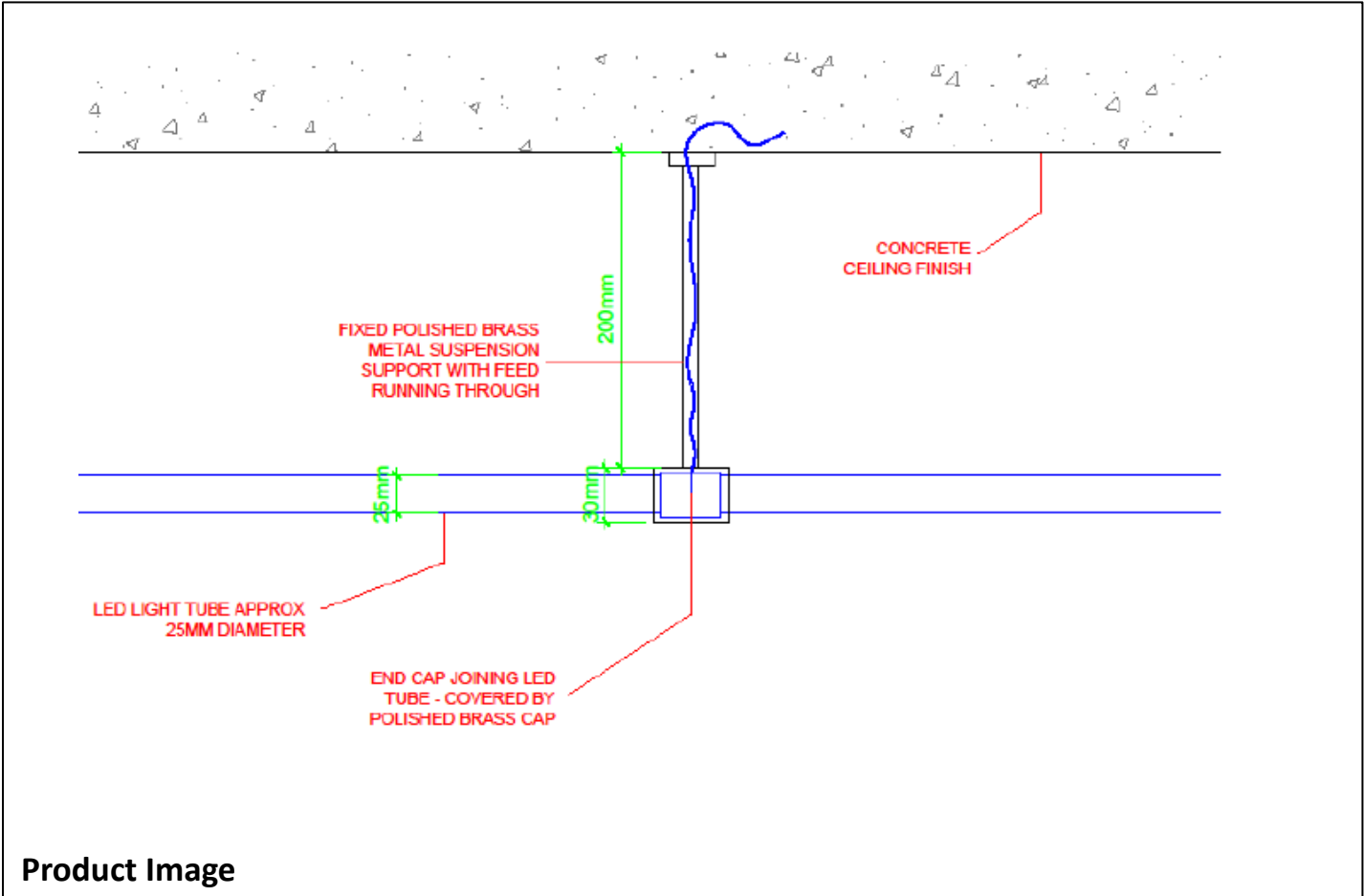
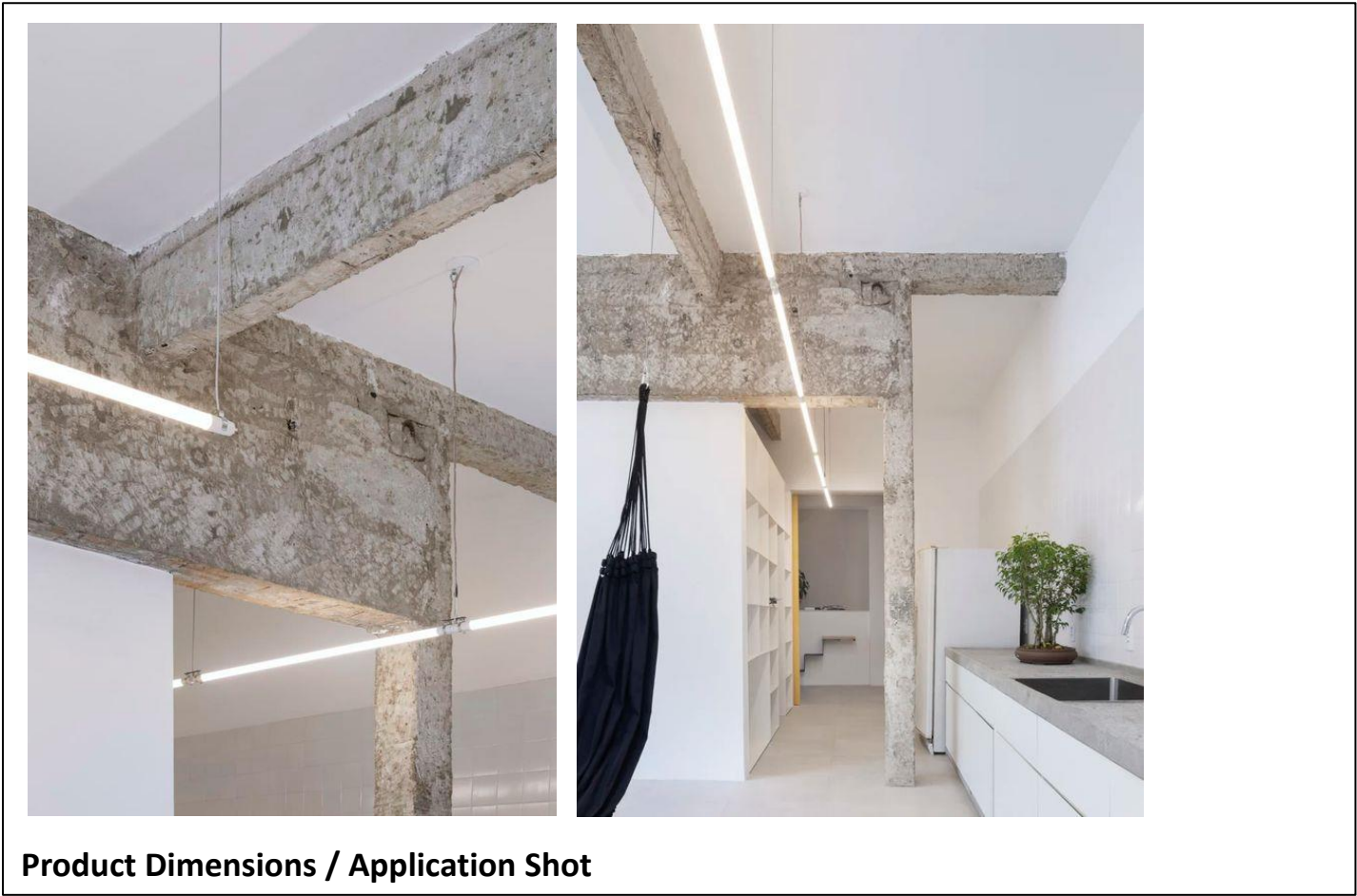
Artin.



L31C

Description	Ceiling suspended impact resistant linear fitting Basement - Circulation, Changing Rooms
Fixing Type	Suspended. Ceiling rod fixed
Finish	Fixing details in a polished brass finish
Attachments / Spec	Allow for 1no colour sleeve per unit Fixing details TBC Northern Lights
Colour Temperature	2700K – With colour sleeve
Colour Rendering Index	>80
Light Source	LED
Dimming Protocol	DALI (Remote LED Driver)
Wattage	11 w
Lumen Output	610 lm
Lumens per Watt	55lm/w
IP Rating	64
Notes	Include for all drivers, connections and fixing details necessary for complete working installation
Manufacturer	Luminaire - Encapsulite UK Fixing – Northern Lights
Reference	Luminaire – 24V RD Twin Stick LED – 525mm - with colour sleeve Fixing – Custom
Contact	Lee Grieve E:lee.grieve@northern-lights.co.uk T: 0789650682

Artin.



L32-(N,M,W,F)

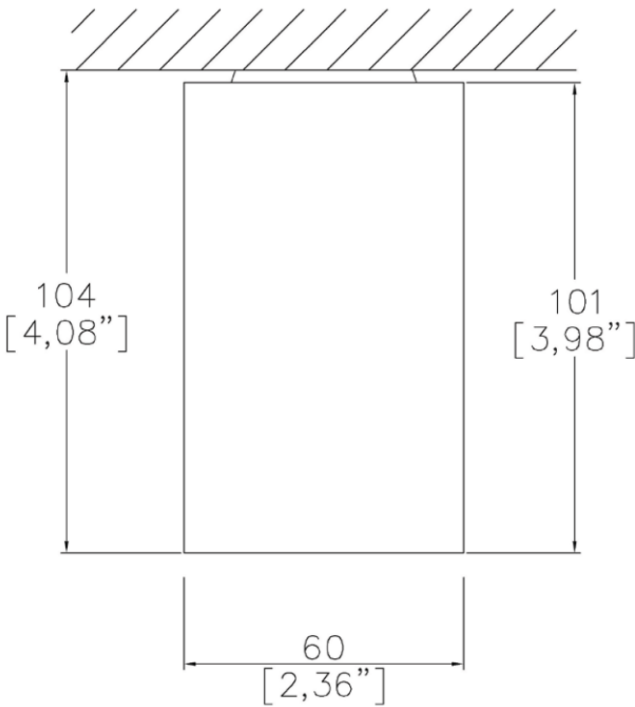
Description	Surface mounted LED downlight with remote driver
Fixing Type	Surface mounted
Finish	Black
Attachments / Spec	Glare Louvre
Colour Temperature	3000K
Colour Rendering Index	>90
Light Source	LED
Dimming Protocol	DALI
Wattage	13.6 w
Lumen Output	907 lm
Lumens per Watt	67 lm/w
IP Rating	20
Notes	Include for all drivers, connections and fixing details necessary for complete working installation
Manufacturer	Lucent Lighting
Reference	Surface Mini Shallow Height
Contact	Alex Hay E: Alex@lucent-lighting.com T: (0) 7971663060

MANUFACTURER / CONTRACTOR NOTES

‘N’ Denotes 12 degree optic
‘M’ Denotes 24 degree optic
‘W’ Denotes 38 degree optic
‘F’ Denotes 55 degree optic



Product Image

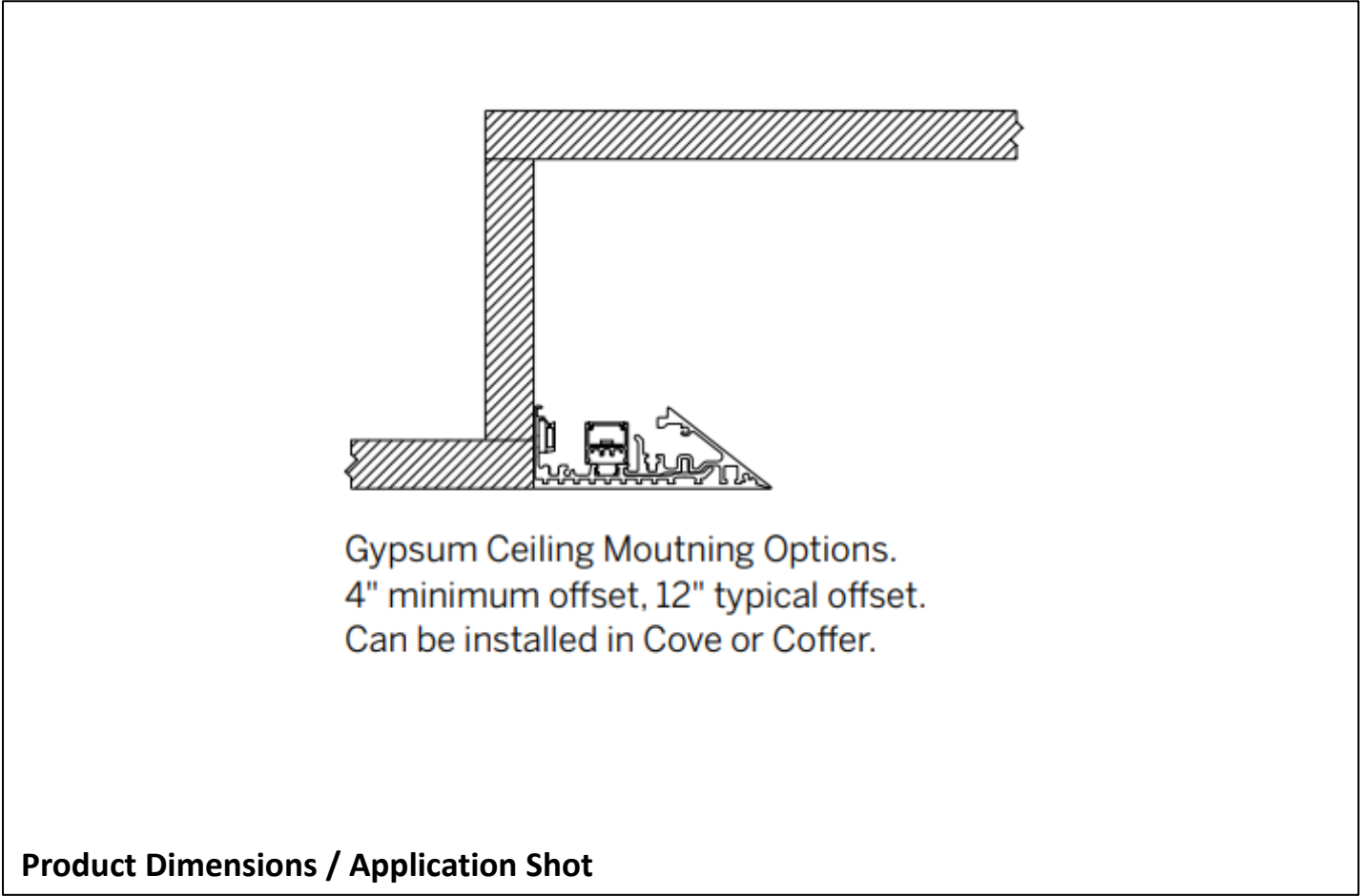


Product Dimensions / Application Shot

L33

Description	Plaster in coffer LED
Fixing Type	Ceiling integrated
Finish	NA
Attachments / Spec	Allow for length as drawn – exact lengths to be confirmed by the architect during construction drawing process
Colour Temperature	2700K
Colour Rendering Index	>90
Light Source	LED
Dimming Protocol	DALI
Wattage	21 w/m
Lumen Output	1355 lm/m
Lumens per Watt	64 lm/w
IP Rating	20
Notes	Include for all drivers, connections and fixing details necessary for complete working installation
Manufacturer	Whitegoods Lighting
Reference	20 Mini Edgeless Cove
Contact	Specilight Associates UK E: uk@specilightassociates.com T: 01656 865 330

Artin.



L34

Description	Track mounted specialist planting LED spotlight
Fixing Type	Track mounted
Finish	Black
Attachments / Spec	Glare Louvre 45 degree optic / PPF = 99 Umol / 3.3. Umol/watt Allow for linear track length as drawn
Colour Temperature	4000K
Colour Rendering Index	>85
Light Source	LED
Dimming Protocol	NA
Wattage	30 w
Lumen Output	lm
Lumens per Watt	67 lm/w
IP Rating	20
Notes	Include for all drivers, connections and fixing details necessary for complete working installation
Manufacturer	I Want Plants
Reference	Planter Spot 30
Contact	Richard Rowlands E: Richard@iwantplants.co.uk T: (0) 7768405937

Artin.



Product Image



Product Dimensions / Application Shot

Decorative

D1 - (A,B,C,D)

Description	Decorative pendant
Fixing Type	Suspended
Finish	TBC
Attachments / Spec	
Colour Temperature	2700K
Colour Rendering Index	>90
Light Source	LED
Dimming Protocol	DALI
Wattage	A = 12w B = 18w C = 18w D = 18w
Lumen Output	A = 1389 lm B = 2083 lm C = 2083 lm D = 2083 lm
Lumens per Watt	124 lm/w
IP Rating	20
Notes	Include for all drivers, connections and fixing details necessary for complete working installation
Manufacturer	Vibia
Reference	Flamingo – Various
Contact	James Mansfield – LSE Lighting E: james@lselighting.com T: 01905 22243

Artin.

MANUFACTURER
/ CONTRACTOR
NOTES

A = 1510
B = 1530
C = 1560
D = 1570



Product Image



Product Dimensions / Application Shot

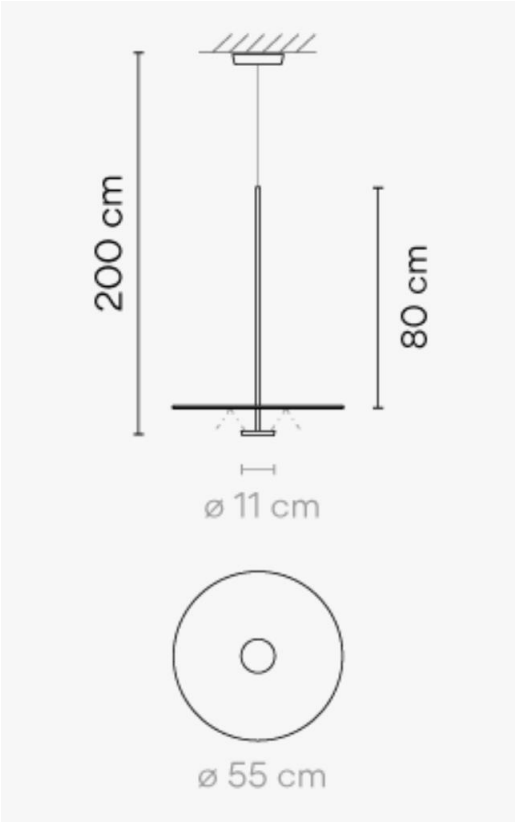
D2

Description	Decorative pendant
Fixing Type	Suspended
Finish	TBC
Attachments / Spec	
Colour Temperature	2700K
Colour Rendering Index	>90
Light Source	LED
Dimming Protocol	DALI
Wattage	13.5 w
Lumen Output	1740 lm
Lumens per Watt	57 lm/w
IP Rating	20
Notes	Include for all drivers, connections and fixing details necessary for complete working installation
Manufacturer	Vibia
Reference	5940
Contact	James Mansfield – LSE Lighting E: james@lselighting.com T: 01905 22243

Artin.



Product Image



Product Dimensions / Application Shot

D3

Description	Decorative pendant
Fixing Type	Suspended
Finish	TBC
Attachments / Spec	Soraa Lamp SM16GW-07-10D-927-03-S3 60 degree snap filter Honeycomb louvre snap filter
Colour Temperature	2700K
Colour Rendering Index	>80
Light Source	LED
Dimming Protocol	Trailing Edge
Wattage	7.5 w
Lumen Output	390 lm
Lumens per Watt	52 lm/w
IP Rating	20
Notes	Include for all drivers, connections and fixing details necessary for complete working installation
Manufacturer	Pholc
Reference	Apollo 59 Pendant - Aluminium
Contact	Nest Lighting T: 0114 243 3000 E: info@nest.co.uk

Artin.



Product Image



Product Dimensions / Application Shot

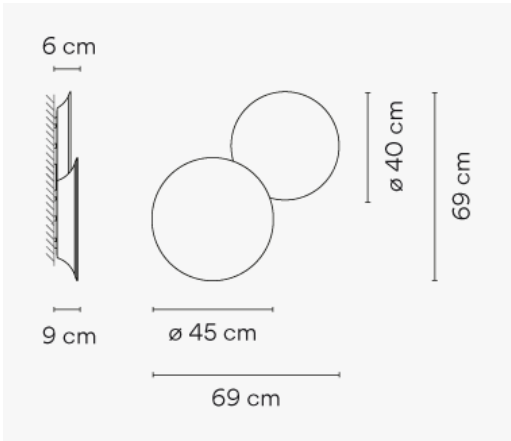
D4A

Description	Decorative wall light
Fixing Type	Wall mounted
Finish	TBC
Attachments / Spec	
Colour Temperature	2700K
Colour Rendering Index	>90
Light Source	LED
Dimming Protocol	DALI
Wattage	25 w
Lumen Output	2871 lm
Lumens per Watt	94 lm/w
IP Rating	20
Notes	Include for all drivers, connections and fixing details necessary for complete working installation
Manufacturer	Vibia
Reference	5481
Contact	James Mansfield – LSE Lighting E: james@lselighting.com T: 01905 22243

Artin.



Product Image



Product Dimensions / Application Shot

D4B

Description	Decorative wall light
Fixing Type	Wall mounted
Finish	TBC
Attachments / Spec	
Colour Temperature	2700K
Colour Rendering Index	>90
Light Source	LED
Dimming Protocol	DALI
Wattage	8.4 w
Lumen Output	952 lm
Lumens per Watt	48 lm/w
IP Rating	20
Notes	Include for all drivers, connections and fixing details necessary for complete working installation
Manufacturer	Vibia
Reference	5470
Contact	James Mansfield – LSE Lighting E: james@lselighting.com T: 01905 22243

Artin.



Product Image



Product Dimensions / Application Shot

D5

Description	Suspended bespoke pendant with 4no glass opal globe lamps
Fixing Type	Suspended
Finish	Matt black metal work 30% reflectance / Opal Glass
Attachments / Spec	E27 lamp holders MASTERVLELED Bulb D5.9-60W E27 927A60FR G UK 929003057799 Philips lighting
Colour Temperature	2700K
Colour Rendering Index	>90
Light Source	LED
Dimming Protocol	Trailing Edge
Wattage	6 w per lamp
Lumen Output	800 lm per lamp
Lumens per Watt	133 lm/w
IP Rating	20
Notes	Include for all drivers, connections and fixing details necessary for complete working installation
Manufacturer	Northern Lights
Reference	Bespoke
Contact	Lee Grieve E:lee.grieve@northern-lights.co.uk T: 0789650682

Artin.



Product Image

BESPOKE DRAWING BY LIGHTING MANUFACTURER

Product Dimensions / Application Shot

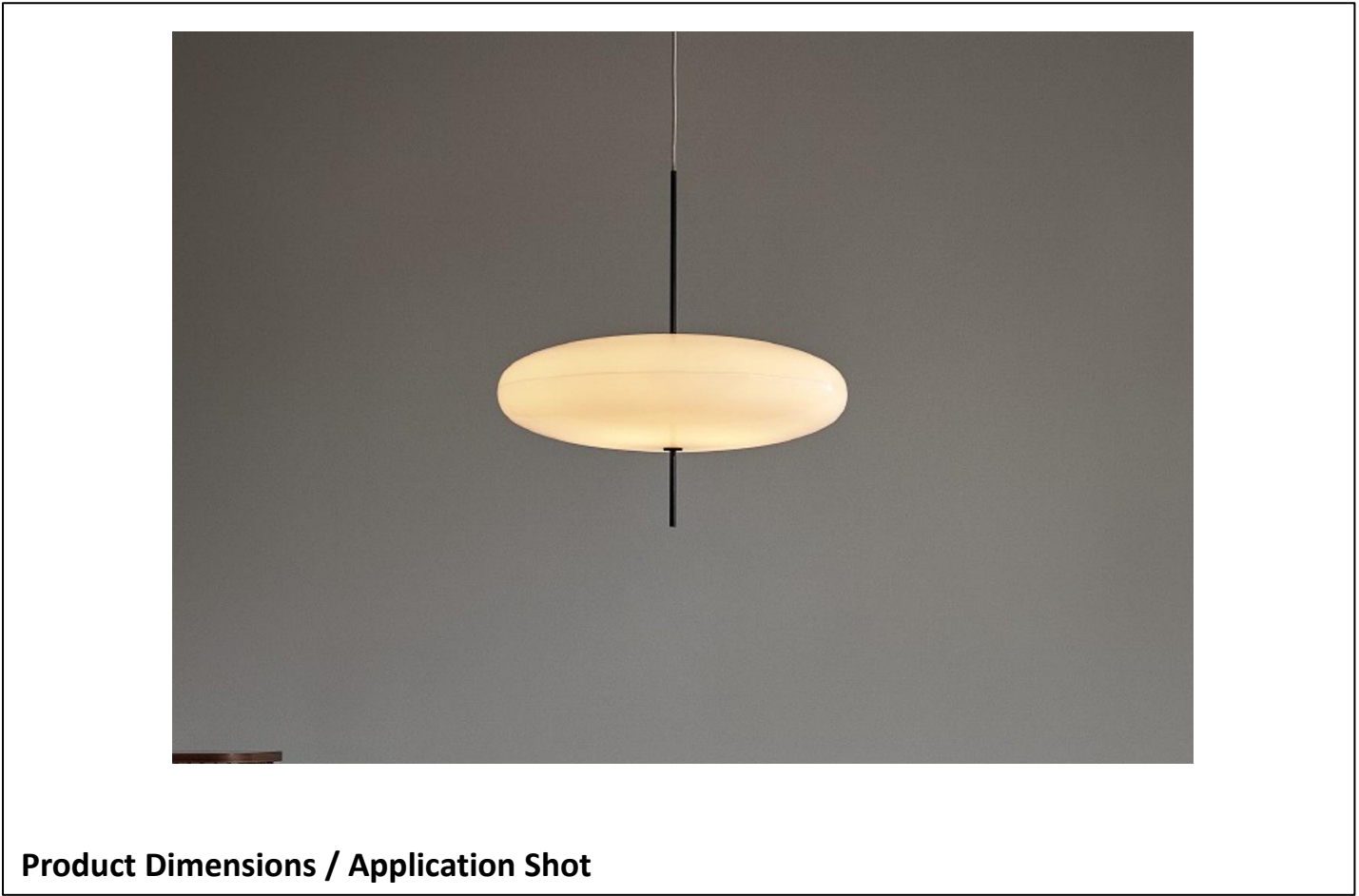
D6

Description	Decorative pendant
Fixing Type	Suspended
Finish	Black and Opal
Attachments / Spec	MASTER VLE LEDCandleD3.4-40W E14 B35 927CLG 929003059502 Philips lighting
Colour Temperature	2700K
Colour Rendering Index	>90
Light Source	LED
Dimming Protocol	Trailing Edge
Wattage	5 x 4.5 w
Lumen Output	5 x 470lm
Lumens per Watt	104 lm/w
IP Rating	20
Notes	Include for all drivers, connections and fixing details necessary for complete working installation
Manufacturer	Astep
Reference	Model 2065 – Black shade / opal
Contact	James Mansfield – LSE Lighting E: james@lselighting.com T: 01905 22243

Artin.



Product Image



Product Dimensions / Application Shot

D7

Description	Decorative Wall Light
Fixing Type	Wall mounted
Finish	Black / Opal glass
Attachments / Spec	MASTER VLE LEDCandleD3.4-40W E14 B35 927CLG 929003059502 Philips lighting
Colour Temperature	2700K
Colour Rendering Index	>90
Light Source	LED
Dimming Protocol	Trailing Edge
Wattage	4.5 w
Lumen Output	470mlm
Lumens per Watt	104 lm/w
IP Rating	20
Notes	Include for all drivers, connections and fixing details necessary for complete working installation
Manufacturer	New Works
Reference	Karl-Johan Wall Lamp – White Opal Glass
Contact	James Mansfield – LSE Lighting E: james@lselighting.com T: 01905 22243

Artin.



Product Image

Product Dimensions
Ø: 230 x D: 180 mm

Product Dimensions / Application Shot

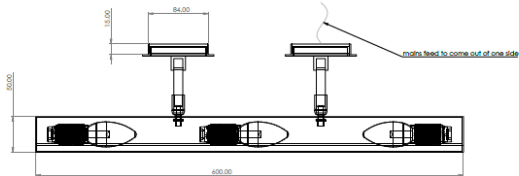
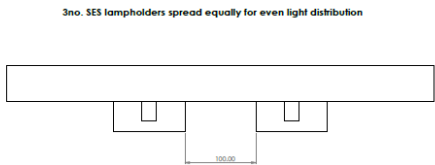
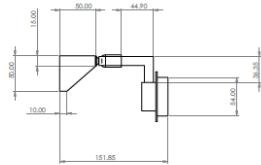
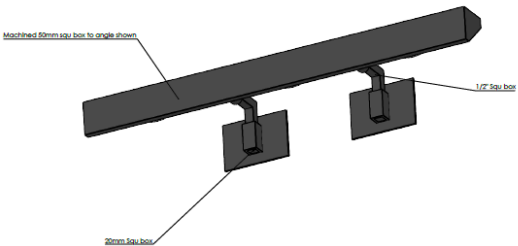
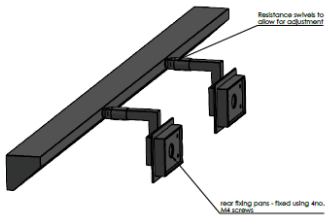
D8

Description	Decorative Picture Light
Fixing Type	Wall Mounted
Finish	Powder coated Brass Finish – Light finish TBC
Attachments / Spec	7161 - LED Candle Filament Clear 5W Dimmable 2700K SES-E14 - Crompton Lamps Ltd
Colour Temperature	2700K
Colour Rendering Index	>80
Light Source	LED
Dimming Protocol	Trailing Edge
Wattage	15 w
Lumen Output	1410 lm
Lumens per Watt	94 lm/w
IP Rating	20
Notes	Include for all drivers, connections and fixing details necessary for complete working installation
Manufacturer	Northern Lights
Reference	Bespoke
Contact	Lee Grieve E:lee.grieve@northern-lights.co.uk T: 0789650682

Artin.



Product Image



Product Dimensions / Application Shot

D9

Description	Task light
Fixing Type	Desk mounted
Finish	TBC
Attachments / Spec	
Colour Temperature	2700K
Colour Rendering Index	>90
Light Source	LED
Dimming Protocol	NA
Wattage	6 w
Lumen Output	255 lm
Lumens per Watt	42 lm/w
IP Rating	20
Notes	Include for all drivers, connections and fixing details necessary for complete working installation
Manufacturer	Nuura
Reference	Blossi Table Lamp – Black / opal
Contact	Nest Lighting T: 0114 243 3000 E: info@nest.co.uk

Artin.



Product Image

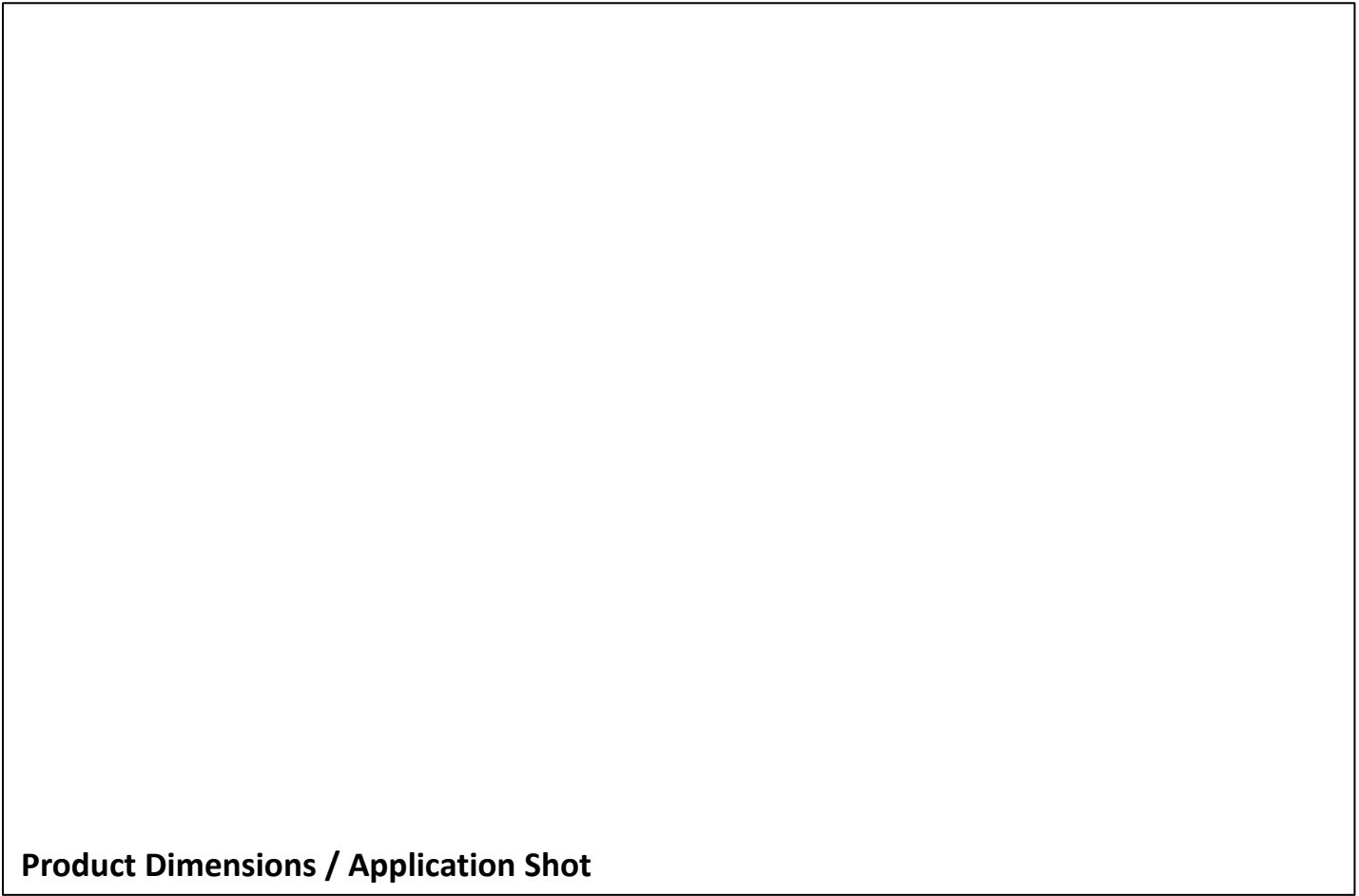


Product Dimensions / Application Shot

D9

Description	Task light
Fixing Type	Desk mounted
Finish	TBC
Attachments / Spec	
Colour Temperature	2700K
Colour Rendering Index	>90
Light Source	LED
Dimming Protocol	NA
Wattage	3 w
Lumen Output	104 lm
Lumens per Watt	34 lm/w
IP Rating	20
Notes	Include for all drivers, connections and fixing details necessary for complete working installation
Manufacturer	&Tradition
Reference	Flower Pot VP9
Contact	Nest Lighting T: 0114 243 3000 E: info@nest.co.uk

Artin.



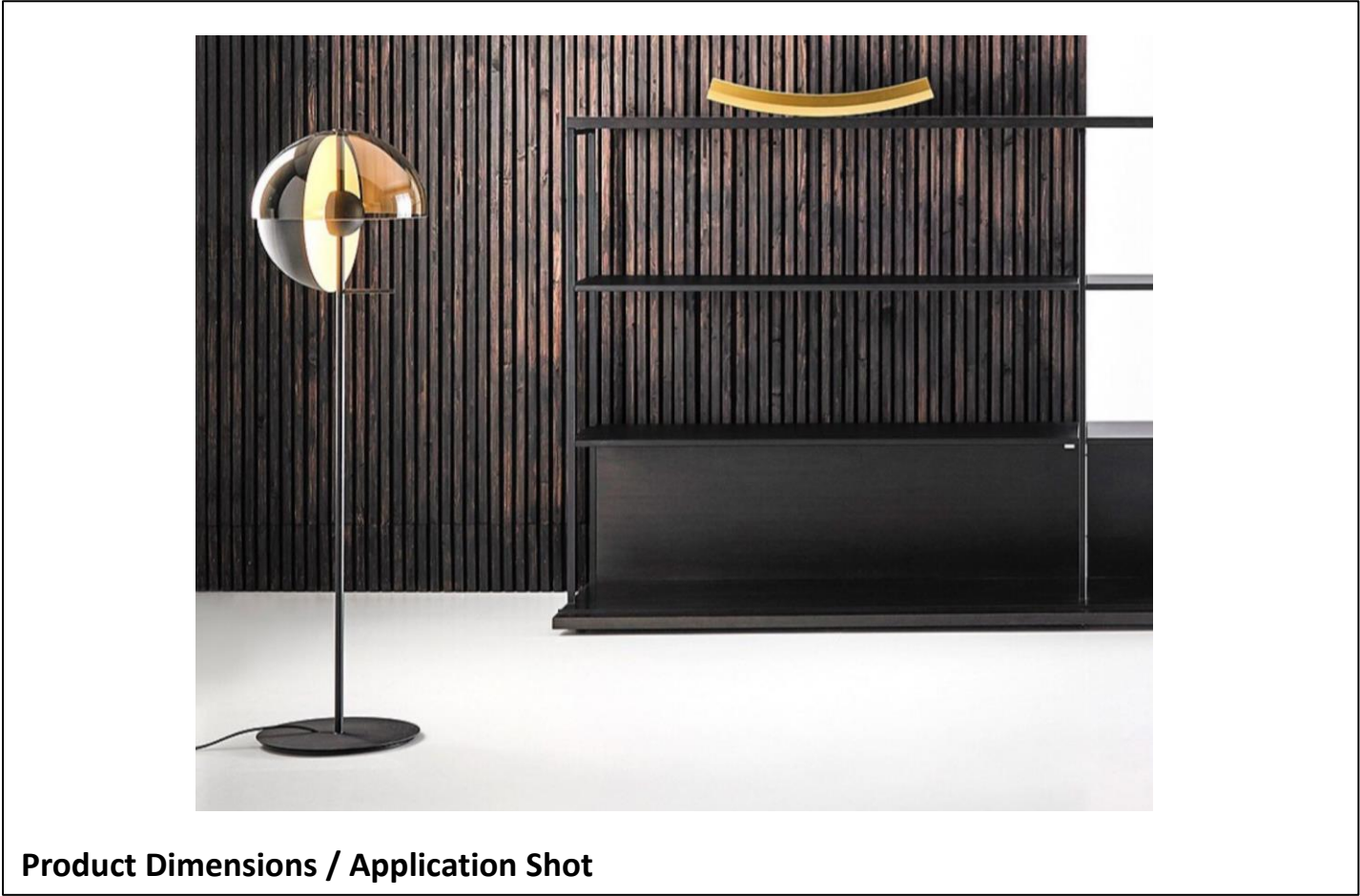
D10

Description	Floor lamp
Fixing Type	Free standing
Finish	TBC
Attachments / Spec	5-amp plug
Colour Temperature	2700K
Colour Rendering Index	>90
Light Source	LED
Dimming Protocol	Trailing Edge
Wattage	8.2 w
Lumen Output	913 lm
Lumens per Watt	111 lm/w
IP Rating	20
Notes	Include for all drivers, connections and fixing details necessary for complete working installation
Manufacturer	Marset
Reference	Theia Floor Lamp
Contact	James Mansfield – LSE Lighting E: james@lselighting.com T: 01905 22243

Artin.



Product Image



Product Dimensions / Application Shot

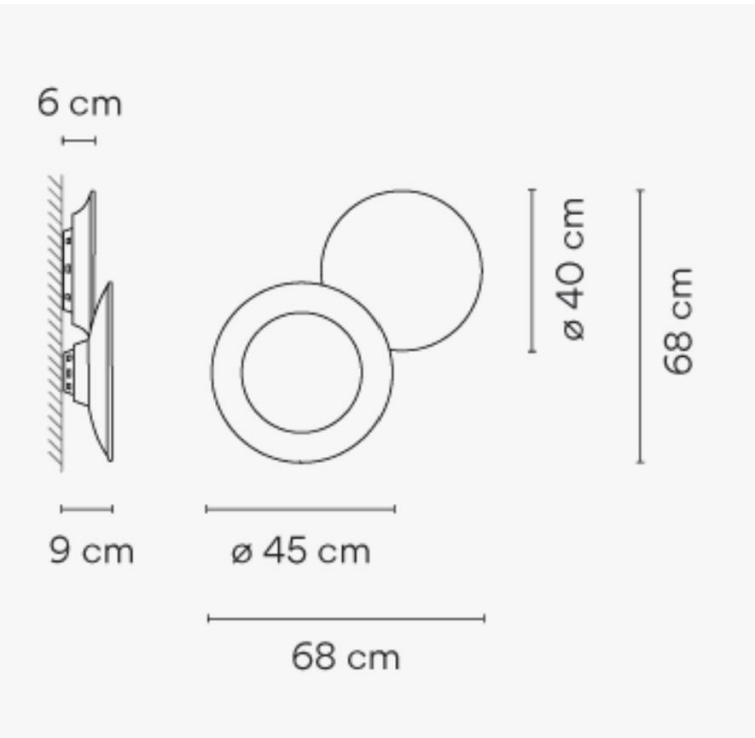
D11

Description	Shower room wall lights
Fixing Type	Wall mounted
Finish	TBC
Attachments / Spec	
Colour Temperature	2700K
Colour Rendering Index	>90
Light Source	LED
Dimming Protocol	DALI
Wattage	21 w
Lumen Output	2388 lm
Lumens per Watt	91 lm/w
IP Rating	20
Notes	Include for all drivers, connections and fixing details necessary for complete working installation
Manufacturer	Vibia
Reference	5485 - 73
Contact	James Mansfield – LSE Lighting E: james@lselighting.com T: 01905 22243

Artin.



Product Image



Product Dimensions / Application Shot

D12

Description	Changing rooms feature light installation
Fixing Type	Ceiling mounted
Finish	TBC
Attachments / Spec	
Colour Temperature	2700K
Colour Rendering Index	>90
Light Source	LED
Dimming Protocol	Trailing Edge
Wattage	14 w/m
Lumen Output	1200 lm/m
Lumens per Watt	85 lm/m
IP Rating	20
Notes	Include for all drivers, connections and fixing details necessary for complete working installation
Manufacturer	Northern Lights
Reference	Bespoke
Contact	Lee Grieve E:lee.grieve@northern-lights.co.uk T: 0789650682

Artin.



Product Image

Product Dimensions / Application Shot

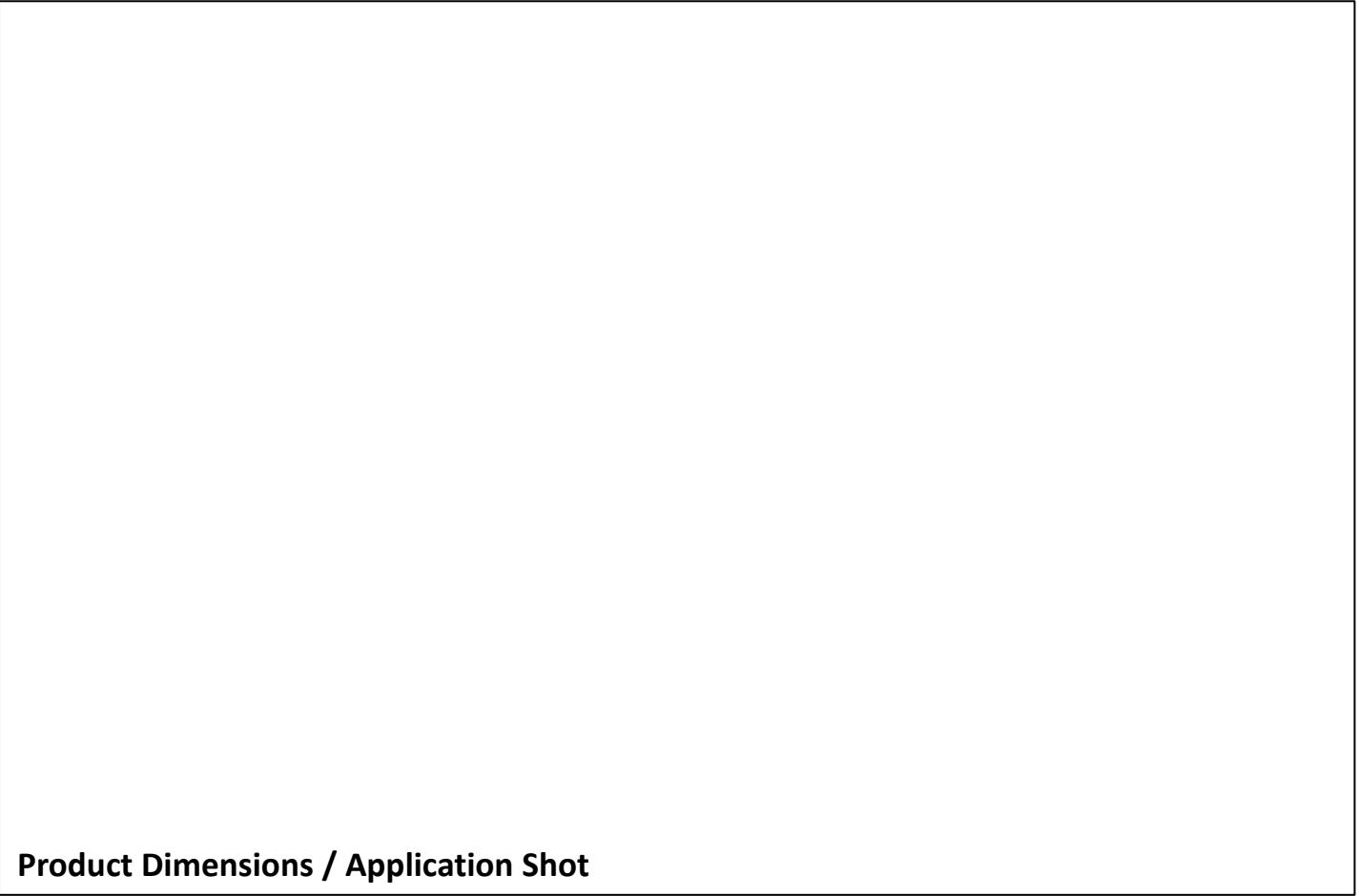
D13

Description	Meeting rooms chandeliers – 1200mm
Fixing Type	Ceiling mounted
Finish	Black / Brass
Attachments / Spec	E27 – Philips lamp 1500lm per lamp MASTER VLE LEDBulbD11.2-100W E27 927 A60FRG 929003058502 Philips lighting
Colour Temperature	2700K
Colour Rendering Index	>90
Light Source	LED
Dimming Protocol	Trailing Edge
Wattage	11.2
Lumen Output	1521 lm
Lumens per Watt	135 lm/w
IP Rating	20
Notes	Include for all drivers, connections and fixing details necessary for complete working installation
Manufacturer	Northern Lights
Reference	Bespoke
Contact	Lee Grieve E:lee.grieve@northern-lights.co.uk T: 0789650682

Artin.



Product Image



Product Dimensions / Application Shot

D14

Description	Task light
Fixing Type	Desk mounted
Finish	TBC
Attachments / Spec	MASTER VLE LEDCandleD3.4-40W E14 B35 927CLG 929003059502 Philips lighting
Colour Temperature	2700K
Colour Rendering Index	>90
Light Source	LED
Dimming Protocol	Trailing Edge
Wattage	3.4 w
Lumen Output	470 lm
Lumens per Watt	138 lm/w
IP Rating	20
Notes	Include for all drivers, connections and fixing details necessary for complete working installation
Manufacturer	&Tradition
Reference	Bellevue AJ11
Contact	Nest Lighting T: 0114 243 3000 E: info@nest.co.uk

Artin.



Product Image

Product Dimensions / Application Shot

D15

Description	Floor lamp
Fixing Type	Free standing
Finish	TBC
Attachments / Spec	5-amp plug E26 dimmable filament lamp required
Colour Temperature	2700K
Colour Rendering Index	>90
Light Source	LED
Dimming Protocol	Trailing Edge
Wattage	11.2
Lumen Output	1521 lm
Lumens per Watt	135 lm/w
IP Rating	20
Notes	Include for all drivers, connections and fixing details necessary for complete working installation
Manufacturer	Santa & Cole
Reference	TMD
Contact	James Mansfield – LSE Lighting E: james@lselighting.com T: 01905 22243

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Product Image

Product Dimensions / Application Shot

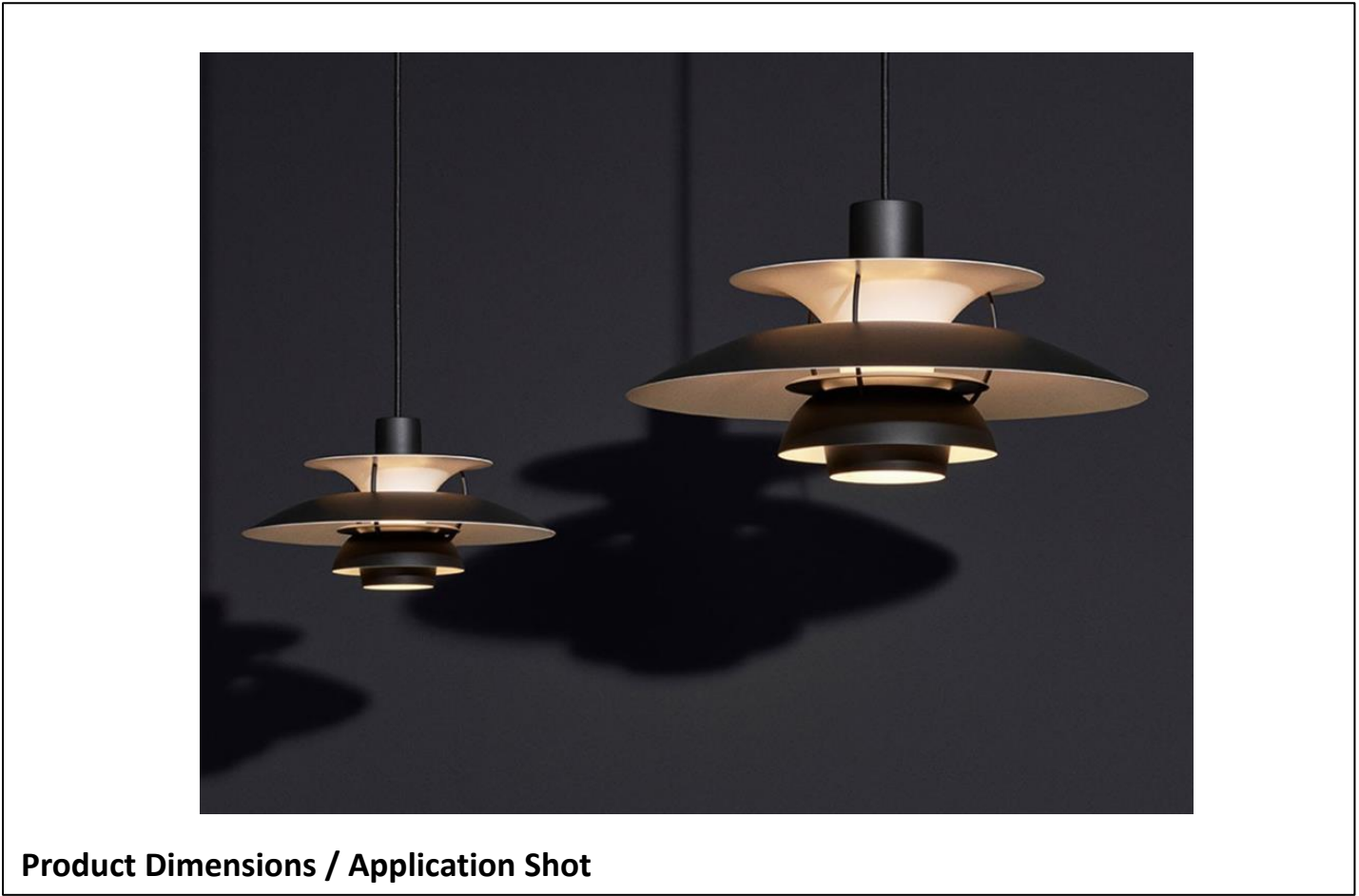
D16

Description	Decorative pendant
Fixing Type	Suspended
Finish	Monochrome
Attachments / Spec	MASTER VLE LEDCandleD3.4-40W E14 B35 927CLG 929003059502 Philips lighting
Colour Temperature	2700K
Colour Rendering Index	>90
Light Source	LED
Dimming Protocol	Trailing Edge
Wattage	4.5 w
Lumen Output	470lm
Lumens per Watt	104 lm/w
IP Rating	20
Notes	Include for all drivers, connections and fixing details necessary for complete working installation
Manufacturer	Louis Poulsen
Reference	PH5 Mini Monochrome
Contact	James Mansfield – LSE Lighting E: james@lselighting.com T: 01905 22243

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Product Image



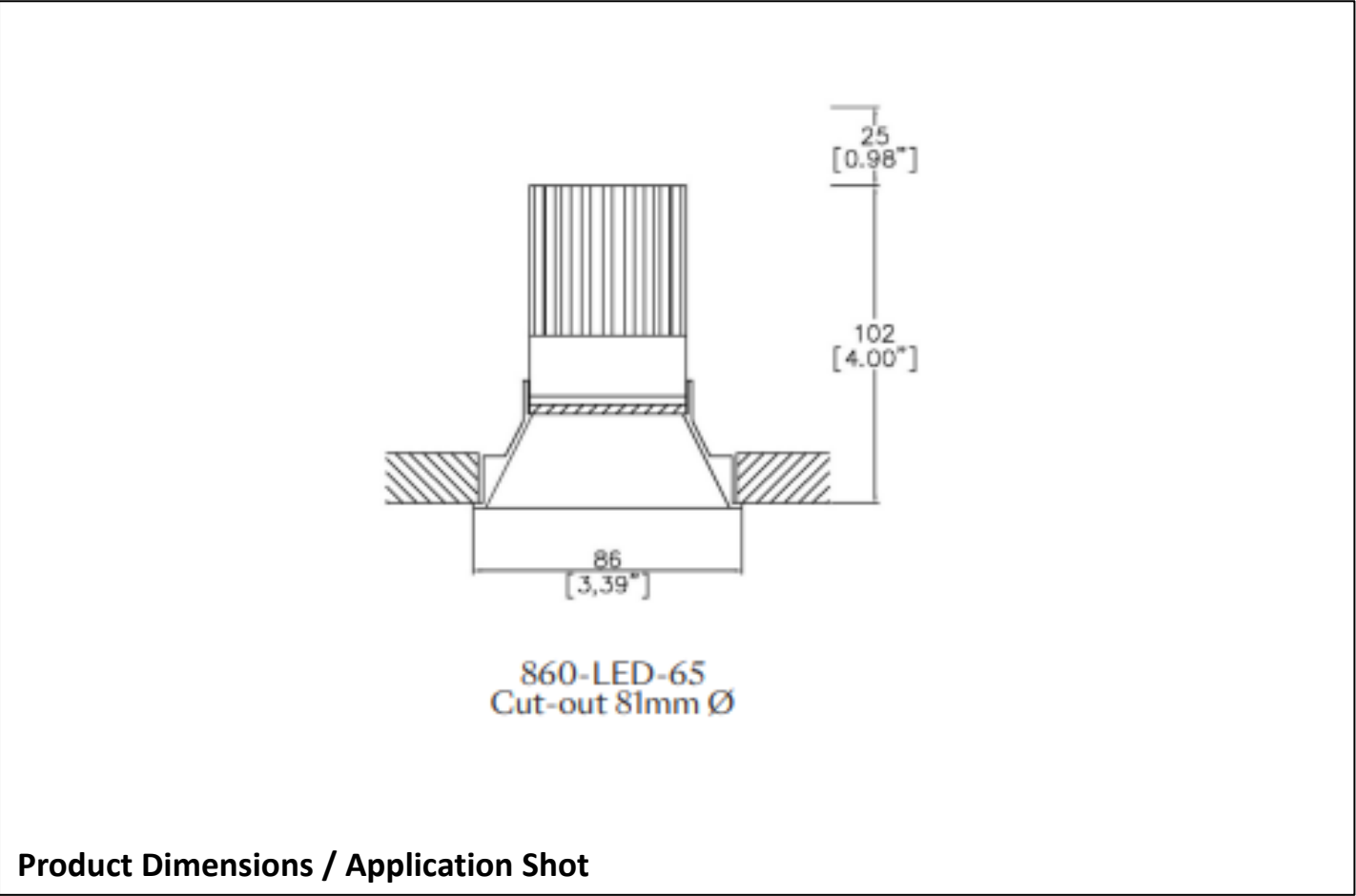
Product Dimensions / Application Shot

Exterior

Description	External recessed canopy downlight with anti glare louvre
Fixing Type	Recessed
Finish	Black
Attachments / Spec	Honeycomb louvre 55 degree
Colour Temperature	2700K
Colour Rendering Index	>90
Light Source	LED
Dimming Protocol	DALI
Wattage	13.6 w
Lumen Output	1064 lm
Lumens per Watt	78 lm/w
IP Rating	65
Notes	Include for all drivers, connections and fixing details necessary for complete working installation
Manufacturer	Lucent Lighting
Reference	Mini Trim IP65
Contact	Alex Hay E: Alex@lucent-lighting.com T: (0) 7971663060



Product Image



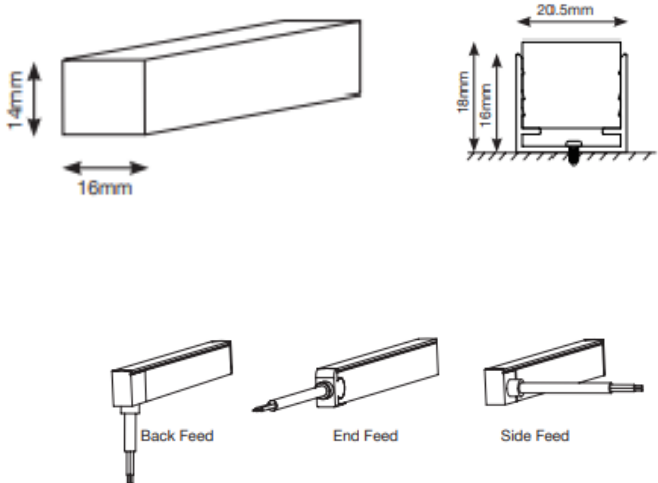
Product Dimensions / Application Shot

X3

Description	Flexible LED profile with homogenous lighting effect – Undercroft
Fixing Type	Detail fixed
Finish	NA
Attachments / Spec	Fixing channel as required Main Contractor to confirm preferred cable entry position and exact linear lengths onsite before ordering equipment
Colour Temperature	2700K
Colour Rendering Index	>90
Light Source	LED
Dimming Protocol	DALI
Wattage	6 w/m
Lumen Output	500 lm/m
Lumens per Watt	50 lm/w
IP Rating	67
Notes	Include for all drivers, connections and fixing details necessary for complete working installation
Manufacturer	Tryka
Reference	Continuity T – Made to measure
Contact	Colin Gawne E: Colin.Gawne@tryka.com T: 07890110951

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Product Image

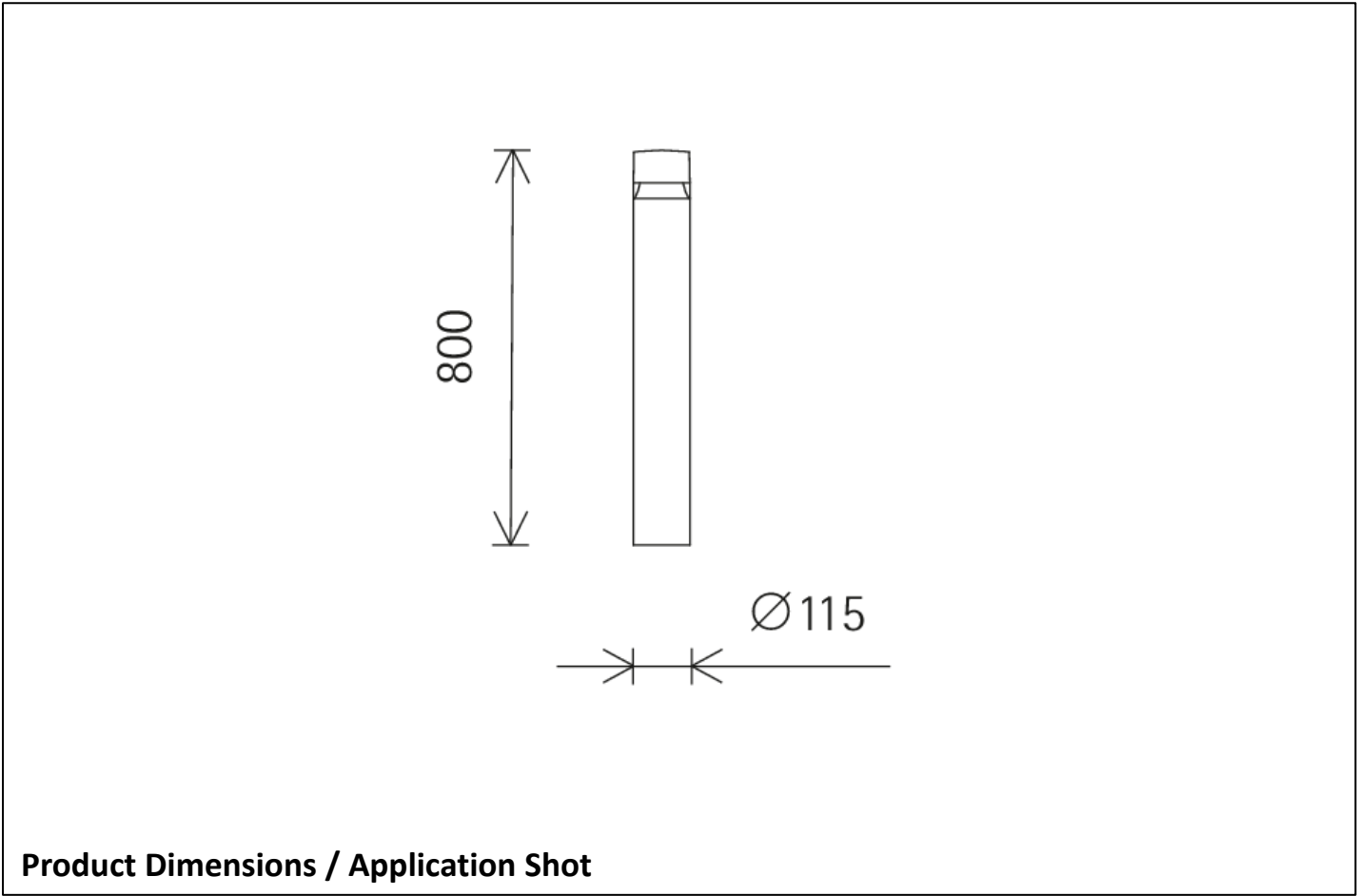


Product Dimensions / Application Shot

X5 (E)

Description	Ground fixed LED bollard with 180 degree illumination
Fixing Type	Ground mounted
Finish	Bronze finish – RAL TBC
Attachments / Spec	Allow for inground recess kit and associated IP cables and glands 'E' denotes with 3 hr integral emergency battery pack
Colour Temperature	2700K
Colour Rendering Index	>90
Light Source	LED
Dimming Protocol	DALI
Wattage	11 w
Lumen Output	161 lm
Lumens per Watt	15 lm/w
IP Rating	65
Notes	Include for all drivers, connections and fixing details necessary for complete working installation
Manufacturer	Erco
Reference	Castor Bollard Luminaire – 180 degree
Contact	Steve Redhead E: s.redhead@erco.com T: +44 (0) 7860 266015

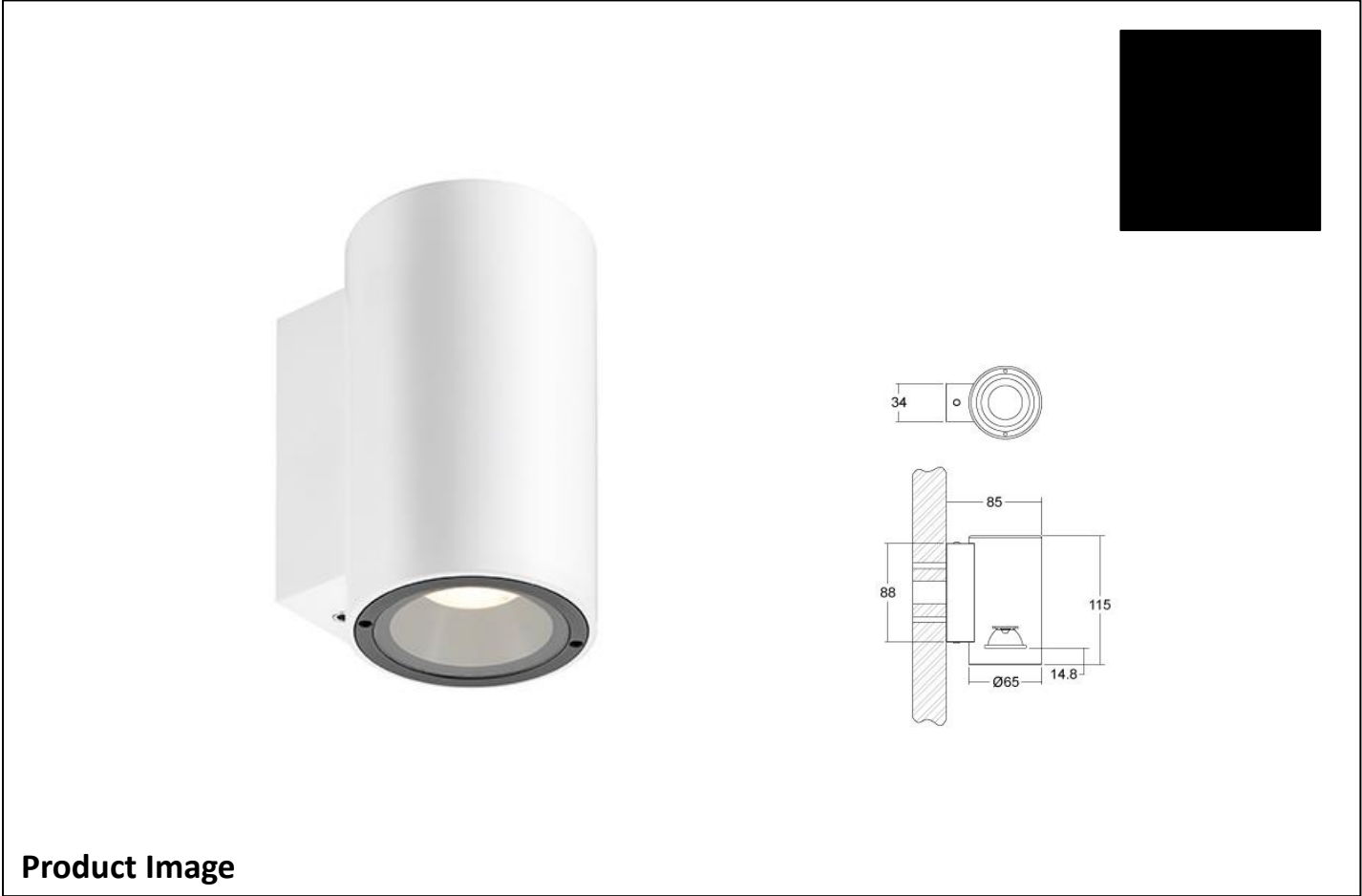
Artin.



X7

Description	Column mounted downlight
Fixing Type	Wall mounted
Finish	TBC
Attachments / Spec	12 degree beam Honeycomb louvre
Colour Temperature	2700K
Colour Rendering Index	>93
Light Source	LED
Dimming Protocol	DALI
Wattage	8.4w
Lumen Output	653 lm
Lumens per Watt	65 lm/w
IP Rating	66
Notes	Include for all drivers, connections and fixing details necessary for complete working installation
Manufacturer	Light Graphix
Reference	LD10235
Contact	Dylan Parry E: dylan@lightgraphix.biz M: 07340399180

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Product Image

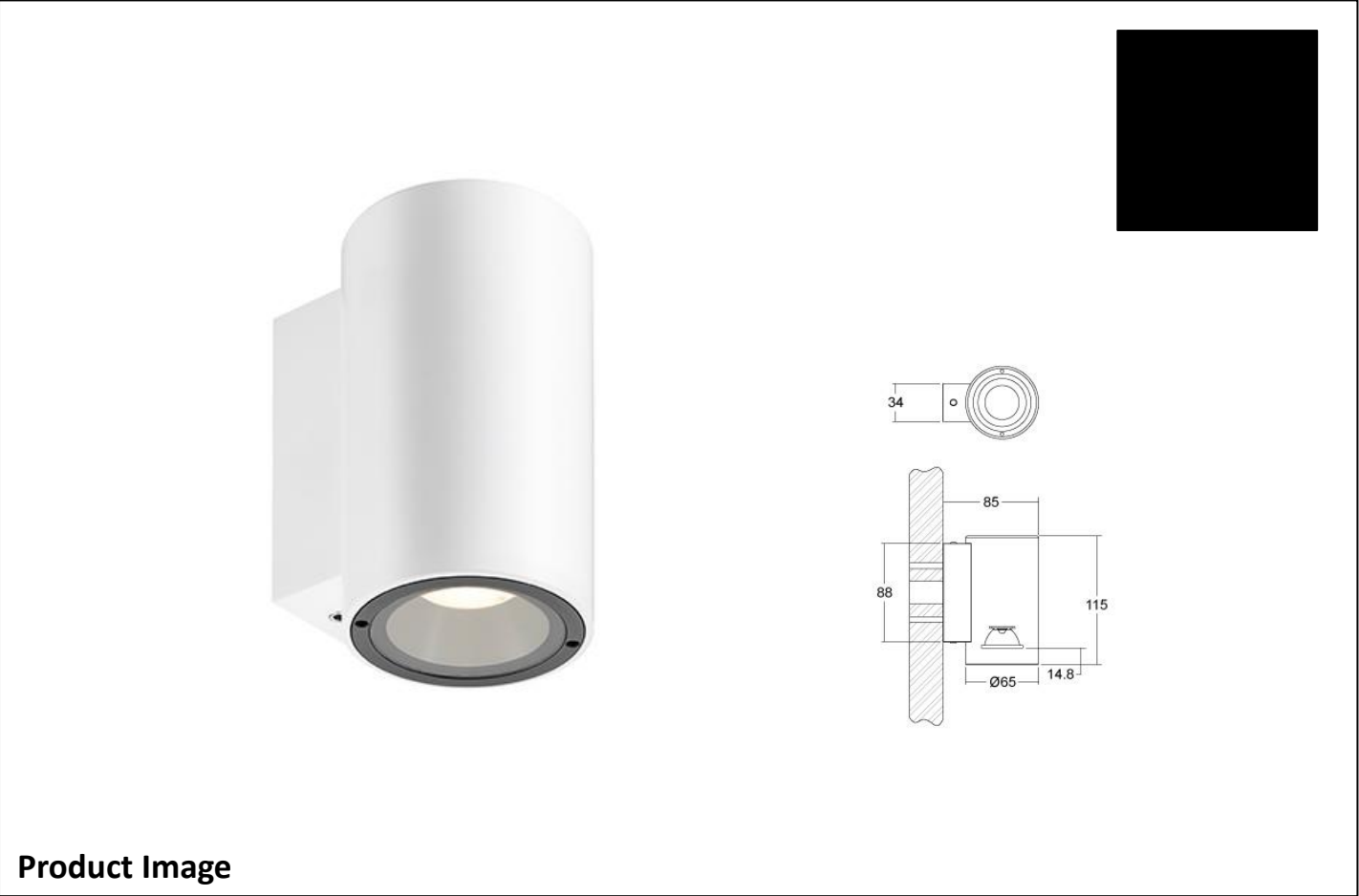


Product Dimensions / Application Shot

X7W

Description	Column mounted downlight
Fixing Type	Wall mounted
Finish	TBC
Attachments / Spec	55 degree beam Honeycomb louvre
Colour Temperature	2700K
Colour Rendering Index	>93
Light Source	LED
Dimming Protocol	DALI
Wattage	8.4w
Lumen Output	653 lm
Lumens per Watt	65 lm/w
IP Rating	66
Notes	Include for all drivers, connections and fixing details necessary for complete working installation
Manufacturer	Light Graphix
Reference	LD10235
Contact	Dylan Parry E: dylan@lightgraphix.biz M: 07340399180

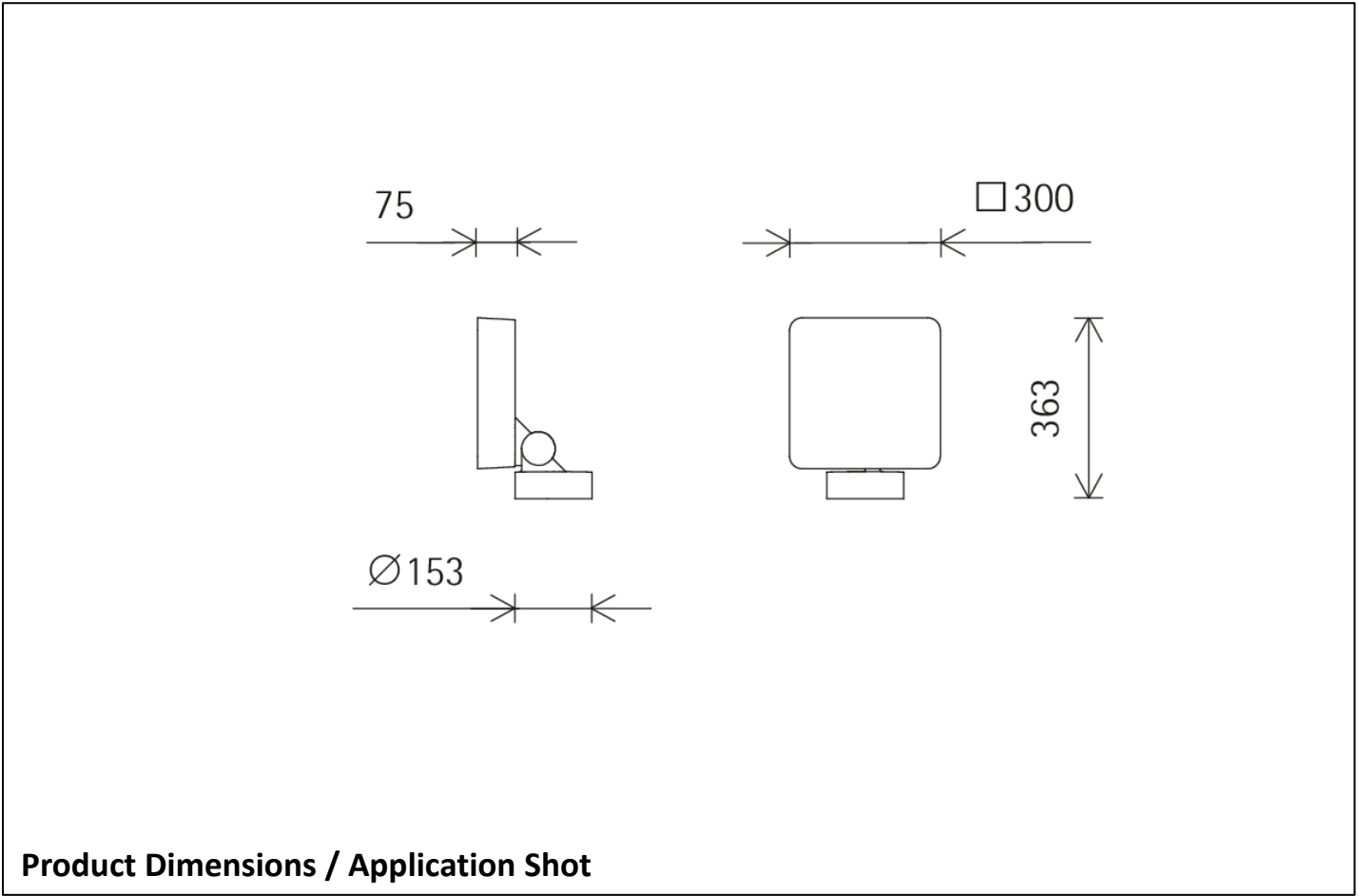
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X8

Description	Surface mounted external projector
Fixing Type	Surface mounted
Finish	TBC
Attachments / Spec	
Colour Temperature	2700K
Colour Rendering Index	>90
Light Source	LED
Dimming Protocol	DALI
Wattage	81 w
Lumen Output	5881 lm
Lumens per Watt	73 lm/w
IP Rating	65
Notes	Include for all drivers, connections and fixing details necessary for complete working installation
Manufacturer	Erco
Reference	Lightscan Projector - Flood
Contact	Steve Redhead E: s.redhead@erco.com T: +44 (0) 7860 266015

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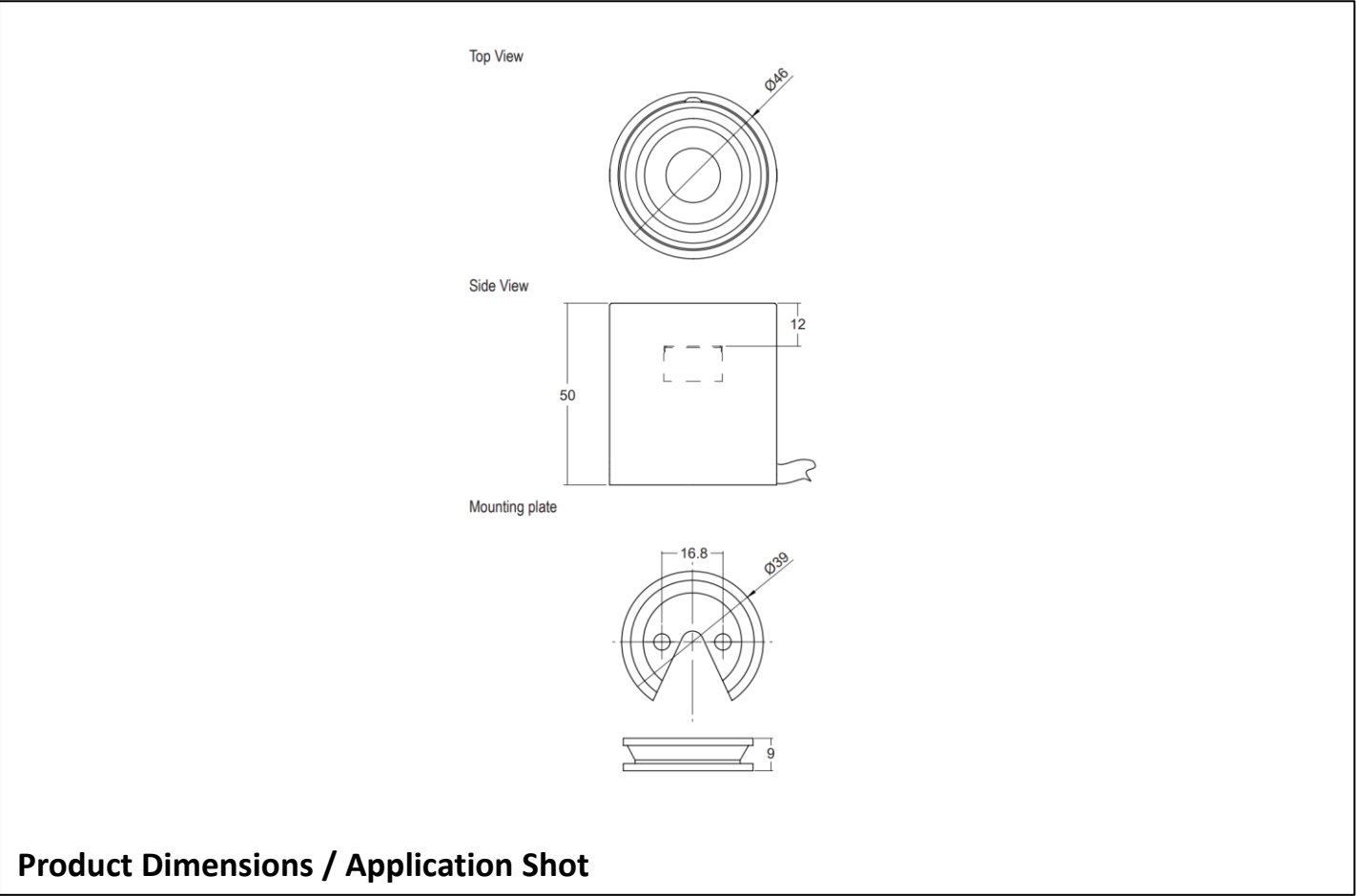
X9

Description	Surface mounted LED downlight
Fixing Type	Ceiling mounted
Finish	TBC
Attachments / Spec	12 degree beam Honeycomb louvre
Colour Temperature	2700K
Colour Rendering Index	>93
Light Source	LED
Dimming Protocol	DALI
Wattage	2.4w
Lumen Output	177 lm
Lumens per Watt	77 lm/w
IP Rating	66
Notes	Include for all drivers, connections and fixing details necessary for complete working installation
Manufacturer	Light Graphix
Reference	LD95
Contact	Dylan Parry E: dylan@lightgraphix.biz M: 07340399180

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Product Image



Product Dimensions / Application Shot

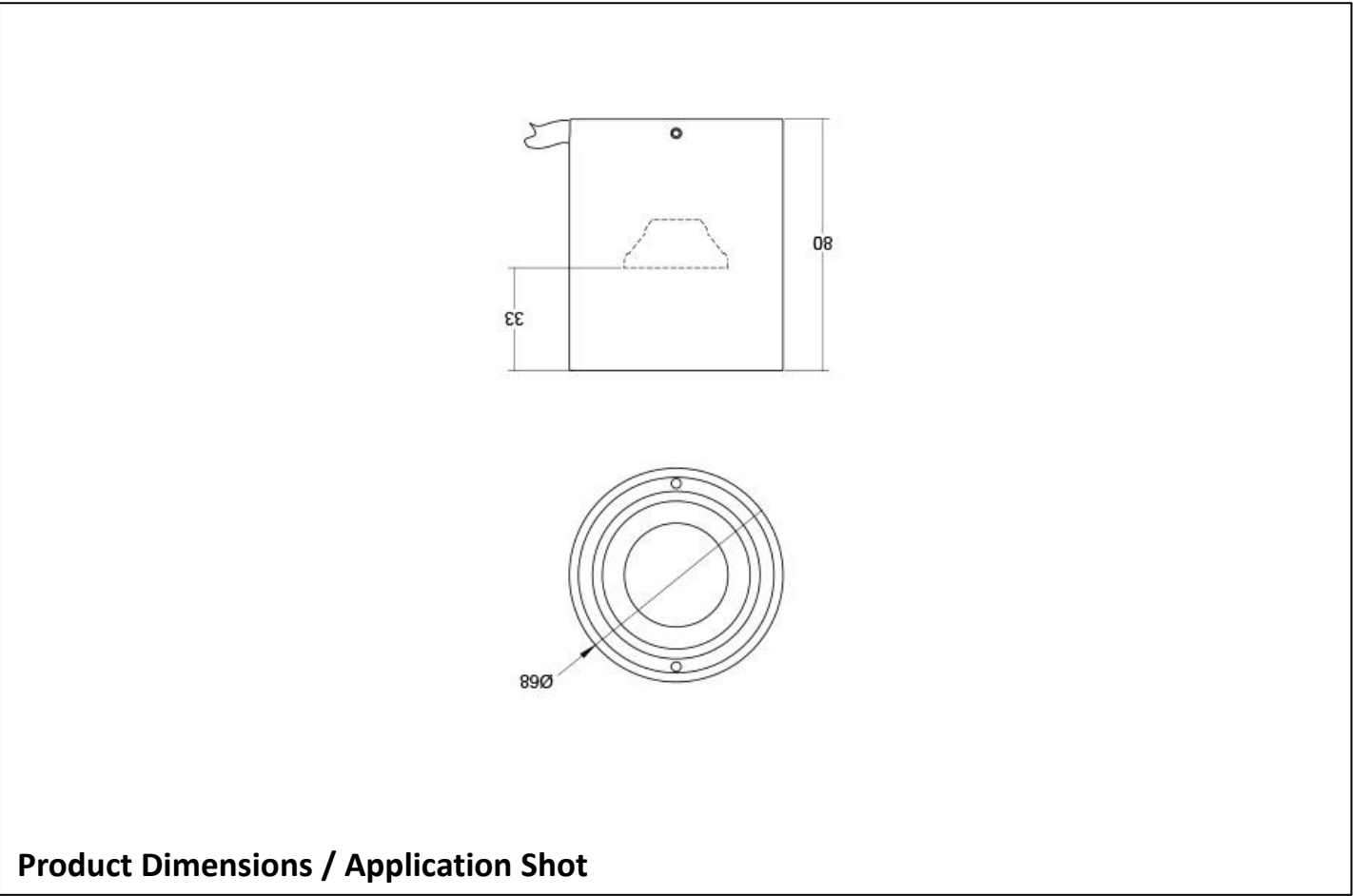
X10

Description	Surface mounted downlight
Fixing Type	Wall mounted
Finish	TBC
Attachments / Spec	54 degree beam Glare shield
Colour Temperature	2700K
Colour Rendering Index	>93
Light Source	LED
Dimming Protocol	DALI
Wattage	8.4w
Lumen Output	653 lm
Lumens per Watt	65 lm/w
IP Rating	66
Notes	Include for all drivers, connections and fixing details necessary for complete working installation
Manufacturer	Light Graphix
Reference	LD10235
Contact	Dylan Parry E: dylan@lightgraphix.biz M: 07340399180

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Product Image



Product Dimensions / Application Shot

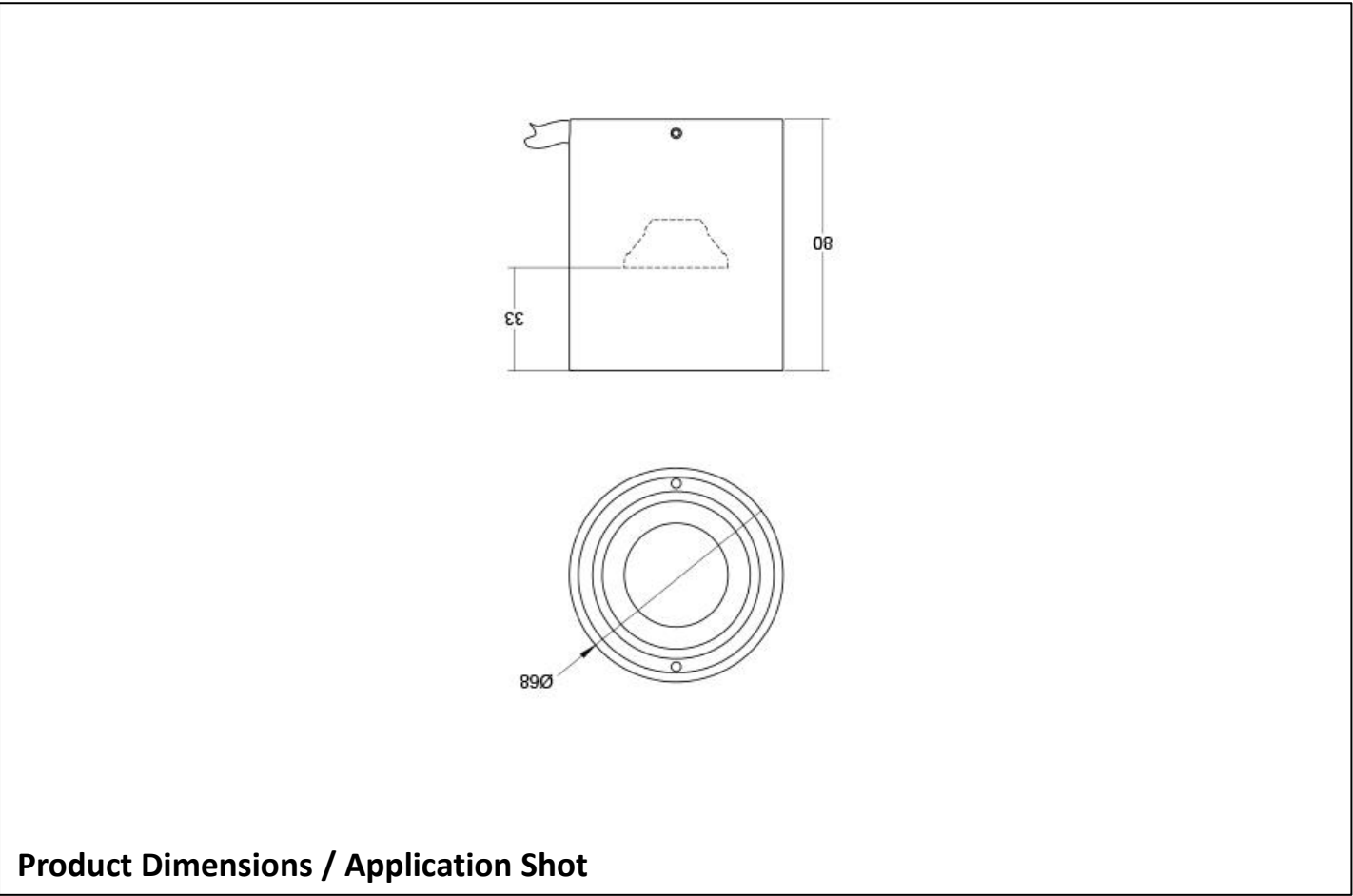
X11

Description	Surface mounted downlight
Fixing Type	Wall mounted
Finish	TBC
Attachments / Spec	54 degree beam
Colour Temperature	2700K
Colour Rendering Index	>93
Light Source	LED
Dimming Protocol	DALI
Wattage	8.4w
Lumen Output	653 lm
Lumens per Watt	65 lm/w
IP Rating	66
Notes	Include for all drivers, connections and fixing details necessary for complete working installation
Manufacturer	Light Graphix
Reference	LD10235
Contact	Dylan Parry E: dylan@lightgraphix.biz M: 07340399180

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Product Image

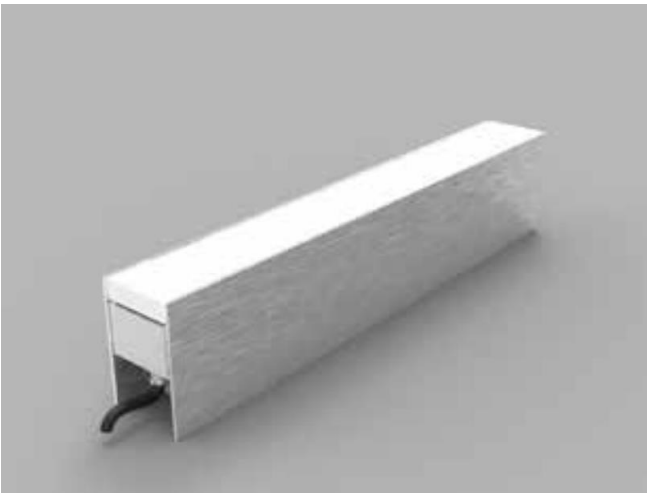


Product Dimensions / Application Shot

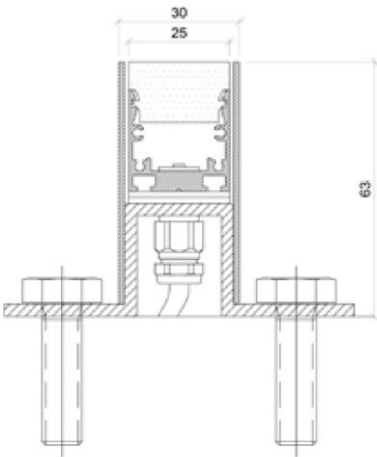
X12

Description	Recessed inground linear LED
Fixing Type	Recessed into ground
Finish	NA
Attachments / Spec	Allow for ground recessing kit
Colour Temperature	2700K
Colour Rendering Index	>90
Light Source	LED
Dimming Protocol	DALI
Wattage	14.4 w/m
Lumen Output	TBC lm/m
Lumens per Watt	TBC lm/w
IP Rating	67
Notes	Include for all drivers, connections and fixing details necessary for complete working installation
Manufacturer	Light Lab
Reference	GL25 Inground with base mount
Contact	Graeme Laurie E: graeme@thelightlab.com T: 0 207 278 2678

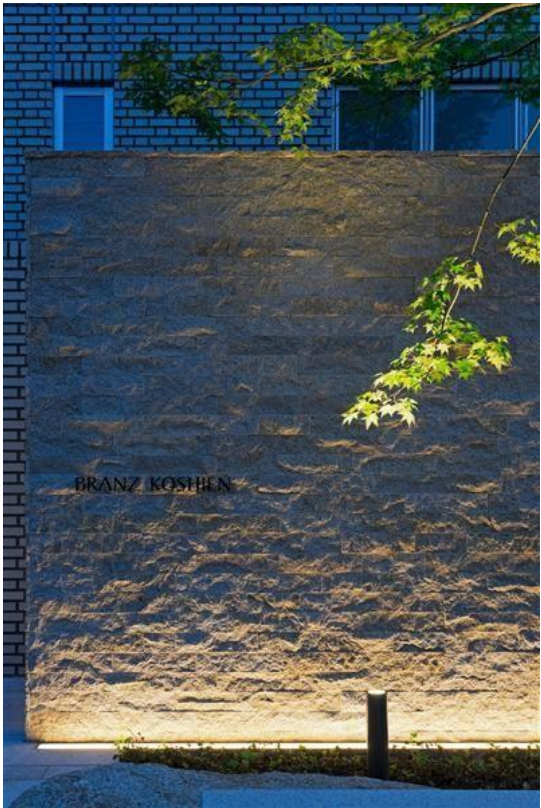
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Flange Mount (FM)



Product Image



Product Dimensions / Application Shot

Emergency

EM

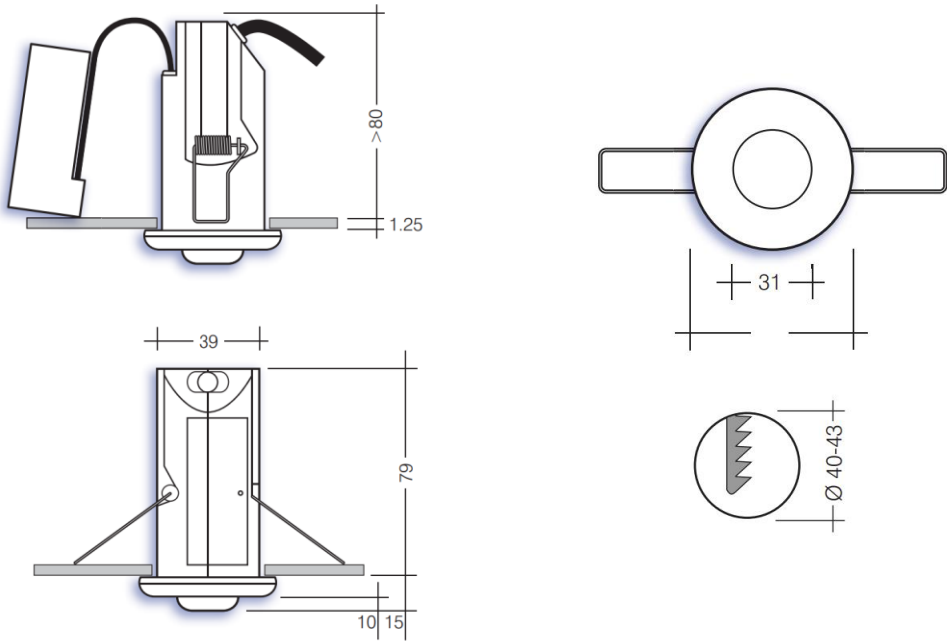
Description	Non maintained emergency LED downlight
Fixing Type	Ceiling Recessed
Finish	Allow for RAL finish to match ceiling finishes
Attachments / Spec	
Colour Temperature	NA
Colour Rendering Index	NA
Light Source	LED
Dimming Protocol	NA
Wattage	NA
Lumen Output	NA
Lumens per Watt	NA
IP Rating	20
Notes	Include for all drivers, connections and fixing details necessary for complete working installation
Manufacturer	LDL Lighting
Reference	TR2 Recessed LED
Contact	James Wilkinson E: james@ldl.lighting T: 07435552084

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RAL
TBC

Product Image

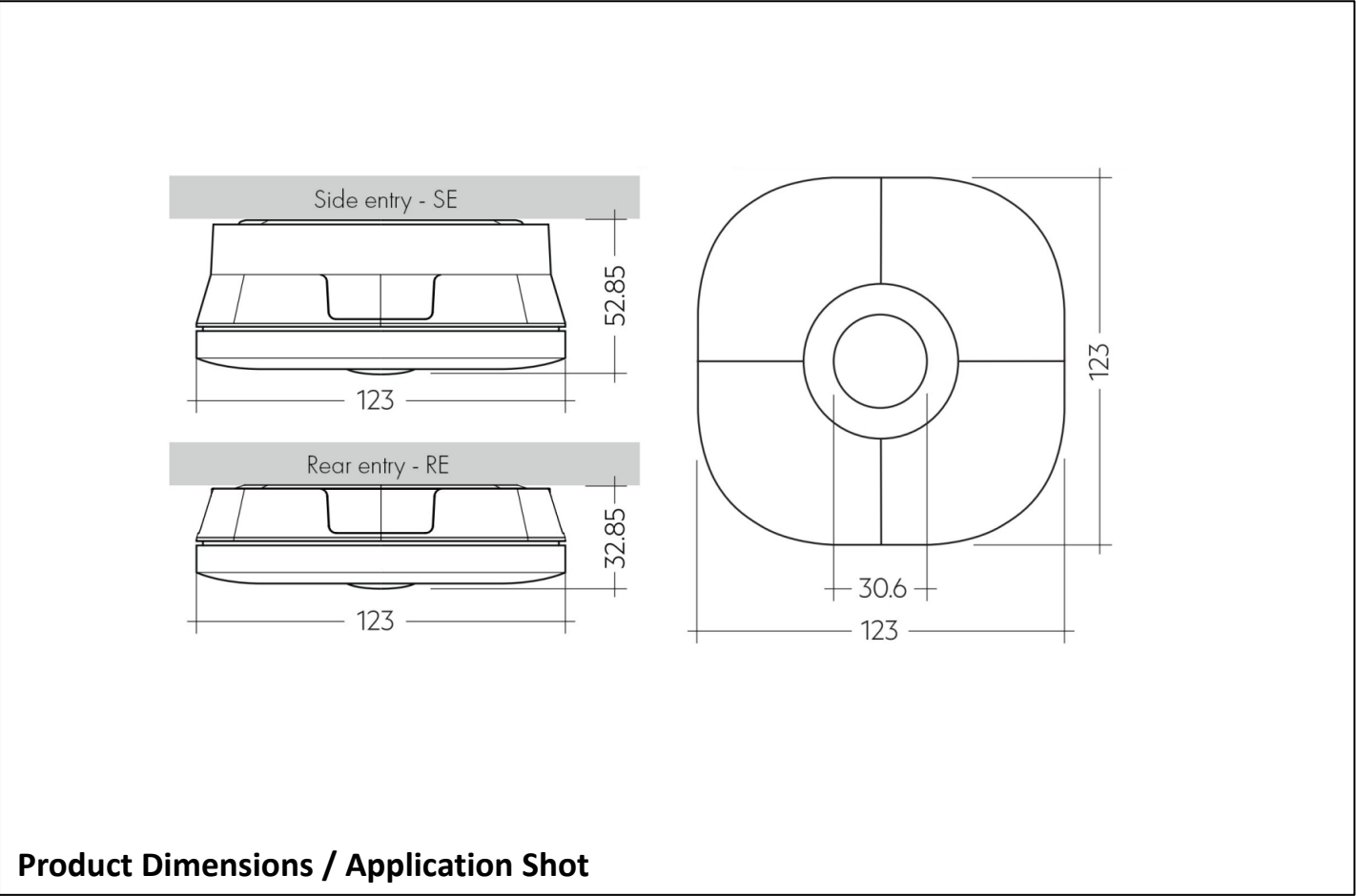


Product Dimensions / Application Shot

EM1

Description	Non maintained emergency LED downlight
Fixing Type	Surface mounted
Finish	Allow for RAL finish to match ceiling finishes
Attachments / Spec	
Colour Temperature	NA
Colour Rendering Index	NA
Light Source	LED
Dimming Protocol	NA
Wattage	NA
Lumen Output	NA
Lumens per Watt	NA
IP Rating	20
Notes	Include for all drivers, connections and fixing details necessary for complete working installation
Manufacturer	LDL Lighting
Reference	TR2 Surface LED
Contact	James Wilkinson E: james@ldl.lighting T: 07435552084

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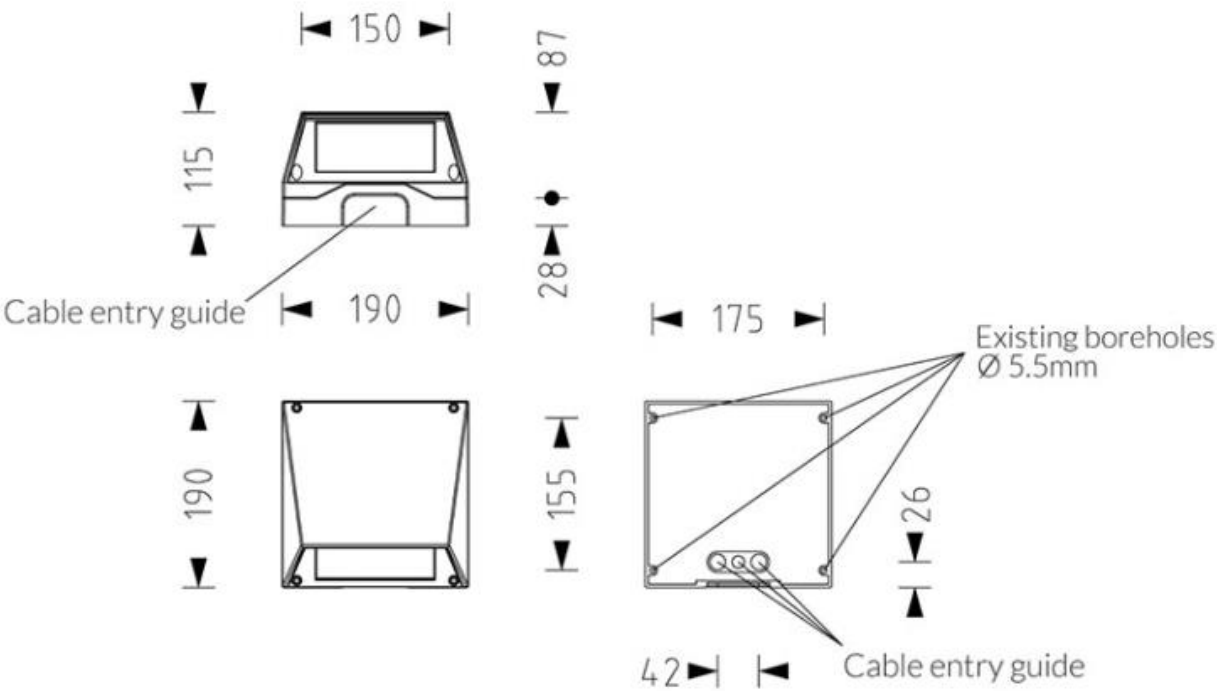
EM2

Description	Final Exit Non maintained emergency LED downlight
Fixing Type	Surface mounted
Finish	Black
Attachments / Spec	
Colour Temperature	NA
Colour Rendering Index	NA
Light Source	LED
Dimming Protocol	NA
Wattage	NA
Lumen Output	NA
Lumens per Watt	NA
IP Rating	65
Notes	Include for all drivers, connections and fixing details necessary for complete working installation
Manufacturer	Arlico
Reference	Peak
Contact	T: +44 (0)23 8202 2100 E: sales@arli.co

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Product Image

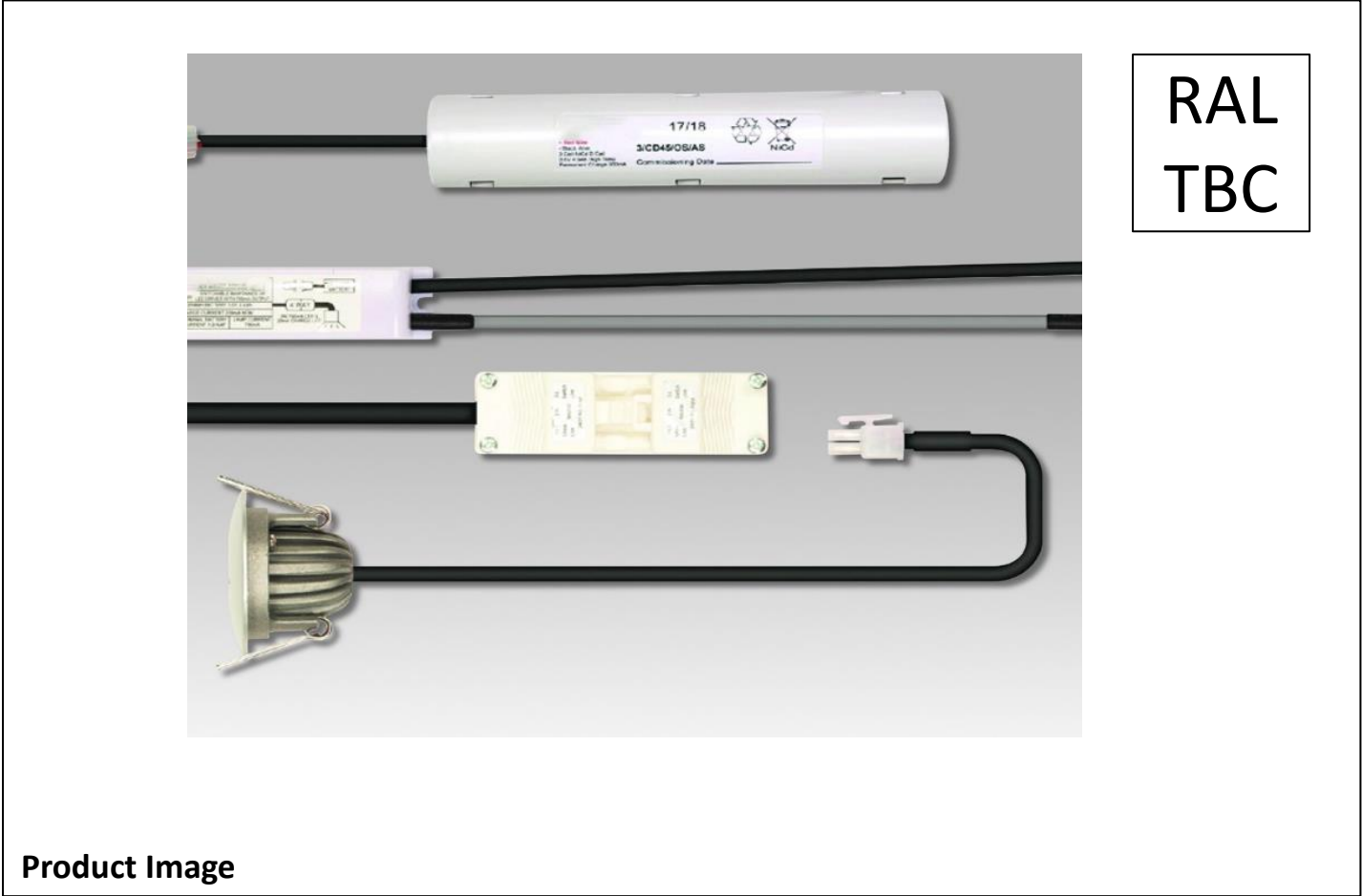
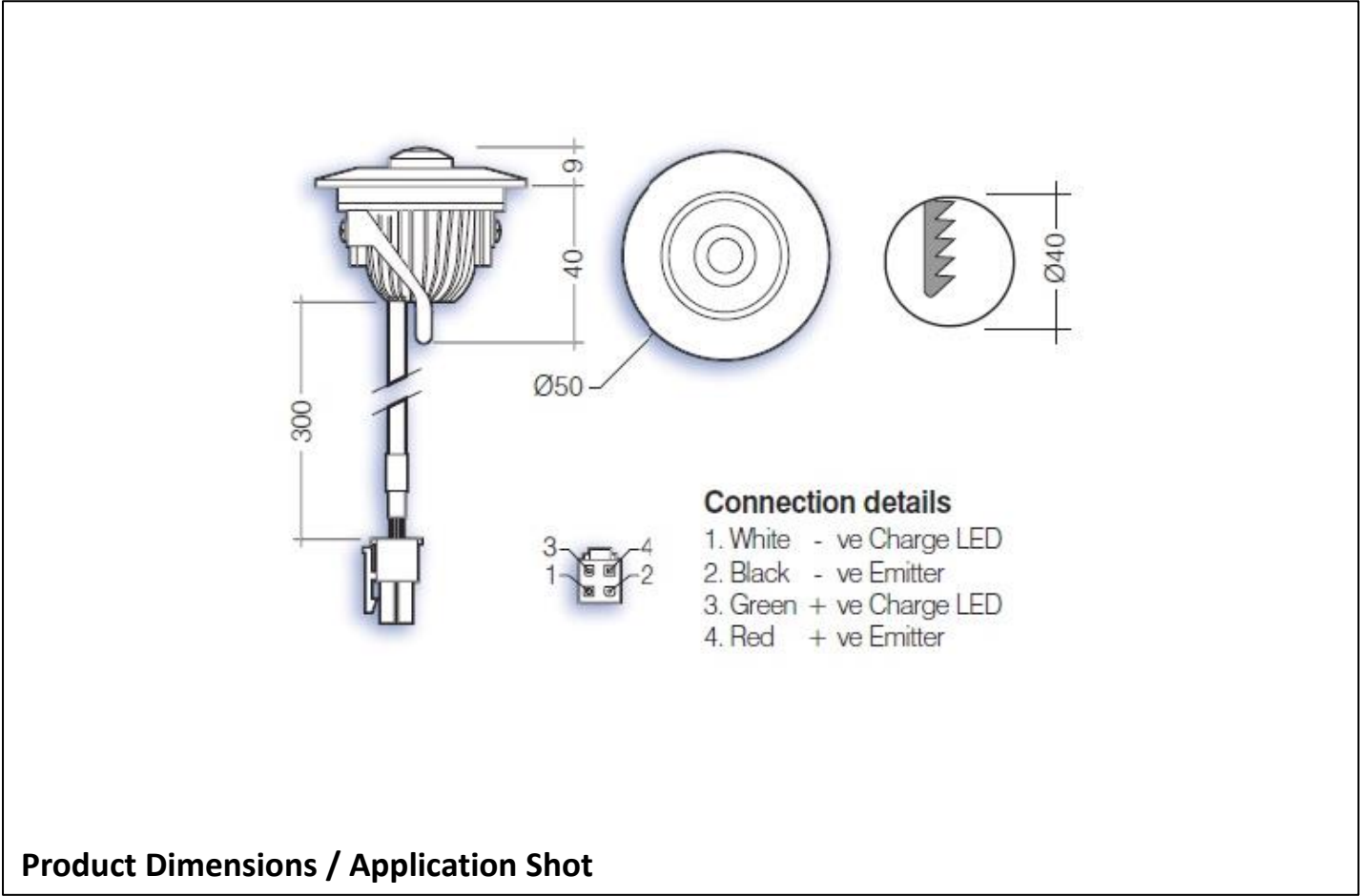


Product Dimensions / Application Shot

EM3

Description	Non maintained emergency LED downlight
Fixing Type	Ceiling Recessed
Finish	Allow for RAL finish to match pergola finish
Attachments / Spec	
Colour Temperature	NA
Colour Rendering Index	NA
Light Source	LED
Dimming Protocol	NA
Wattage	NA
Lumen Output	NA
Lumens per Watt	NA
IP Rating	54
Notes	Include for all drivers, connections and fixing details necessary for complete working installation
Manufacturer	LDL Lighting
Reference	LED3 Recessed
Contact	James Wilkinson E: james@ldl.lighting T: 07435552084

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LUMINAIRE SCHEDULE NOTES

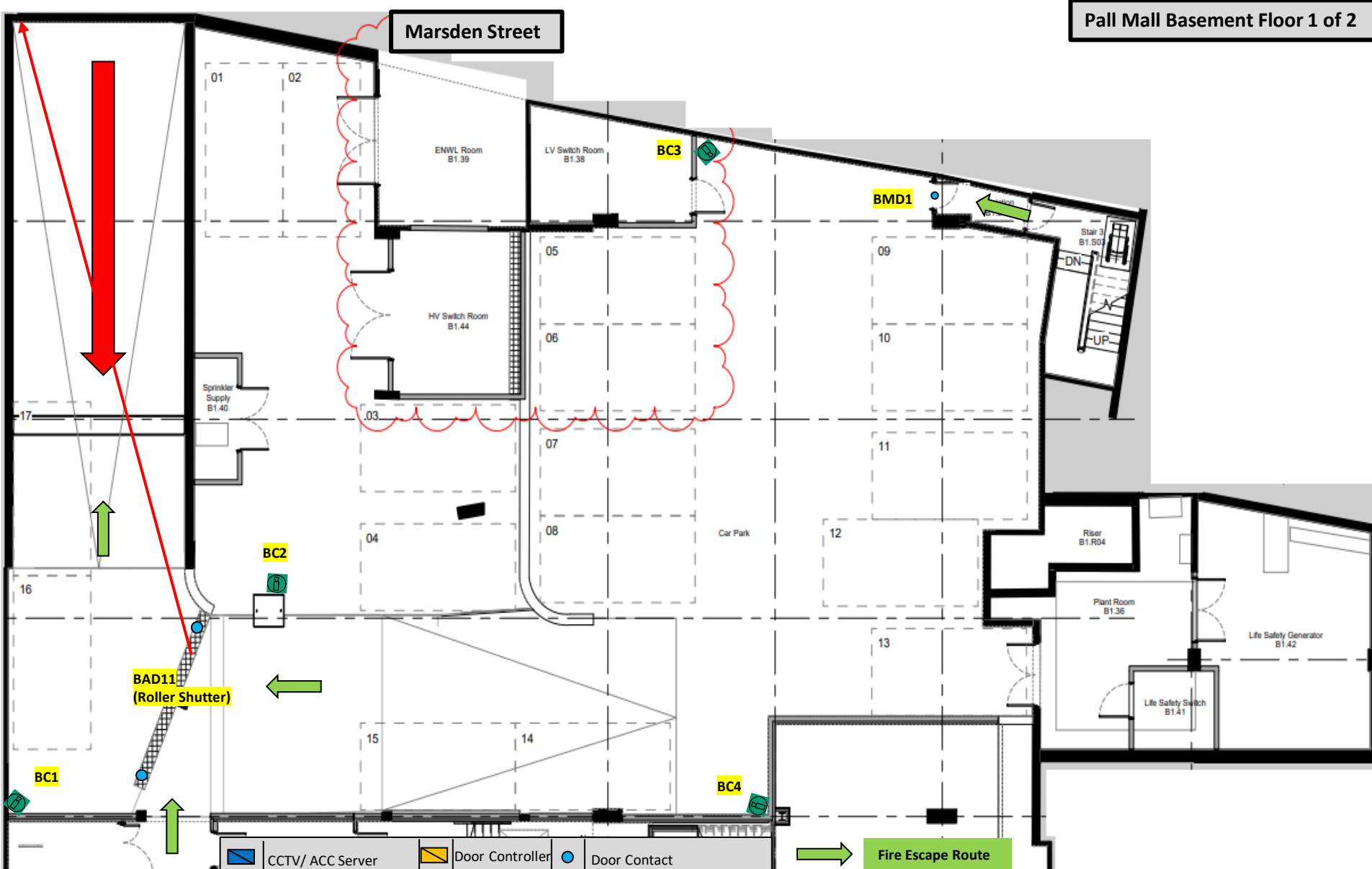
- The luminaire schedule shall be read in conjunction with the architects coordinated ceiling drawings, joinery detail drawings, and low-level power and data drawings.
- The main contractor shall provide 1no sample of each luminaire type for the client, architect and lighting designer to review prior to final sign off and ordering of the equipment
- All samples shall be plugged to review light distribution and effect
- Where bespoke luminaires have been specified the main contractor shall issue detail design drawings for each fitting type for the client, architect and lighting designer to review prior to final sign off and ordering of the equipment
- The main contractor shall ensure all lighting equipment is compatible with the chosen control gear and provides both seamless dimming and colour change capabilities
- 'e' Adjacent to luminaire references denotes 3hr integral emergency conversion unless otherwise stated
- The Main Contractor shall ensure all luminaires have the necessary British Standard compliance with Building Regulations and Fire Safety Regulations

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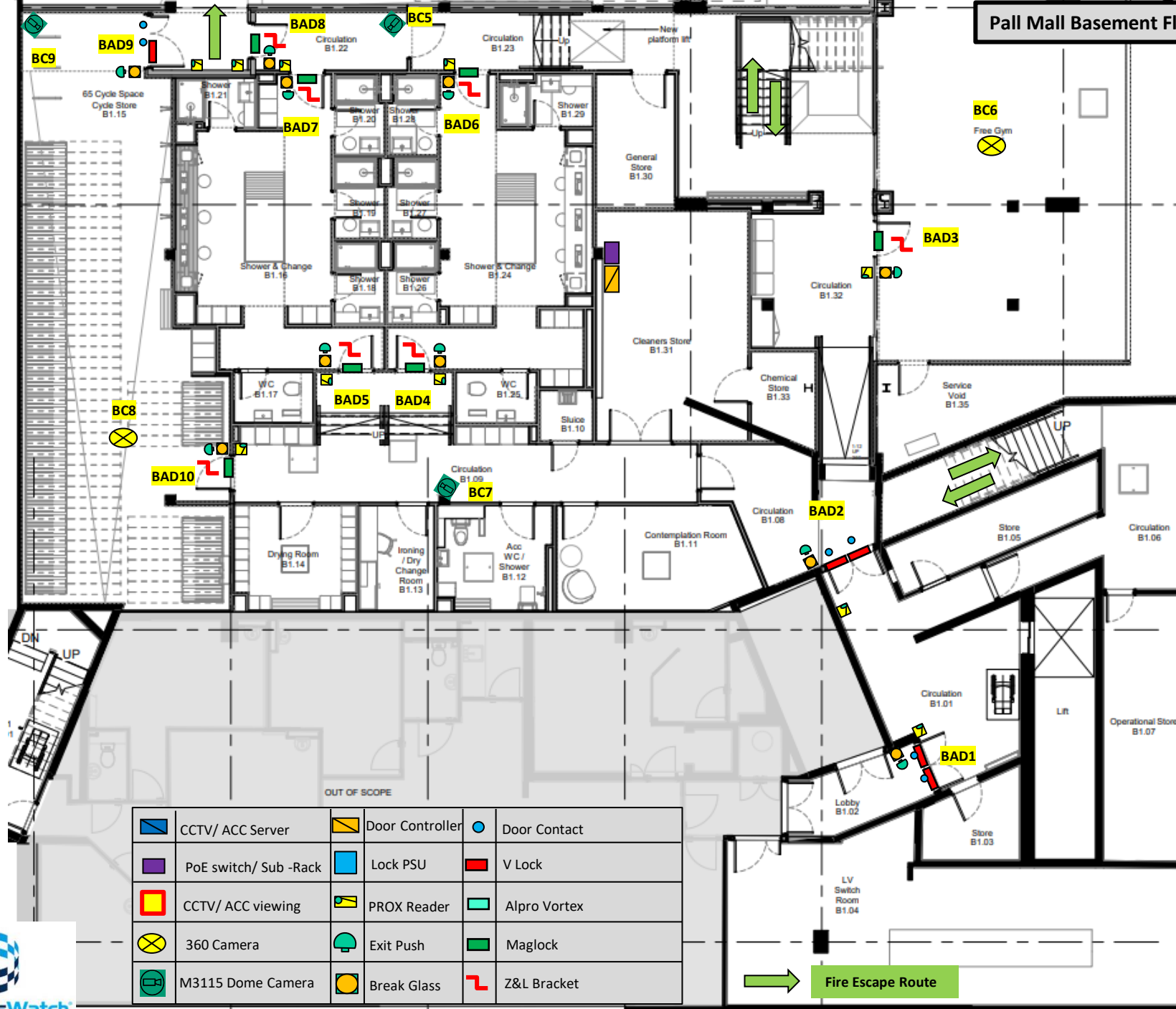
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Contact - Luke Artingstall – Director - E: lukeart@artinlight.co.uk - T: +44 (0)7754056647

Marsden Street



	CCTV/ ACC Server		Door Controller		Door Contact
	PoE switch/ Sub -Rack		Lock PSU		V Lock
	CCTV/ ACC viewing		PROX Reader		Alpro Vortex
	360 Camera		Exit Push		Maglock
	M3115 Dome Camera		Break Glass		Z&L Bracket



	CCTV/ ACC Server		Door Controller		Door Contact
	PoE switch/ Sub -Rack		Lock PSU		V Lock
	CCTV/ ACC viewing		PROX Reader		Alpro Vortex
	360 Camera		Exit Push		Maglock
	M3115 Dome Camera		Break Glass		Z&L Bracket



Marsden Street

Pall Mall Lower Ground Floor

BAD11
(Roller Shutter)

LGFC12

LGFC11

LGFC4

LGFC5

LGFC10

LGFC9

LGFC2

Riser
LG.R02

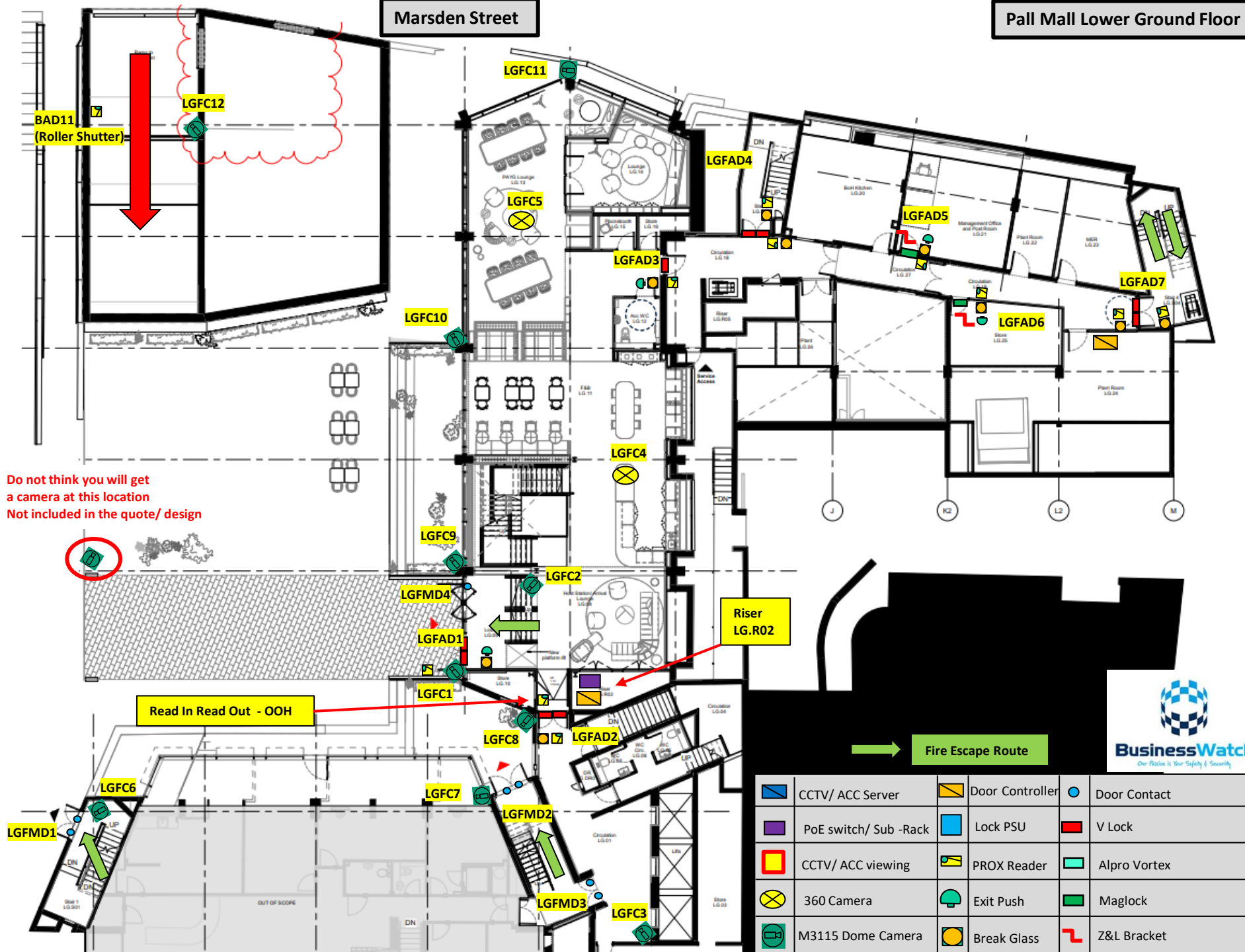
Read In Read Out - OOH

Fire Escape Route

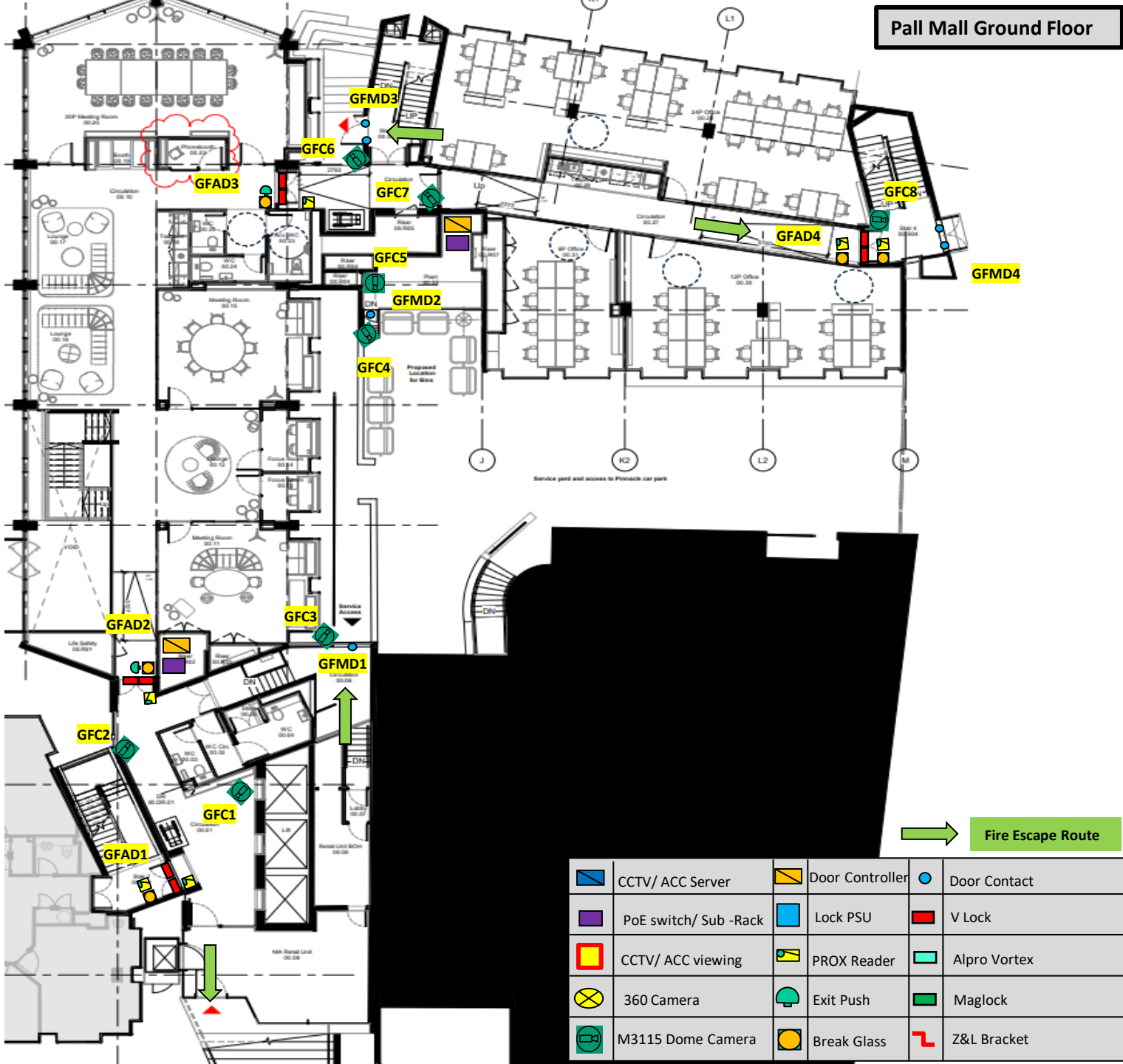


	CCTV/ ACC Server		Door Controller		Door Contact
	PoE switch/ Sub -Rack		Lock PSU		V Lock
	CCTV/ ACC viewing		PROX Reader		Alpro Vortex
	360 Camera		Exit Push		Maglock
	M3115 Dome Camera		Break Glass		Z&L Bracket

Do not think you will get
a camera at this location
Not included in the quote/ design

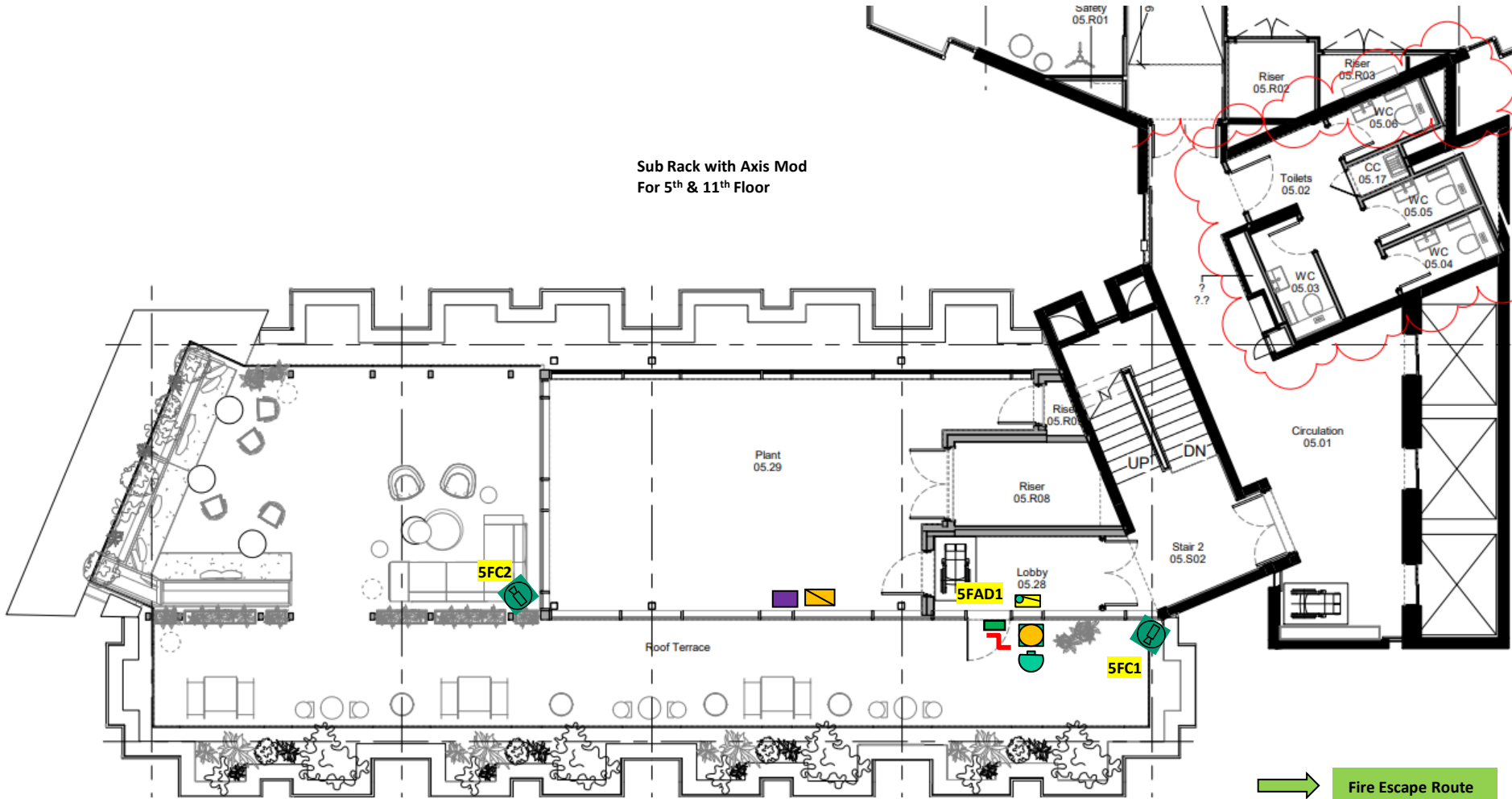


Pall Mall Ground Floor



	CCTV/ ACC Server		Door Controller		Door Contact
	PoE switch/ Sub -Rack		Lock PSU		V Lock
	CCTV/ ACC viewing		PROX Reader		Alpro Vortex
	360 Camera		Exit Push		Maglock
	M3115 Dome Camera		Break Glass		Z&L Bracket

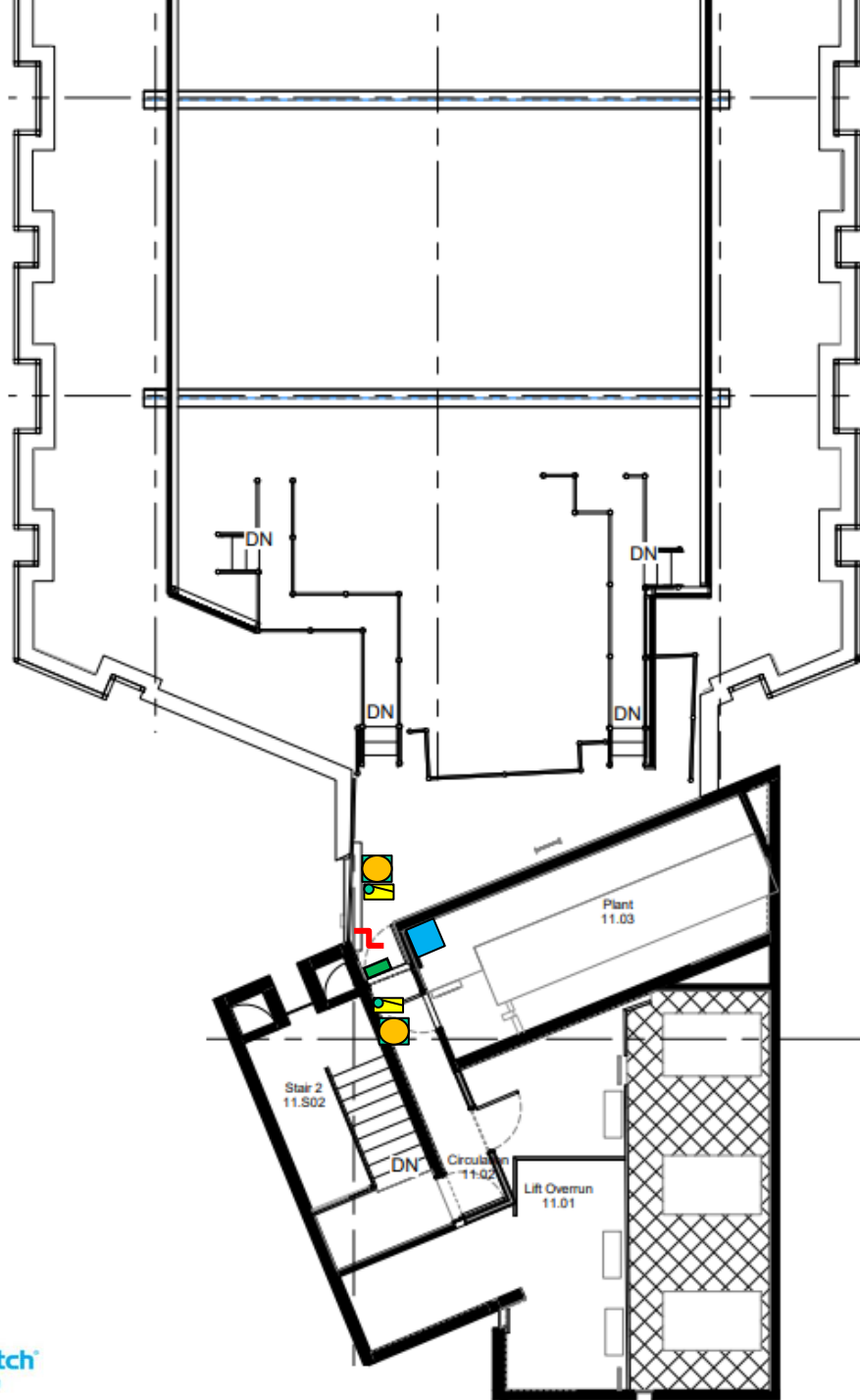
Sub Rack with Axis Mod
For 5th & 11th Floor



Fire Escape Route

	CCTV/ ACC Server		Door Controller		Door Contact
	PoE switch/ Sub -Rack		Lock PSU		V Lock
	CCTV/ ACC viewing		PROX Reader		Alpro Vortex
	360 Camera		Exit Push		Maglock
	M3115 Dome Camera		Break Glass		Z&L Bracket





→ Fire Escape Route

	CCTV/ ACC Server		Door Controller		Door Contact
	PoE switch/ Sub -Rack		Lock PSU		V Lock
	CCTV/ ACC viewing		PROX Reader		Alpro Vortex
	360 Camera		Exit Push		Maglock
	M3115 Dome Camera		Break Glass		Z&L Bracket



AXIS M3115-LVE Network Camera

Affordable flat-faced 1080p dome with IR

AXIS M3115-LVE is an affordable, flat-faced dome designed to suppress light reflections. This compact, IK08-rated camera features a wide-angle view in HDTV 1080p video. It includes Forensic WDR, Lightfinder and built-in IR illumination for sharp video with clear colors even in challenging light or complete darkness. Additionally, it offers flexible installation for both indoor and outdoor surveillance. And, with its 3-axis camera-angle adjustment, it can be easily leveled and directed. It features enhanced security functionality, and Axis Zipstream with support for H.264/H.265 significantly reduces bandwidth and storage requirements without compromising image quality.

- > **HDTV 1080p video quality**
- > **Forensic WDR, Lightfinder and IR illumination**
- > **Flat-faced design suppressing light reflections**
- > **Zipstream supporting H.264 and H.265**
- > **Signed firmware and secure boot**



AXIS M3115-LVE Network Camera

Camera		Pre- and post-alarm video or image buffering for recording or upload Notification: email, HTTP, HTTPS, TCP, and SNMP trap Overlay text
Image sensor	1/2.9" progressive scan RGB CMOS	
Lens	2.8 mm, F2.0 Horizontal field of view: 105° Vertical field of view: 58° Fixed iris, Fixed focus, IR corrected	
Day and night	Automatically removable infrared-cut filter	
Minimum illumination	Color: 0.17 lux at 50 IRE, F2.0 B/W: 0.03 lux at 50 IRE, F2.0 0 lux with IR illumination on	
Shutter speed	1/33500 s to 2 s	
Camera angle adjustment	Pan: ±180° Tilt: 0° to 60° (0° = lens directed at a right angle to camera base) Rotation: ±95° Can be directed in any direction and see the wall/ceiling	
System on chip (SoC)		
Model	ARTPEC-7	
Memory	512 MB RAM, 512 MB Flash	
Video		
Video compression	H.264 (MPEG-4 Part 10/AVC) Baseline, Main and High Profiles H.265 (MPEG-H Part 2/HEVC) Main Profile Motion JPEG	
Resolution	1920x1080 to 160x90	
Frame rate	Up to 25/30 fps with power line frequency 50/60 Hz	
Video streaming	Multiple, individually configurable streams in H.264, H.265 and Motion JPEG Axis Zipstream technology in H.264 and H.265 Controllable frame rate and bandwidth VBR/ABR/MBR H.264/H.265	
Multi-view streaming	Up to 2 individually cropped out view areas in full frame rate	
Image settings	Compression, color saturation, brightness, sharpness, contrast, local contrast, white balance, day/night threshold, tone mapping, exposure control (including automatic gain control), exposure zones, Forensic WDR: up to 120 dB depending on scene, fine tuning of low-light behavior, defogging, dynamic text and image overlay, privacy masks, mirroring, rotation: 0°, 90°, 180°, 270° including Corridor Format	
Pan/Tilt/Zoom	Digital PTZ	
Audio		
Audio input/output	Two-way audio connectivity via the optional AXIS T61 Audio and I/O Interfaces with portcast technology	
Network		
Security	Password protection, IP address filtering, HTTPS ^a encryption, IEEE 802.1x (EAP-TLS) ^a network access control, Digest authentication, User access log, Centralized Certificate Management, brute force delay protection, signed firmware, secure boot	
Network protocols	IPv4, IPv6 USGv6, ICMPv4/ICMPv6, HTTP, HTTP/2, HTTPS ^a , TLS ^a , QoS Layer 3 DiffServ, FTP, SFTP, CIFS/SMB, SMTP, mDNS (Bonjour), UPnP [®] , SNMP v1/v2c/v3 (MIB-II), DNS/DNSv6, DDNS, NTP, NTS, RTSP, RTP, SRTP, TCP, UDP, IGMPv1/v2/v3, RTCP, ICMP, DHCPv4/v6, ARP, SSH, SIP, LLDP, CDP, MQTT v3.1.1, Syslog, Link-Local address (ZeroConf)	
System integration		
Application Programming Interface	Open API for software integration, including VAPIX [®] and AXIS Camera Application Platform; specifications at axis.com One-Click Cloud Connection ONVIF [®] Profile G, ONVIF [®] Profile M, ONVIF [®] Profile S, and ONVIF [®] Profile T, specification at onvif.org Support for Session Initiation Protocol (SIP) for integration with Voice over IP (VoIP) systems, peer to peer or integrated with SIP/PBX.	
Event triggers	Analytics, Edge storage events, Virtual inputs through API	
Event actions	Record video: SD card and network share Upload of images or video clips: FTP, SFTP, HTTP, HTTPS, network share, and email	
Built-in installation aids		
Analytics		
Metadata	Object data: Classes: humans, faces, vehicles (types: cars, buses, trucks, bikes), license plates Confidence, position Event data: Producer reference, scenarios, trigger conditions	
Applications	Included AXIS Motion Guard, AXIS Fence Guard, AXIS Loitering Guard AXIS Video Motion Detection, active tampering alarm Support for AXIS Camera Application Platform enabling installation of third-party applications, see axis.com/acap	
General		
Casing	IP66/IP67- and NEMA 4X-rated, IK08 impact-resistant casing Encapsulated electronics and captive screws (Torx 10) Color: white NCS S 1002-B For repainting instructions and impact on warranty, contact your Axis partner	
Sustainability	PVC free	
Power	Power over Ethernet (PoE) IEEE 802.3af/802.3at Type 1 Class 3 Typical: 3.7 W, Max.: 8.7 W	
Connectors	RJ45 10BASE-T/100BASE-TX PoE Audio and I/O connectivity via the optional AXIS T61 Audio and I/O Interfaces with portcast technology	
IR illumination	Power-efficient, long-life 850 nm IR LED. Range of reach 20 m (65 ft) or more depending on the scene	
Storage	Support for microSD/microSDHC/microSDXC card Support for SD card encryption (AES-XTS-Plain64 256bit) Recording to network-attached storage (NAS) For SD card and NAS recommendations see axis.com	
Operating conditions	-30 °C to 50 °C (-22 °F to 122 °F) Start-up temperature: -20 °C to 50 °C (-4 °F to 122 °F) Humidity 10–100% RH (condensing)	
Storage conditions	-40 °C to 65 °C (-40 °F to 149 °F) Humidity 5–95% RH (non-condensing)	
Approvals	EMC EN 55024, EN 55032 Class A, EN 55035, EN 61000-6-1, EN 61000-6-2, FCC Part 15 Subpart B Class A, KC KN32 Class A, KC KN35, RCM AS/NZS CISPR 32 Class A, ICES-3(A)/NMB-3(A), VCCI Class A Environment IEC 60068-2-1, IEC 60068-2-2, IEC 60068-2-78, IEC 60068-2-14, IEC 60068-2-6, IEC 60068-2-27 IEC/EN 62262 IK08, IEC/EN 60529 IP66/IP67, NEMA 250 Type 4X Safety IEC/EN/UL 60950-22, IEC/EN/UL 62368-1, IEC/EN 62471, IS 13252 Network NIST SP500-267, IPv6 USGv6	
Dimensions	Height: 94 mm (3.7 in) ø 101 mm (4.0 in)	
Weight	390 g (0.85 lb)	
Included accessories	Installation Guide, Windows decoder 1-user license, Torx [®] L-key, Connector guard, Cable gasket	
Optional accessories	AXIS T94B02D Pendant kit, AXIS T94B01P Conduit Back Box, AXIS T94B02M J-Box/Gang Box Plate, AXIS TM3807 Black Casing, Axis Mounts, AXIS Surveillance microSDXC [™] Card, AXIS Weathershield Kit C, AXIS T61 Audio and I/O Interface Series For more accessories, see axis.com	
Video management software	AXIS Companion, AXIS Camera Station, Video management software from Axis' Application Development Partners available on axis.com/vms	
Languages	English, German, French, Spanish, Italian, Russian, Simplified Chinese, Japanese, Korean, Portuguese, Traditional Chinese	

Warranty 5-year warranty, see axis.com/warranty

- a. *This product includes software developed by the OpenSSL Project for use in the OpenSSL Toolkit. (www.openssl.org), and cryptographic software written by Eric Young (eay@cryptsoft.com).*

Environmental responsibility:

axis.com/environmental-responsibility

Hidden Platform Lift



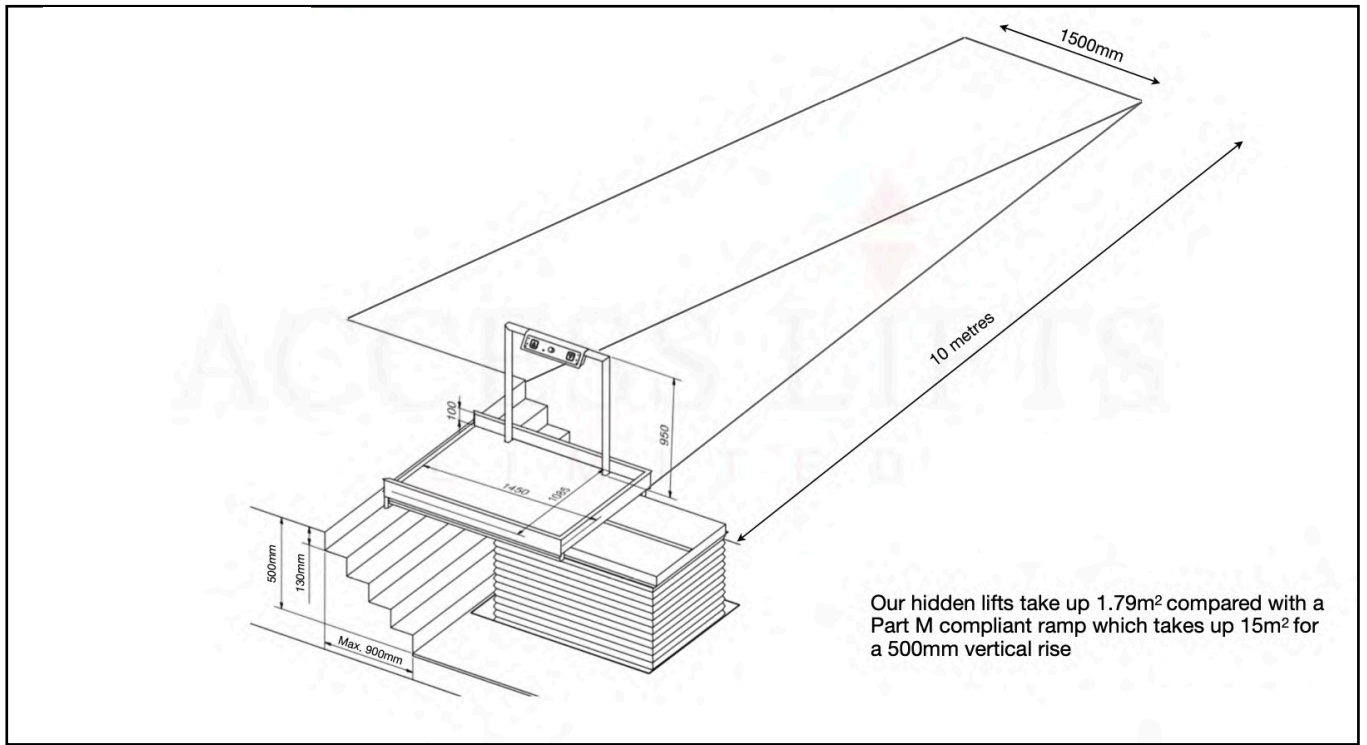
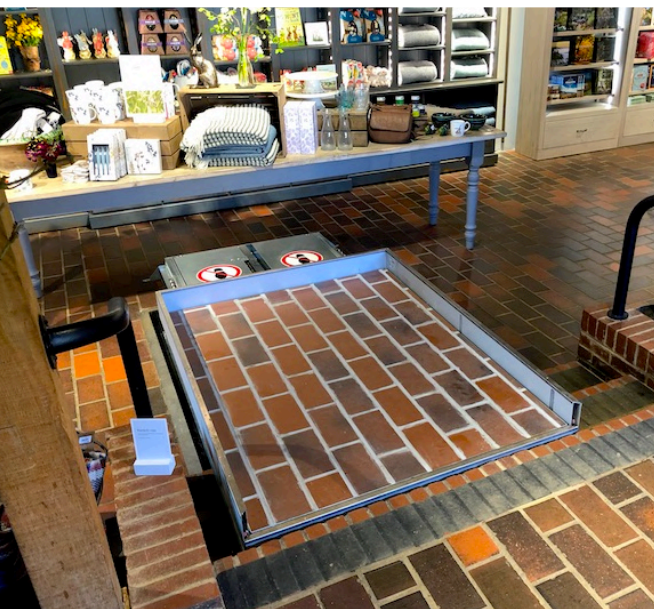
Technical Specification

Principal Information

The Hidden Platform Lift is the perfect solution for discreet sites such as listed buildings and buildings of historic importance. Our Hidden Platform Lift comes in its own pit tray which allows for simple installation which can take only a matter of hours. The recessed design allows users to enter the platform from any of the 3 lower landing sides make it easier to use compared with a traditional platform lift. When compared with a Part M compliant ramp for a 500mm vertical rise, the Hidden Platform Lift takes up less than an 1/8th of the space. This makes it perfect for buildings where space is at a premium such as restaurants, bars or shops. The lift can be finished with any material to match the surrounding flooring. With a 830mm vertical rise and 900mm horizontal travel, the Hidden Platform lift can provide access for most small stairwells offering a space saving solution which hides in plain sight. The Hidden Platform Lift comes with a number of on platform and landing controls which makes it exceptionally versatile. In addition we offer a number of bespoke finishes to make sure that the Hidden Platform Lift fits perfectly with each project.

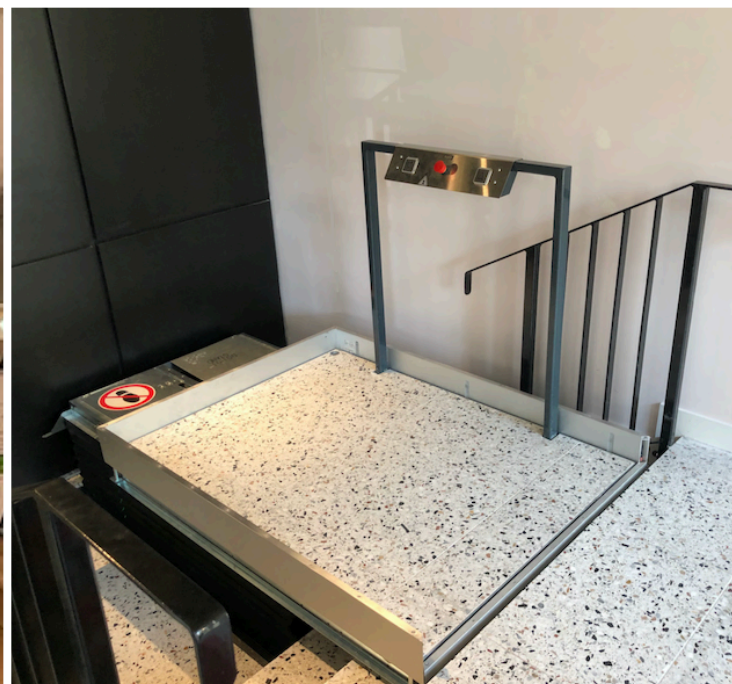
Platform size	1090mm x 1450mm
Pit size	1185mm x 1520mm
Pit depth	155mm
Lifting height	830mm
Traverse	900mm
Load	375kg
Speed	0.1m/s
Drive mechanism	Electric scissor





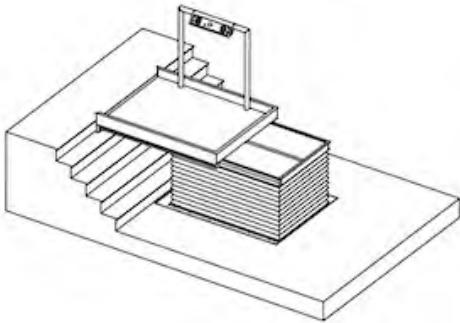
Finishes

Pit tray construction	Galvanised steel
Top tray finish	Any material up to 22mm including adhesive
Trim finish	Black rubber, stainless steel or anodised aluminium
Platform controls	Column, goalpost or without
Platform control finish	Stainless steel or powder-coated RAL colour
Platform protection	100mm retractable roll off protection on all sides
Underside protection	Black hard plastic bellows
Safety Edge	Underside anti-trap safety edge to all sides

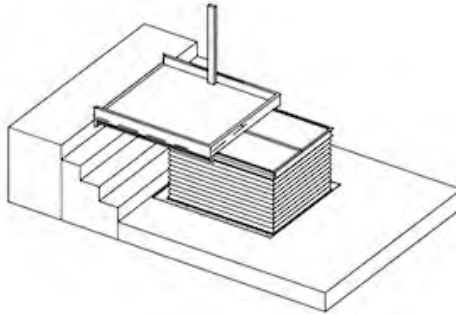


Optional Finishes

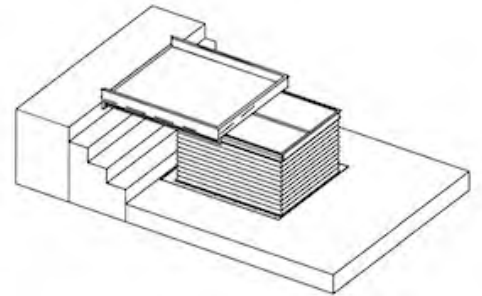
Platform controls



Goalpost

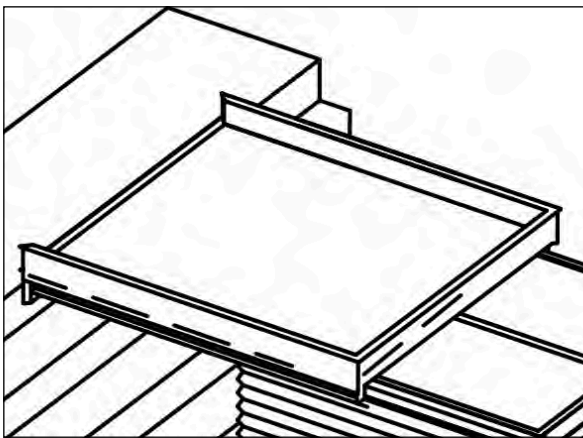


Column

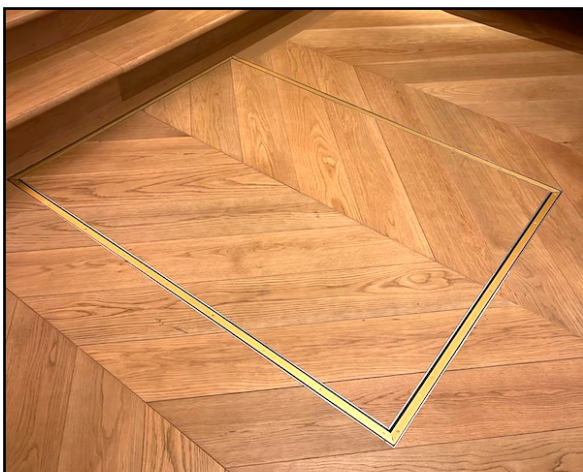


Without

Trim finish



Black rubber



Anodised aluminum



Stainless steel

Landing Controls

Access Lifts can provide a number of bespoke landing push buttons from easy to use 50mm x 50mm square push buttons which are surface mounted to more discreet 34mm x 34mm circular push buttons which are flush mounted. All push buttons are available in stainless steel, black and brass. Back boxes are available powder-coated in any RAL colour. Flush mounted face plates are available in a number of stainless steel finishes.



Dimensions	80 (w) x 160 (h) x 55 (d)
Push buttons	50 x 50 square buttons
Rating	IP67
Operation	Continuous pressure
Finish	RAL Colour
Connection	Wireless

Dimensions	80 (w) x 160 (h)
Push buttons	34 x 34 circular buttons
Rating	IP66
Operation	Continuous pressure
Finish	Stainless steel
Connection	Wireless

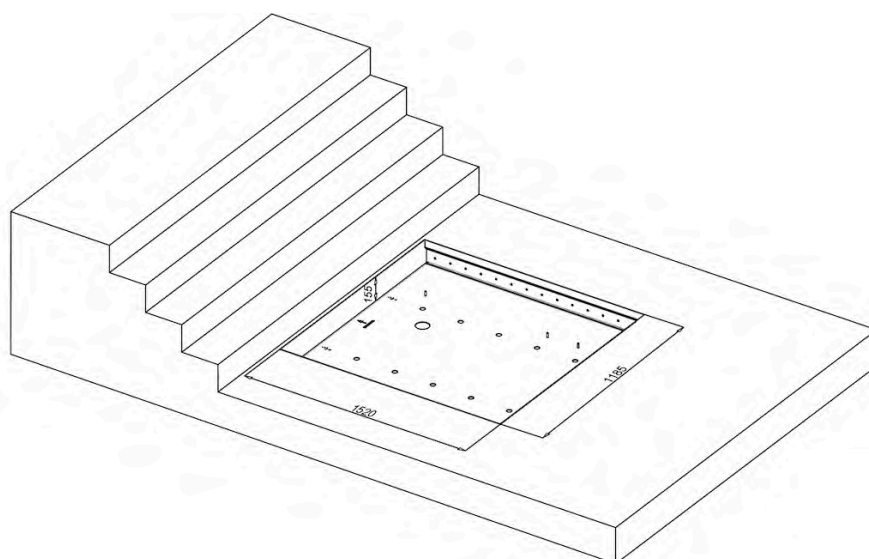
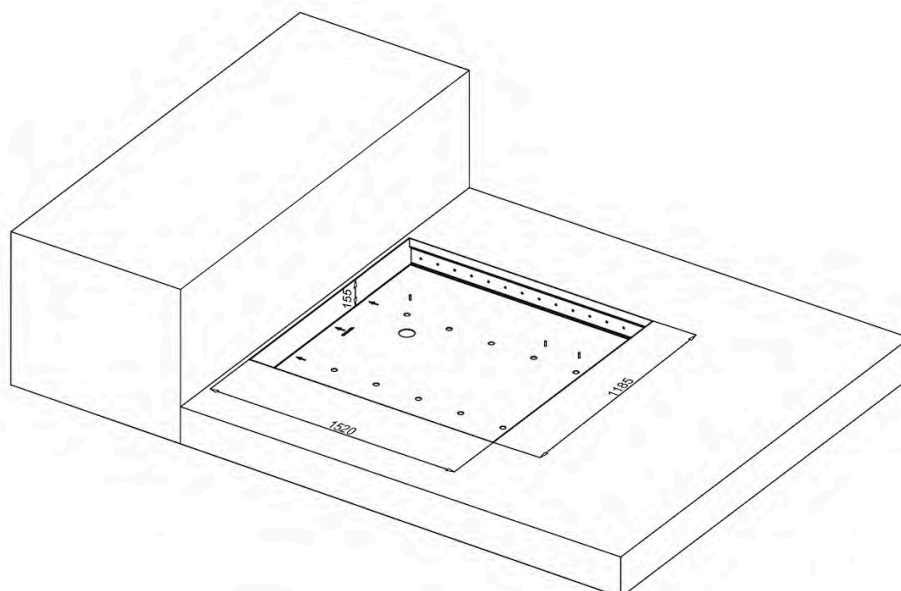


The Hidden Platform Lift can also come with remote control wireless key fobs, these controls offer the best form of control in projects with authorised use as well as private homes.

Electrical Requirements

Power supply	Single phase, 230V, 16A, 50Hz
Auxiliary circuit	24V DC
Power consumption	3W idle, 14.7W in use
Duty Cycle	19%
Fuse	T25A
Batteries	2x 12V, 7.2A

Pit Dimensions



ACCESS LIFTS
LIMITED





Fixing Methodology for the Mechanical Installation on Coffered Ceiling

Fan coil unit

- All fixings are to be drilled a minimum of 100mm up from the bottom of the structural beam.
- A 35mm deep 6 mm hole will then be drilled.
- Angle bracket will then be installed and fixed to the side off the structural beam using a 35mm HUSS concrete screw.
- M10 rod will then be secured through the angle bracket to allow Unistrut to be fixed to the underside of the coffer.
- The fan coil is then to be hung from the Unistrut supported via the angle bracket.

HVRF pipework containment

- All fixings are to be drilled a minimum of 100mm up from the bottom of the structural concrete beam.
- A 35mm deep 6 mm hole will then be drilled.
- Angle bracket will then be installed and fixed to the side off the structural beam using a 35mm HUSS concrete screw.
- M8 rod will then be secured through the angle bracket to allow Unistrut to be fixed to the underside of the coffer.
- All containment will then be hung from the Unistrut supported via the angle bracket.

Duct work

- All fixings are to be drilled a minimum of 100mm up from the bottom of the structural concrete beam.
- A 35mm deep 6 mm hole will then be drilled.
- An 6mm knock in anchor will then be installed utilising an 6mm washer.
- All duct work will then be installed using a gripple wire.

LTHW pipework

- All fixings are to be drilled a minimum of 100mm up from the bottom of the structural concrete beam.
- A 35mm deep 6 mm hole will then be drilled.
- Angle bracket will then be installed and fixed to the side off the structural beam using a 35mm HUSS concrete screw.
- M10 rod will then be secured through the angle bracket to allow Unistrut to be fixed to the underside of the coffer.
- All containment will then be hung from the Unistrut supported via the angle bracket.

Plumbing pipework

- All fixings are to be drilled a minimum of 100mm up from the bottom of the structural concrete beam.
- A 35mm deep 6 mm hole will then be drilled.
- Angle bracket will then be installed and fixed to the side off the structural beam using a 35mm HUSS concrete screw.
- M10 rod will then be secured through the angle bracket to allow Unistrut to be fixed to the underside of the coffer.
- All containment will then be hung from the Unistrut supported via the angle bracket.

Drainage pipework

- All fixings are to be drilled a minimum of 100mm up from the bottom of the structural concrete beam.
- A 35mm deep 6 mm hole will then be drilled.
- Angle bracket will then be installed and fixed to the side off the structural beam using a 35mm HUSS concrete screw.
- M8 rod will then be secured through the angle bracket to allow Unistrut to be fixed to the underside of the coffer.
- All containment will then be hung from the Unistrut supported via the angle bracket.





Hilti HUS-H SCREW ANCHOR

Technical Datasheet

Update: Jan-23





HUS-H Screw anchor

Ultimate performance screw anchor with hex-head

Anchor version



HUS-H
(10)

Benefits

- Quick and easy setting
- Low expansion forces in base materials
- Through fastening
- Removable
- Forged-on washer and hexagon head with no protruding head

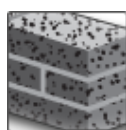
Base material



Concrete
(non-cracked)



Concrete
(cracked)

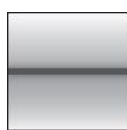


Solid brick



Autoclaved
aerated
concrete

Load conditions



Static /
quasi-static

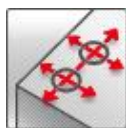


Seismic
ETA-C1



Fire
resistance

Installation conditions



Small edge
distance and
spacing

Small edge
distance and
spacing

Other information



European
Technical
Assessment

European
Technical
Assessment



CE
conformity

CE
conformity



PROFIS
Engineering
design
software
PROFIS
Engineering
design
software



DIBt
Approval
Reusability

DIBt
Approval
Reusability

Approvals / certificates

Description	Authority / Laboratory	No. / date of issue
European Technical Assessment	DIBt, Berlin	ETA-08/0307 / 2018-08-23
Fire test report	IBMB, Brunswick	UB3574/5146 / 2006-05-20
Fire Assessment report	Exova Warringtonfire	WF 166402 / 2007-10-26

a) All data given in this section according ETA-08/0307 issue 2015-08-27.

Static and quasi-static loading data (for a single anchor)

All data in this section applies to:

- Correct setting (See setting instruction)
- No edge distance and spacing influence
- Steel failure
- Minimum base material thickness
- Concrete C 20/25, $f_{ck,cube} = 25 \text{ N/mm}^2$

Anchorage depth

Anchor size		Hilti Technical Data	ETA 08/0307	
Type	HUS-H 10	10	10	
Nominal embedment depth	h_{nom} [mm]	60	70	85

Characteristic resistance

Anchor size		Hilti Technical Data	ETA 08/0307	
Type	HUS-H 10	10	10	
Non-cracked concrete				
Tension	N _{Rk} [kN]	12,0	12,0	20,0
Shear	V _{Rk} [kN]	23,8	23,8	23,8
Cracked concrete				
Tension	N _{Rk} [kN]	6,4	7,5	16,0
Shear	V _{Rk} [kN]	21,0	23,8	23,8

Design resistance

Anchor size		Hilti Technical Data		ETA 08/0307	
Type	HUS-H 10	10	10		
Non-cracked concrete					
Tension	N _{Rd}	[kN]	6,7	6,7	9,5
Shear	V _{Rd}	[kN]	15,9	15,9	15,9
Cracked concrete					
Tension	N _{Rd}	[kN]	3,6	4,2	7,6
Shear	V _{Rd}	[kN]	14,0	15,9	15,9

Recommended loads

Anchor size		Hilti Technical Data	ETA 08/0307	
Type	HUS-H 10	10	10	
Non-cracked concrete				
Tension	N _{Rec} [kN]	4,8	4,8	6,8
Shear	V _{Rec} [kN]	11,3	11,3	11,3
Cracked concrete				
Tension	N _{Rec} [kN]	2,5	3,0	5,4
Shear	V _{Rec} [kN]	10,0	11,3	11,3

- a) With overall partial safety factor for action $\gamma = 1,4$, The partial safety factors for action depend on the type of loading and shall be taken from national regulations,



Seismic loading data (for single anchor)

All data in this section applies to:

- Correct setting (See setting instruction)
- No edge distance and spacing influence
- Steel failure
- Minimum base material thickness
- Concrete C 20/25, $f_{ck,cube} = 25 \text{ N/mm}^2$
- $\alpha_{gap} = 0,5$

Anchorage depth

Anchor size		Hilti Technical Data	ETA 08/0307	
Type	HUS-H	10	10	
Nominal embedment depth	h_{nom} [mm]	60	70	85

Characteristic resistance in case of seismic performance category C1

Anchor size		Hilti Technical Data	ETA 08/0307	
Type	HUS-H	10	10	
Tension	$N_{Rk,seis}$ [kN]	-	-	12,5
Shear	$V_{Rk,seis}$ [kN]	-	-	9,0

Design resistance in case of seismic performance category C1

Anchor size		Hilti Technical Data	ETA 08/0307	
Type	HUS-H	10	10	
Tension	$N_{Rd,seis}$ [kN]	-	-	6,0
Shear	$V_{Rd,seis}$ [kN]	-	-	6,0

Fire resistance

All data in this section applies to:

- Correct setting
- No edge distance and spacing influence
- Steel failure
- Minimum base material thickness
- The following technical data are based on: ETA-08/0307 issue 2018-08-23
- For more fire resistance data please see the full ETA-08/0307 report
- Partial safety factor for resistance under fire exposure $\gamma_{M,fi}=1,0$ (in absence of other national regulations)

Anchorage depth

Anchor size		ETA 08/0307	
Type	HUS-H	10	
Nominal anchorage depth	h_{nom} [mm]	70	85

Characteristic resistance

Anchor size			ETA 08/0307	
Type	HUS-H		10	
Fire exposure R30				
Tension	N _{Rk,fi}	[kN]	1,9	4,0
Shear	V _{Rk,fi}	[kN]	5,0	5,0
Fire exposure R120				
Tension	N _{Rk,fi}	[kN]	1,5	1,5
Shear	V _{Rk,fi}	[kN]	1,5	1,5

Design resistance

Anchor size			ETA 08/0307	
Type	HUS-H		10	
Fire exposure R30				
Tension	N _{Rd,fi}	[kN]	1,9	4,0
Shear	V _{Rd,fi}	[kN]	5,0	5,0
Fire exposure R120				
Tension	N _{Rd,fi}	[kN]	1,5	1,5
Shear	V _{Rd,fi}	[kN]	1,5	1,5

Materials

Mechanical properties

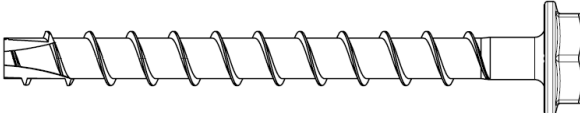
Anchor size		HUS-H	10
Nominal tensile strength	f_{uk}	[N/mm ²]	1000
Yield strength	f_{yk}	[N/mm ²]	900
Stressed cross-section	A_s	[mm ²]	55,4
Moment of resistance	W	[mm ³]	58,2
Characteristic bending resistance	$M^{0}_{Rk,s}$	[Nm]	70,0

Material quality

Type	Material
HUS - H	Carbon steel, galvanized ($\geq 5 \mu\text{m}$)

Head configuration

Type	Part
HUS-H	Hexagonal head




Anchor dimensions

Anchor size		HUS-H	10
Nominal length	l_s	[mm]	75..280
Outer diameter of thread	d_s	[mm]	12,3
Core diameter	d_k	[mm]	8,4

Setting information

Setting details

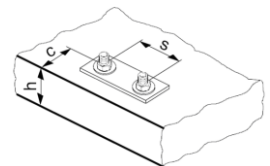
Anchor size		HUS-H	10		
		h_{nom}	60	70	85
Nominal diameter of drill bit	d_o	[mm]	10		
Cutting diameter of drill bit	$d_{cut} \leq$	[mm]	10,45		
Clearance hole diameter	d_f	[mm]	14		
Depth of drill hole in floor/wall position	$h_1 \geq$	[mm]	$h_{nom} + 10 \text{ mm}$		
Depth of drill hole in ceiling position	$h_1 \geq$	[mm]			
Thickness of fixture	t_{fix}	[mm]	$l_s - h_{nom}$		
Max. installation torque for hand setting	$T_{inst, max}$	[Nm]	45	45	55
Impact screw driver for machine setting			SIW 22T-A ; SI 100		

Setting parameters

Anchor size		HUS-H	10		
		h_{nom}	60	70	85
Minimum base material thickness	h_{min}	[mm]	110	130	130
Non-cracked concrete					
Minimum spacing	S_{min}	[mm]	65		
Minimum edge distance	C_{min}	[mm]	65		
Cracked concrete					
Minimum spacing	S_{min}	[mm]	65	50	50
Minimum edge distance	C_{min}	[mm]	65	50	50
Effective anchorage depth	h_{ef}	[mm]	44	54	67
Critical spacing for concrete cone failure	$S_{cr,N}$	[mm]	3 h_{ef}		
Critical spacing for splitting failure	$S_{cr,sp}$	[mm]			
Critical edge distance for concrete cone failure	$C_{cr,N}$	[mm]	1,5 h_{ef}		
Critical edge distance for splitting failure	$C_{cr,sp}$	[mm]			

For spacing (edge distance) smaller than critical spacing (critical edge distance) the design loads have to be reduced (see system design resistance),
Critical spacing and critical edge distance for splitting failure apply only for non-cracked concrete, For cracked concrete only the critical spacing and critical edge distance for concrete cone failure are decisive.

a) Only hand setting is recommended



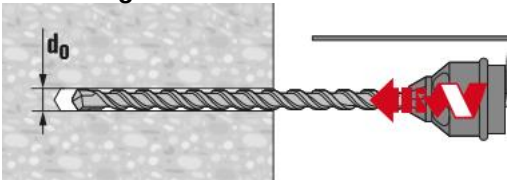
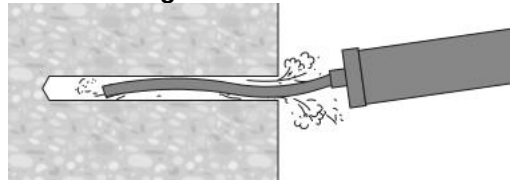
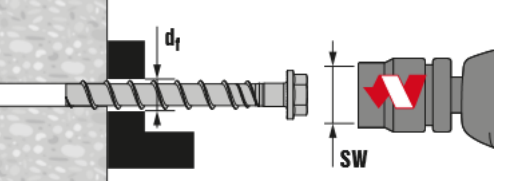
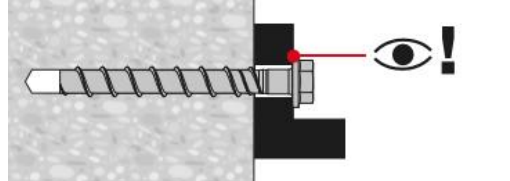
Installation equipment

Anchor size	HUS-H	10
Rotary hammer		TE 2 - TE 30
Drill bit for concrete, solid clay brick solid sand-lime brick		TE -CX 10
Drill bit for aerated concrete		TE -CX 8
Socket wrench insert		S-NSD 15 1/2
Setting tool		SIW 22T-A ; SI 100

Setting instructions

***For detailed information on installation see instruction for use given with the package of the product**

Setting instruction without adjustment

1. Drilling 	2. Cleaning 
3. Installing the anchor by impact screw driver 	4. Checking 

Basic loading data for single anchor in solid masonry units

Solid bricks: a reduction of the cross section area by a vertical perforation perpendicular to the bed joint area must not be greater than 15%

Drilling:

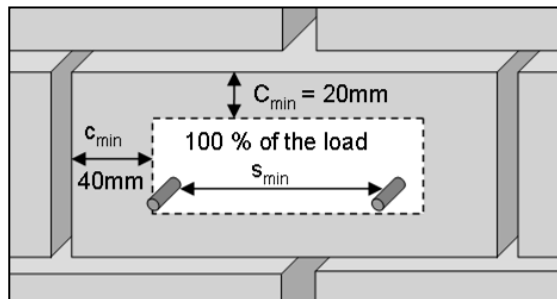
- Holes in Mz and KS drilled with TE rotary hammers drilled with hammering mode
- Holes in PPW drilled with TE rotary hammers drilled without hammering mode

Installation:

- Make sure that anchor is not spinning in the borehole after the screw anchor head is touching the base plate (Step 4. in the setting instructions). Spinning may lead to significant load drop of the fastening point.

Edge distance and spacing influences:

- Distance to free edge free edge to solid masonry (Mz and KS) units $c_{min, free} \geq 200 \text{ mm}$
- Distance to free edge free edge to solid masonry (autoclaved aerated gas concrete) units $c_{min, free} \geq 170 \text{ mm}$
- The minimum distance to horizontal and vertical mortar joint $c_{min, h}$ and $c_{min, v}$ is stated in drawing below
- Minimum anchor spacing in one brick/block is $s_{min} = 80 \text{ mm}$



Recommended loads

Anchor size			Hilti Technical Data
Base material	Type	HUS-H	10
	h_{nom}	[mm]	60
	Compressive strength class	[N/mm ²]	$F_{rec}^{a)}$ [kN] Tensile and Shear
 Solid clay brick Mz 2,0-2DF DIN V 105-100 / EN 771-1 LxWxH [mm]: 240x115x113 h_{min} [mm]: 115	≥ 8		1,0
	≥ 10		1,2
	≥ 12		1,3
	≥ 16		1,5
	≥ 20		1,7
 Solid sand-lime brick KS 2,0-2DF DIN V 106-100 / EN 771-2 LxWxH [mm]: 240x115x113 h_{min} [mm]: 115	≥ 8		1,1
	≥ 10		1,2
	≥ 12		1,3
	≥ 16		1,5
	≥ 20		1,7
 Aerated concrete PPW -0,65 DIN 4165/ EN 771-4 LxWxH [mm]: 499x240x249 h_{min} [mm]: 240	≥ 6		1,3

- a) Characteristic resistance for tension, shear or combined tension and shear loading.
The characteristic resistance is valid for single anchor or for a group of two or four anchors with a spacing equal or larger than the minimum spacing s_{min} according to specification.

Load values:

- The technical data for the HUS-H anchors are reference loads for MZ 12 2,0-2DF, KS 12 2,0-2DF and PPW 6-0,65.
- The load values are valid for non-structural applications.
- Due to the natural variation of stone solid bricks, on site anchor testing is recommended to validate technical data.
- The HUS-H anchor was installed and tested in the centre area of solid bricks as shown considering minimal edge and space distances.
- The HUS-H anchor was not tested in the mortar joint between solid bricks or in hollow bricks; however a load reduction is expected.
- For brick walls where anchor position in brick can not be determined, 100% anchor testing is recommended.

Limitations of loads:

- All data is for redundant fastening for non structural applications
- Plaster, graveling, lining or leveling courses are regarded as non-bearing and may not be taken into account for the calculation of embedment depth.
- The decisive resistance to tension loads is the lower value of N_{rec} (brick breakout, pull out) and $N_{max,pb}$ (pull out of one brick).

Pull out of one brick:

The allowable load of an anchor or a group of anchors in case of single brick pull out, $N_{max,pb}$ [kN], is given in the following tables:

Clay bricks:

$N_{max,pb}$ [kN]		brick breadth b_{brick} [mm]					
		80	120	200	240	300	360
brick length l_{brick} [mm]	240	1,1	1,6	2,7	3,3	4,1	4,9
	300	1,4	2,1	3,4	4,1	5,1	6,2
	500	2,3	3,4	5,7	6,9	8,6	10,3

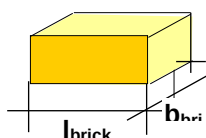
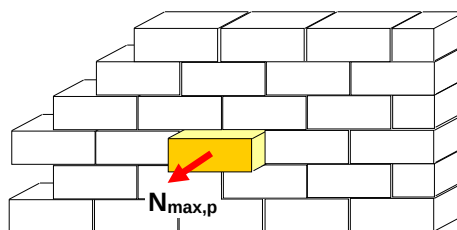
All other brick types:

$N_{max,pb}$ [kN]		brick breadth b_{brick} [mm]					
		80	120	200	240	300	360
brick length l_{brick} [mm]	240	0,8	1,2	2,1	2,5	3,1	3,7
	300	1,0	1,5	2,6	3,1	3,9	4,6
	500	1,7	2,6	4,3	5,1	6,4	7,7

$N_{max,pb}$ = resistance for pull out of one brick

l_{brick} = length of the brick

b_{brick} = breadth of the brick



Setting details in masonry

Anchor size		HUS-H	10
		h_{nom}	70
Nominal diameter of drill bit diameter for solid clay (Mz) and sand-lime brick (KS)	d_0	[mm]	10
Nominal diameter of drill bit Aerated concrete (PPW)	d_0	[mm]	8
Clearance hole diameter	d_f	[mm]	14
Depth of drill hole	$h_1 \geq$	[mm]	$h_{nom}+10\text{ mm}$
Thickness of fixture	t_{fix}	[mm]	
Max. installation torque for hand setting ^{a)}			
Solid clay brick (MZ)	$T_{inst, max}$	[Nm]	8
Solid sand-lime brick (KS)	$T_{inst, max}$	[Nm]	16
Aerated concrete (PPW)	$T_{inst, max}$	[Nm]	8



HILTI HKD FLUSH ANCHOR

Technical Datasheet

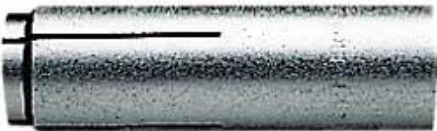
Update: Jan-23

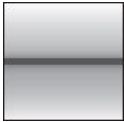




HKD Flush anchor

Everyday standard manual set flush anchor for single anchor applications

Anchor version		Benefits
	HKD (M8-M20)	<ul style="list-style-type: none"> - Simple and well proven - Approved, tested and confirmed by everyday jobsite experience - Reliable setting thanks to simple visual check - Versatile - For medium-duty fastening with bolts or threaded rods - Available in various materials and sizes for maximized coverage of possible applications
	HKD-S(R) (M6-M20)	
	HKD-E(R) (M6-M20)	

Base material	Load conditions
 <p>Concrete (non-cracked)</p>	 <p>Static/ quasi-static</p>
Installation conditions	Other information
 <p>Hammer drilled holes</p>	<div>  <p>European Technical Assessment</p> </div> <div>  <p>CE conformity</p> </div> <div>  <p>PROFIS Engineering design software</p> </div> <div>  <p>A4 316 Corrosion resistance</p> </div>

Approvals / certificates

Description	Authority / Laboratory	No. / date of issue
European Technical Assessment ^{a)}	CSTB, Marne-la-Vallée	ETA-02/0032 / 2020-11-04
Hilti technical data	Hilti	

a) All data given in this section according to ETA-02/0032, issue 2015-01-07.

Static resistance

All data in this section applies to:

- Correct setting (See setting instruction)
- No edge distance and spacing influence
- Concrete as specified in the table
- Steel failure
- Minimum base material thickness
- Concrete C 20/25, $f_{ck,cube} = 25 \text{ N/mm}^2$
- Screw or rod with steel grade 5.8 (carbon steel) and / or A4-70 (stainless steel)

Effective anchorage depth for static

Anchor size	M6	M8	M10	M12	M16	M8	M8	M10	M10	M12	M16	M20
Effective anchorage depth h_{ef} [mm]	25	25	25	25	30	30	40	30	40	50	65	80

Characteristic resistance

Anchor size		Hilti technical data				ETA-02/0032, issued 2020-11-04							
		M6x25	M8x25	M10x25	M12x25	M6x30	M8x30	M8x40	M10x30	M10x40	M12x50	M16x65	M20x80
Tension	HKD	6,1	6,1	6,1	6,1	-	8,1	9,0	8,1	12,4	17,4	25,8	35,2
	HKD-S, HKD-E	6,1	-	-	-	8,1	8,1	9,0	8,1	12,4	17,4	25,8	35,2
	HKD-SR, HKD-ER	6,1	-	-	-	8,1	8,1	-	-	12,4	17,4	25,8	35,2
Shear	HKD	5,0	6,1	6,1	6,1	-	8,6	9,2	10,0	11,0	18,3	33,8	49,5
	HKD-S, HKD-E	5,0	-	-	-	5,0	7,0	7,0	7,4	8,0	14,1	21,9	34,7
	HKD-SR, HKD-ER	6,2	-	-	-	6,4	8,4	-	-	10,5	18,7	32,1	51,0

Design resistance

Anchor size		Hilti technical data				ETA-02/0032, issued 2020-11-04							
		M6x25	M8x25	M10x25	M12x25	M6x30	M8x30	M8x40	M10x30	M10x40	M12x50	M16x65	M20x80
Tension	HKD	4,1	4,1	4,1	4,1	-	5,4	6,0	5,4	8,3	11,6	17,2	23,5
	HKD-S, HKD-E	4,1	-	-	-	5,4	5,4	5,0	5,4	8,3	11,6	17,2	23,5
	HKD-SR, HKD-ER	4,1	-	-	-	5,4	5,4	-	-	8,3	11,6	17,2	23,5
Shear	HKD	4,0	4,1	4,1	4,1	-	6,9	7,3	8,0	8,8	14,6	27,0	39,6
	HKD-S, HKD-E	3,9	-	-	-	3,9	5,5	5,5	5,9	6,4	11,3	17,5	27,8
	HKD-SR, HKD-ER	4,1	-	-	-	4,2	5,5	-	-	6,9	12,3	21,1	33,6



Recommended loads ^{a)}

Anchor size			Hilti technical data				ETA-02/0032, issued 2020-11-04							
			M6x25	M8x25	M10x25	M12x25	M6x30	M8x30	M8x40	M10x30	M10x40	M12x50	M16x65	M20x80
Tension	HKD	N _{Rec} [kN]	2,9	2,9	2,9	2,9	-	3,8	3,6	3,8	5,9	8,3	12,3	16,8
	HKD-S, HKD-E		2,9	-	-	-	3,8	3,8	3,6	3,8	5,9	8,3	12,3	16,8
	HKD-SR, HKD-ER		2,9	-	-	-	3,8	3,8	-	-	5,9	8,3	12,3	16,8
Shear	HKD	V _{Rec} [kN]	2,9	2,9	2,9	2,9	-	4,9	5,2	5,7	6,3	10,5	19,3	28,3
	HKD-S, HKD-E		2,8	-	-	-	2,8	3,9	4,2	3,9	4,6	8,1	12,5	19,8
	HKD-SR, HKD-ER		2,9	-	-	-	3,0	3,9	-	-	4,9	8,8	15,1	24,0

a) With overall partial safety factor for action $\gamma = 1,4$. The partial safety factors for action depend on the type of loading and shall be taken from national regulations.

Materials

Mechanical properties

Anchor size			M6	M8	M10	M12	M16	M20
Nominal tensile strength	HKD	f_{uk} [N/mm ²]	570	570	570	570	640	590
	HKD-S, HKD-E		560	560	510	510	-	460
	HKD-SR, HKD-ER		540	540	540	540	-	540
Yield strength	HKD	f_{yk} [N/mm ²]	460	460	460	480	510	470
	HKD-S, HKD-E		440	440	410	410	-	375
	HKD-SR, HKD-ER		355	355	355	355	-	355
Stressed cross-section	HKD	A_s [mm ²]	20,7	26,7	32,7	60,1	105	167
	HKD-S, HKD-E		20,9	26,1	28,8	58,7	-	163
	HKD-SR, HKD-ER							
Moment of resistance	HKD	W [mm ³]	32,3	54,6	82,9	184	431	850
	HKD-S, HKD-E		50	79	110	264	602	1191
	HKD-SR, HKD-ER							
Char. bending resistance for rod or bolt	With 5.8 Gr. Steel	$M^0_{RK,S}$ [Nm]	7,6	18,7	37,4	65,5	167	325
	HKD-SR		11	26	52	92	187	454
	HKD-ER with A4-70							

Material quality

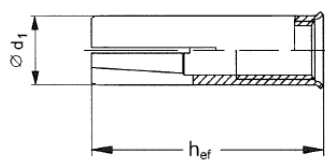
Part		Material
Anchor body	HKD	Cold formed steel / galvanised to min. 5 μ m
	HKD-S, HKD-E	Steel Fe/Zn5 galvanised to min. 5 μ m
	HKD-SR, HKD-ER	Stainless steel, 1.4401, 1.4404, 1.4571
Expansion plug	HKD	Cold formed steel
	HKD-S, HKD-E	Cold formed steel
	HKD-SR, HKD-ER	Stainless steel, 1.4401, 1.4404, 1.4571

Anchor dimensions of HKD, HKD-S, HKD-E, HKD-SR, HKD-ER

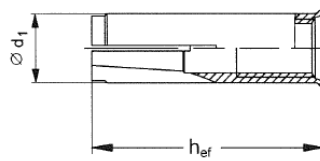
Anchor size	Hilti technical data				ETA-02/0032, issued 2015-01-07								
		M6x25	M8x25	M10x25	M12x25	M6x30	M8x30	M8x40	M10x30	M10x40	M12x50	M16x65	M20x80
Eff. anchorage depth	h_{ef} [mm]	25	25	25	25	30	30	40	30	40	50	65	80
Anchor diameter	d_1 [mm]	7,9	9,95	11,9	14,9	8	9,95	9,95	11,8	11,95	14,9	19,75	24,75
Plug diameter	d_2 [mm]	5,1	6,35	8,1	9,7	5	6,5	6,35	8,2	8,2	10,3	13,8	16,4
Plug length	l_1 [mm]	10	7	7	7,2	15	12	16	12	16	20	29	30

Anchor body

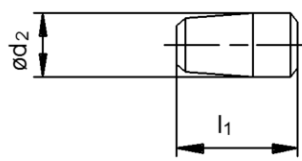
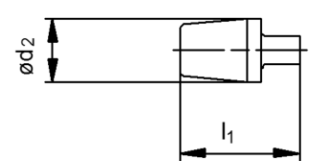
HKD



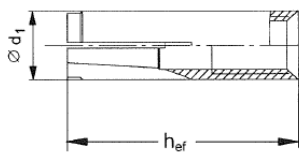
HKD-S and HKD-SR



Expansion plugs



HKD-E and HKD ER

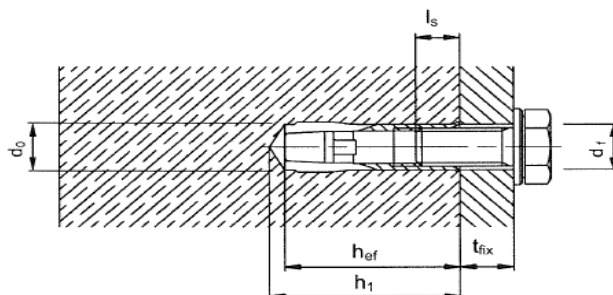


Setting information

Setting details

Anchor size	Hilti technical data				ETA-02/0032, issued 2015-01-07								
		M6x25	M8x25	M10x25	M12x25	M6x30	M8x30	M8x40	M10x30 ^{a)}	M10x40	M12x50	M16x65	M20x80
Effective embedment depth	h_{ef} [mm]	25	25	25	25	30	30	40	30	40	50	65	80
Nominal diameter of drill bit	d_o [mm]	8	10	12	15	8	10	10	12	12	15	20	25
Cutting diameter of drill bit	$d_{cut} \leq$ [mm]	8,45	10,5	12,5	15,5	8,45	10,5	10,5	12,5	12,5	15,5	20,5	25,5
Depth of drill hole	$h_1 \geq$ [mm]	27	27	27	27	32	33	43	33	43	54	70	85
Screwing depth	$l_{s,min}$ [mm]	6	8	10	12	6	8	8	10	10	12	16	20
Thread engagement depth	$l_{s,max}$ [mm]	12	11,5	12	12	12,5	14,5	17,5	12,7	18	23,5	30,5	42
Diameter of clearance hole in the fixture	$d_f \leq$ [mm]	7	9	12	14	7	9	9	12	12	14	18	22
Max. torque moment	T_{inst} [Nm]	4	8	15	35	4	8	8	15	15	35	60	100

a) With anchor size M10x30 only threaded rod is to be used.



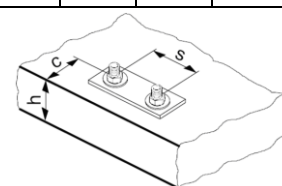
Installation equipment

Anchor size		M6	M8	M10	M10	M12	M16
Rotary hammer for setting		TE 1 – TE 3				TE 16 – TE 50	
Machine setting tool	HSD-M	6x25/30	8x25/30	10x25/30	10x40	12x50	16x65
Hand setting tool	HSD-G HSD-M	6x25/30	8x25/30	10x25/30	10x40	12x50	16x65
Other tools		hammer, torque wrench, blow out pump					

Setting parameters

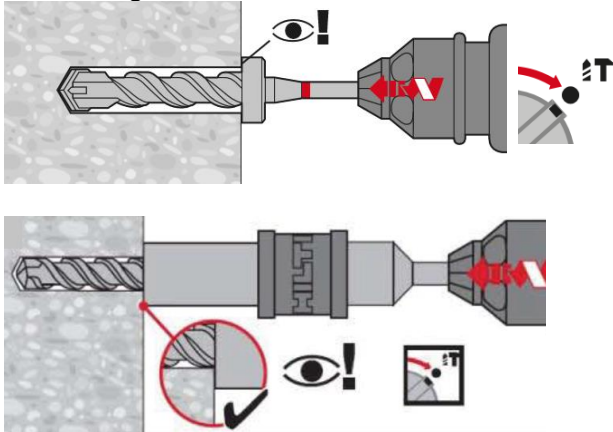
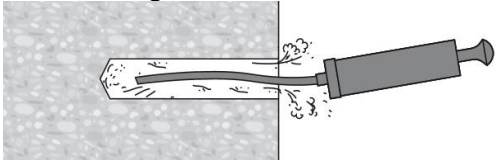
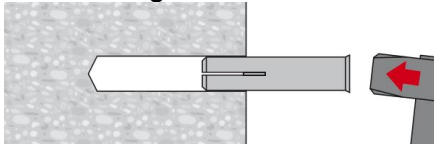
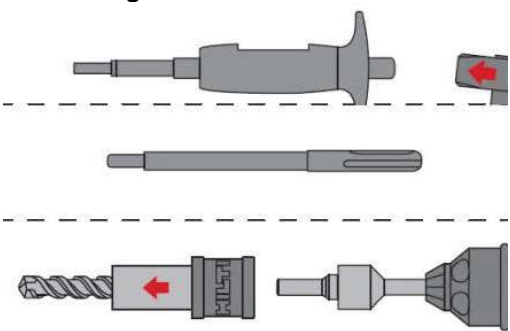
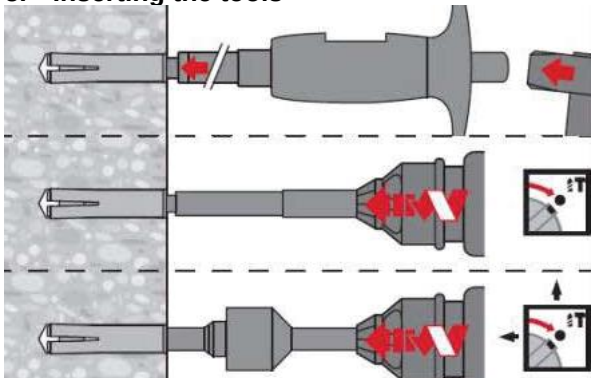
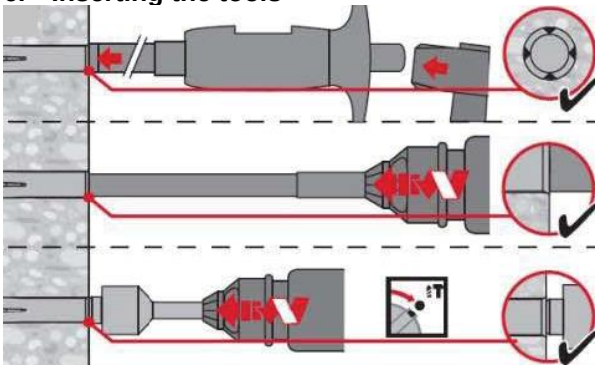
Anchor size		Hilti technical data				ETA-02/0032, issued 2015-01-07							
		M6x25	M8x25	M10x25	M12x25	M6x30	M8x30	M8x40	M10x30	M10x40	M12x50	M16x65	M20x80
Minimum base material thickness	h_{min} [mm]	100	100	100	100	100	100	100	100	100	100	130	160
Minimum spacing and minimum edge distance HKD-S (R) / HKD-E (R)	s_{min} [mm]	60	60	60	60	60	60	80	60	80	125	130	160
	c_{min} [mm]	88	88	88	88	105	105	140	105	140	175	230	280
Minimum spacing HKD	s_{min} [mm]	80	80	80	80	60	60	80	60	80	125	130	160
	$c \geq$ [mm]	140	140	140	140	105	105	140	105	140	175	230	280
Minimum edge distance HKD	c_{min} [mm]	100	100	100	100	80	80	140	80	140	175	230	280
	$s \geq$ [mm]	150	150	150	150	120	120	80	120	80	125	130	160
Critical spacing and edge distance for splitting failure HKD	$s_{cr,sp}$ [mm]	200	200	200	200	210	210	280	210	280	350	455	560
	$c_{cr,N}$ [mm]	100	100	100	100	105	105	140	105	140	175	227	280
Critical spacing and edge distance for concrete cone failure HKD / HKDS-(R) / HKD-E(R)	$s_{cr,N}$ [mm]	80	80	80	80	90	90	120	90	120	150	195	240
	$c_{cr,N}$ [mm]	40	40	40	40	45	45	60	45	60	75	97	120
Critical spacing and edge distance for splitting failure HKD-S(R) / HKD-E(R)	$s_{cr,sp}$ [mm]	176	176	176	176	210	210	280	210	280	350	455	560
	$c_{cr,N}$ [mm]	88	88	88	88	105	105	140	105	140	175	227	280

For spacing (edge distance) smaller than critical spacing (critical edge distance) the design loads have to be reduced.



Setting instruction

*For detailed information on installation see instruction for use given with the package of the product.

Setting instruction	
<p>1. Drilling</p> 	<p>2. Cleaning</p> 
<p>3. Inserting the anchor</p> 	<p>4. Setting tools</p> 
<p>5. Inserting the tools</p> 	<p>6. Inserting the tools</p> 
<p>7. Attaching the belonging washer</p> 