

**TROUP**  
**BYWATERS**  
**+ ANDERS**



## Working together

Bringing buildings to life in the Commercial Sector

**Department For Transport**  
**International Maritime Organization**  
**4 Albert Embankment, London**  
**Mechanical, Electrical and Public Health Services Design Specification**  
**Spec\_T1**  
**June 2017**

**JOB:** Department For Transport

**JOB NO:** 18080

**DOCUMENT:** Mechanical, Electrical and Public Health Services Design Specification

**DOCUMENT NUMBER:** Spec\_T1

**STATUS:** T1

**DATE:** June 2017

This specification has been authorised by:

**James Campbell**  
Partner

Revision	DCC No.	Comments	Date	Author	Checked
T1	Spec_T1	Tender Issue	June 2017	SIM/BH/PF/JC	JC
P1	Spec_P1	Draft for Comments	May 2017	SIM/BH/PF/JC	JC

# Contents

A10 PROJECT PARTICULARS .....	7
A12 THE SITE EXISTING BUILDINGS.....	9
A13 DESCRIPTION OF THE WORKS.....	10
A31 PROVISION, CONTENT AND USE OF DOCUMENTS .....	14
A32 MANAGEMENT OF THE WORKS .....	23
A33 QUALITY STANDARDS / CONTROL.....	27
A34 SECURITY / SAFETY / PROTECTION .....	36
A35 SPECIFIC LIMITATIONS ON METHOD / SEQUENCE / TIMING.....	39
A37 OPERATION / MAINTENANCE OF THE FINISHED BUILDING .....	40
C12 UNDERGROUND SERVICES SURVEY .....	50
C14 BUILDING SERVICES SURVEY .....	56
R11 FOUL DRAINAGE ABOVE GROUND .....	57
V20 LV DISTRIBUTION .....	96
V40 EMERGENCY LIGHTING .....	158
Y10 PIPELINES AND PIPEWORK .....	208
Y11 PIPELINE ANCILLARIES .....	233
Y20 PUMPS .....	260
Y25 CLEANING AND CHEMICAL TREATMENT .....	264
Y41 FANS.....	272
Y50 THERMAL INSULATION .....	273
Y51 TESTING AND COMMISSIONING.....	309
Y54 IDENTIFICATION - MECHANICAL.....	318
Y60 CONDUIT AND CABLE TRUNKING .....	321
Y61 CABLES AND WIRING.....	332
Y62 BUSBAR TRUNKING.....	355
Y63 SUPPORT COMPONENTS - CABLES .....	357
Y71 LV SWITCHGEAR AND DISTRIBUTION BOARDS.....	359
Y72 CONTACTORS AND STARTERS .....	378
Y73 LUMINAIRES AND LAMPS .....	389
Y74 ACCESSORIES FOR ELECTRICAL SERVICES.....	400
Y80 EARTHING AND BONDING .....	412
Y81 TESTING AND COMMISSIONING OF ELECTRICAL SERVICES .....	418
Y82 IDENTIFICATION - ELECTRICAL.....	421
Y90 FIXING TO BUILDING FABRIC.....	426
Y91 PAINTING AND ANTI-CORROSION TREATMENTS .....	428
Y92 MOTOR DRIVES - ELECTRIC .....	429

# Appendices

Appendix One	-	Drawing Schedule
Appendix Two	-	LV Upgrade Works
A2.1	-	Drawings
A2.2	-	Distribution Board Schedules
Appendix Three	-	Emergency Lighting Works
A.3.1	-	Drawings
A.3.2	-	Manufacturers Literature
Appendix Four	-	Control Panel Replacement Works
A4.1	-	Drawings
A4.2	-	Variable Speed Drive Schedules
A4.3	-	Manufacturers Literature
Appendix Five	-	Sump Pump Replacement Works
A5.1	-	Drawings
A5.2	-	Sump Pump Schedules
A5.3	-	Manufacturers Literature

## **NES - Introduction**

This document has been compiled using NES, which the copyright belongs to AMTECH Group.

The content incorporates that of the National Engineering Specification (NES).

### **NOTES FOR TENDERERS**

Dependant on the nature of the works specified within this document, the specification shall contain some or all of the items below:

#### **1. PRELIMINARIES**

The Preliminary clauses ('A' sections) included are those that relate to the Engineering Works in particular and must be read in conjunction with the "Preliminaries" of the "Main Contract".

#### **2. SYSTEM SPECIFICATIONS**

The system specifications are sub-divided into four parts:-

##### **Part 1 System objectives:**

The system objectives are clauses giving details of design information, system performance and description, together with lists of the system schematics and drawings.

##### **Part 2 Selection schedules for the reference specifications:**

These selection schedules specify items in the system that is contained in the Reference Specifications (Y group). Required Y group clauses are invoked by reference.

##### **Part 3 Clauses specific to the system:**

These specification clauses are specific to the system concerned and in general make no reference to the Y group clauses.

##### **BS Appendix**

The BS Appendix contains a list of all the British and European Standards referred to in the particular system specification.

#### **3. APPENDICES**

The appendices shall consist of some or all of the following:-

##### **Equipment Schedules**

Schedules for the equipment specified within the document.

##### **Reference Specifications (Clauses from the Y Group).**

All the reference specifications relevant to all the systems for the job. Required clauses are invoked in

Part 2 (Selection schedules for the reference specifications) for each system.

#### **4. NON-SPECIFICATION CLAUSES**

User created, non NES, clauses may appear within the specification.

---

## **A10 PROJECT PARTICULARS**

### **110.000 THE PROJECT**

- Particulars of the project as a whole are
  - given in Main Contract Preliminaries.

### **120.000 THE EMPLOYER:**

- Department for Transport.

### **130.000 CONTRACT ADMINISTRATOR:**

- The term Contract Administrator (CA) is used throughout this specification and his duties will be carried out by
  - the Project Manager

### **140.000 DESIGN TEAM:**

- Project Manager – Faithful + Gould
- Quantity Surveyor – Faithful + Gould
- Structural Engineer - ATK
- Building Services Engineer – Troup Bywaters + Anders

### **150.000 EMPLOYER'S SITE STAFF:**

- Resident Engineer (Engineering Services) – Engie

### **160.000 STATUTORY UNDERTAKINGS:**

- Building Control
- Fire Prevention
- Drainage

### **170.000 SUBCONTRACTOR:**

- The term Subcontractor is used throughout this specification and is deemed to be synonymous with the term Contractor, Subtrader and the like which may be used elsewhere within the Contract Documentation.

### **180.000 THE SUBCONTRACT:**

- This document has been prepared using the Common Arrangement of Sections and this Subcontract

comprises the following

- Mechanical Services Installations
- Public Health Service Installations
- Electrical Services Installations
- Automatic Controls Installations
- Building Management System Installations

190.000 MAIN CONTRACTOR:

- This appointment.

---

## A12 THE SITE EXISTING BUILDINGS

### 110.000 THE SITE / EXISTING BUILDINGS:

- The site/existing buildings are described in
  - Main Contract Preliminaries.

### 120.000 SITE LOCATION:

- The site is located at:
  - 4 Albert Embankment  
London  
SE1 7SR

### 140.000 RISKS TO HEALTH AND SAFETY:

- The nature and condition of the site/building(s) cannot be fully and certainly ascertained before opening up.
- The Contractor should be aware that confined spaces have been identified by Engie and it is the responsibility of the Contractor to ensure safe systems of work are in place before works commence.
- The accuracy and sufficiency of this information is not guaranteed by the Employer or the CA and the Subcontractor must ascertain for himself any information he may require to ensure the safety of all persons and the Works.
- Comply with the requirements of the CDM Regulations by:
  - Compiling risk assessments for the Subcontract works.
  - Providing information on the Subcontract works which might affect the health or safety of any person.
  - Providing appropriate input to the Pre-Construction Information, Construction Phase Plan, and Health and Safety Files for the works.

### 150.000 SURVEY:

- Ascertain the nature of the site and all local conditions and restrictions likely to affect the execution of the Works.
- Before commencing work, carry out a survey and examination of buildings, structure and engineering services affected by the works.
- Examine all available drawings of the engineering services and report any discrepancies to the CA.

### 170.000 SITE VISIT:

- Before tendering, ascertain the nature of the site, access there to and all local conditions and restrictions likely to affect the execution of the Subcontract Works. Site visit may be made by the Subcontractor

---

## A13 DESCRIPTION OF THE WORKS

### 110.0 MAIN CONTRACT WORK:

- The main contract work is described in detail within this document. A summary of the works are described below.
    - LV Upgrade Works – Replacement of life expired distribution boards and MICC cabling.
    - Emergency Lighting Works – Installation of manual test key switching banks to emergency lighting circuits and installation of emergency lighting to Core B risers.
    - Control Panel Works – Replacement of AHU Fan Motor Starters with Variable Speed Drives.
    - Sump Pump Works – Replacement of basement ground water sump pumps, control panels and associated wiring and discharge pipework and installation of a new central control panel with BMS integration.
- The contractor will have the design responsibility for BMS installations, modifications and alterations and will be required to submit all designs and proposals to the Services Engineer for review.

### 120.000 THE BUILDING:

- Refer to Architectural and Structural drawings for full details.

### 130.000 PREPARATORY WORK BY OTHERS:

- Not applicable

### 150.000 WORK BY OTHERS AND CO-ORDINATION OF TRADES:

- Allow for co-ordinating the subcontract works with the works of other trades and installations which may be on-site during the period of the subcontract.

### 160.000 COMPLETION WORK BY OTHERS:

- All works to be completed by the Contractor.

### 210.000 COMMON DESIGN CRITERIA:

- The criteria listed in the following clauses applies to all Sections included in the Contract unless specified otherwise.

### 240.000 ELECTRICAL SUPPLY:

- Where systems are specified as being maintained 'under fire conditions' ensure wiring selected is suitable for the temperatures to be encountered.

### 250.000 PLANT OPERATING CONDITIONS:

- Ensure all plant items are suitable for operation in the environment in which they are to be located.
- Ensure all plant, motors, starters and ancillary equipment etc. are suitable for operation at full capacity

under the following conditions

- Height above sea level not exceeding 1000m.
- Air cooling at an average temperature over 24 hours not exceeding 35°C dry bulb.
- Maximum conditions of 40°C dry bulb and 50 per cent relative humidity.
- Supply voltage approximately 415v sinusoidal
- Atmospheric dust condition, as defined in BS ISO 5011 (mg/m<sup>3</sup>)
- Provide equipment for operation in the following areas
  - with the environment as specified below
  - Internal
    - Temperature 0°C to 40°C
    - Temperature (°C)
    - Humidity (% rh)
  - External
    - Temperature -20°C to 50°C
    - Temperature (°C)
    - Humidity (% rh)
    - Provide sun shielding
- Protect equipment to BS EN 60529
  - IP54
  - IP 65

#### 260.000 ROOM TERMINAL LOCATIONS:

- The positions of all connection points, accessories, apparatus, equipment and other room terminals shown on the tender drawings are approximate and for guidance in the preparation of the tender.
- Agree, with CA, which terminals are subject to final positioning on-site.
- Allow for the movement of all such terminals up to a radius of 2.0m from the positions shown on the drawings.
- Mounting heights indicated in tender documents are for tender purposes only. Confirm mounting heights with the CA before commencing work on-site.

#### 271.000 ELECTROMAGNETIC COMPATIBILITY:

- Ensure all equipment and systems are installed to provide electromagnetic compatibility within the system and with any other systems installed in the same area.
- Ensure all systems and buildings are assessed for protection to, and that such protection meets the requirements of BS EN 62305. Ensure all equipment meets the requirements of the appropriate

electromagnetic compatibility standard.

- Standard
  - Particular equipment
    - Industrial, Scientific and Medical
      - BS EN 61000-6-4.
      - BS EN 55011.
      - Household electrical appliances, portable tools and similar apparatus.
        - Relevant parts of BS EN 55014.
    - Fluorescent lamps and Luminaires
      - BS EN 55015.
    - Information technology equipment
      - BS EN 55022
      - BS EN 55032
      - BS EN 50561-1
    - Mains signalling
      - BS EN 50065
    - Broadcast receivers and associated equipment
      - BS EN 55013 and BS EN 55020.
    - Industrial process measurement and control
      - BS EN 60801-2.
  - Other equipment to generic standards
    - Emissions
      - Domestic, commercial and light industrial
        - BS EN 61000-6-3.
        - BS EN 55014-1.
      - Heavy industrial
        - BS EN 61000-6-4.
    - Immunity
      - Domestic, commercial and light industrial
        - BS EN 61000-6-1.
        - BS EN 55014-2.
      - Heavy industrial
        - BS EN 61000-6-2.
  - Ensure all apparatus covered by the Wireless Telegraphy Act 2006 meets regulations issued by Ofcom.
  - Ensure all equipment and systems meet the requirements of BS 6701 and BS EN 41003.
  - Ensure that all cable installations meet the minimum separation in BS 7671 and BS EN 50174.

290.000 SOFTWARE:

- Obtain on behalf of the end user all appropriate licences, permissions, copyright waivers, rights of use and the like from the owners of the software rights.
- Ensure that the end user is properly registered with the software supplier for support and appropriate updating.
- Ensure that application software is written in compliance with BS 7649.

---

## **BS APPENDIX**

**BS 6701:2010**

Telecommunications equipment and telecommunications cabling. Specification for installation, operation and maintenance

**BS 7649:1993**

Guide to the design and preparation of documentation for users of application software

**BS 7671:2008+A3:2015**

Requirements for electrical installations. IET Wiring Regulations. Seventeenth edition

**BS EN 41003:2009**

Particular safety requirements for equipment to be connected to telecommunications networks

**BS EN 55015:2013+A1:2015**

Limits and methods of measurement of radio disturbance characteristics of electrical lighting and similar equipment

**BS EN 55022:2010**

Information technology equipment. Radio disturbance characteristics. Limits and methods of measurement

**BS EN 60529:1992+A2:2013**

Degrees of protection provided by enclosures (IP code)

**BS EN 60801-2:1993**

Electromagnetic compatibility for industrial-process measurement and control equipment. Part 2  
Electrostatic discharge requirements

**BS EN 61000-6-3:2007+A1:2011**

Electromagnetic compatibility (EMC). Generic standards. Part 6-3 Emission standard for residential, commercial and light-industrial environments

---

## A31 PROVISION, CONTENT AND USE OF DOCUMENTS

### 100.000 DEFINITIONS AND INTERPRETATIONS

#### 110.000 MAIN CONTRACT PRELIMINARIES:

Definitions and interpretations given in Main Contract Preliminaries apply to the whole of the Works, including this Subcontract. In the case of conflicting statements the Contract Preliminaries will prevail.

#### 120.000 DEFINITIONS:

- The definitions of technical terms associated with the engineering services installations are those included in
  - CIBSE, IOP and BSRIA Technical Publications
  - BS 7671 - Requirements for Electrical Installations (IET Wiring Regulations).
  - British Standards, including Codes of Practice.
  - Associated Statutory Acts.
- Where used in the documentation the following definitions apply
  - Duct: An enclosed space specifically intended for the distribution of services, with direct access for personnel.
  - Trench: A covered horizontal service space in the floor or ground with access from above.
  - Cavity: A space enclosed within the elements of a building within which services are installed, e.g. the space between ceiling and floor above. See Building Regulations.
  - Service Areas: Includes areas within a building with limited finishes such as loading bays, car parks etc.
  - Concealed Services: Includes installations within ducts, trenches or cavities.
  - Exposed Services: Includes installations within plant rooms, outdoors or unprotected within service or occupied areas.
  - System: System means all equipment, accessories, controls, supports and ancillary items, including supply, installation, connection, testing, commissioning and setting to work necessary for that section of the Works to function.
  - Services: Services means the inclusion of one or more systems.

#### 130.000 REFERENCES TO BSI DOCUMENTS:

- References to BSI documents are to the versions and amendments listed in the British Standards Catalogue
- and in subsequent issues of BSI Update Standards up to and including that for
- any subsequent versions and amendments specifically referred to in the project documents.

#### 140.000 MANUFACTURERS' REFERENCES:

- Manufacturers' references are those current at the time of issue of this specification.
- References mean the particular product as specified in the manufacturer's technical literature current at that time.

#### 150.000 TENDER DRAWINGS:

- Tender drawings means drawings listed in
  - The Appendices
- The tender drawings show the general arrangement of the engineering services to be provided and the

inter-relationship of the works and are to be fully verified by the Contractor before works commence.

**160.000 DRAWINGS:**

- The Contractor shall provide the following drawings at all stages of the
  - co-ordination/co-ordinated working drawings, installation drawings, builder's work details, manufacturer's drawings and record drawings are as defined in BSRIA BG 6/2014.

**163.005 BUILDER'S WORK INFORMATION:**

- A drawing to show the provisions required to accommodate the services which significantly affect the design of the building structure, fabric and external works.
- Drawings (or schedules) of work to be carried out by building trade and required to be costed at the design state e.g. plant bases.

**164.000 CO-ORDINATED WORKING DRAWINGS:**

- Drawings showing the inter-relationship of 2 or more engineering services and their relation to the structure and building fabric. The main features of a co-ordinated drawing are as follows:
  - Plan layouts to a scale of at least 1:50, accompanied by cross-sections to a scale of at least 1:20 for all congested areas.
  - The drawing should be spatially co-ordinated and there should be no physical clashes between the system components when installed. Critical dimensions, datum levels and invert levels should be provided.
  - The spaces between pipe and duct runs shown on the drawing should make allowance for the service at its widest point. Allow for insulation, standard fitting dimensions and joint widths on the drawing.
  - Make allowance for installation working space and space to facilitate commissioning and maintenance.
  - Indicate positions of main fixing points and supports where they have significance to the structural design or spatial constraints.

**165.000 INSTALLATION DRAWING:**

- A drawing based on the technical design drawing or co-ordinated working drawing with the primary purpose of defining that information needed by the tradesmen on-site to install the works. The main features of installation drawings should be as per co-ordinated working drawings plus:
  - Allowances for inclusion of all supports and fixings necessary to install the works.
  - Allowances for installation details provided from manufacturers' drawings.
  - Allowances for plant and equipment. This includes any alternatives to the designer's original specified options that have been chosen.

**166.000 INSTALLATION WIRING DIAGRAM:**

- Drawing showing the interconnection of electric components, panels etc in accordance with the design intent indicated in the schematic drawings and incorporating the details provided on manufacturer's certified drawings.
- Indicate the following: maximum electrical loading for each supply cable; cable termination facilities; and cable identification and all terminal numbers.

**166.005 BUILDER'S WORK DETAILS:**

- Drawings to show requirements for building works necessary to facilitate the installation of the

engineering services.

- Unless agreed otherwise, the following can be marked out on-site.
  - Holes less than the threshold agreed by the team.
  - Electrical socket and switch boxes
  - Openings that are best cut into blockwork or partitions
  -

#### 168.000 MANUFACTURER'S DRAWING:

- Drawing prepared by a manufacturer, fabricator or supplier for a particular project and which is unique to that project. Examples include drawings for ductwork, pre-fabricated pipework, sprinkler systems, control and switchgear panels and associated internal wiring, pre-fabricated plant, customised plant and equipment.

#### 170.000 RECORD DRAWING:

- Drawing showing the building and services installations as installed at the date of practical completion. The main features of the record drawings should be as follows:
  - Use a scale not less than that of the installation drawings.
  - Include locations of all the mechanical, electrical and public health systems and components installed including ducts, pipes, cables, busbars, plant items, pumps, fans, valves, dampers, control devices, strainers, terminals, electrical switchgear and components, security and fire sensors and control components.
  - Labelled with appropriate pipe, duct and cable sizes, pressures and flow rates.
  - Have marked on the drawings the positions of access points for operating and maintenance purposes.
  - The drawings should not be dimensioned unless the inclusion of a dimension is considered necessary for location.

#### 180.000 CONTROLS LOGIC DIAGRAMS:

- Diagrams, drawings and/or schematic details of all control components and instruments showing the layout with each item uniquely identified together with a description of the controls operation and details of the associated interlocking.

#### 181.000 SWITCHGEAR, STARTER AND CONTROL INSTRUMENTATION PANEL DRAWINGS:

- Drawings showing the construction and internal wiring diagrams of the starters, panels and/or other devices.

#### 182.000 AS-INSTALLED DRAWINGS:

- Drawings/records retained on-site to record the progress of and any site modifications to the Works including any changes to software.

#### 183.000 PLANTROOM SCHEDULES AND SCHEMATICS:

- Frame the following under glass and hang in each plant room and any other appropriate location.
  - Schematic drawings of circuit layouts showing identification and duties of equipment, numbers and locations, controls and circuits.
  - Valve schedules in the form of printed sheets showing the number, type, location, application/service

and symbol, and normal operating position of each valve.

- Control schematics.
- Location of mechanical and electrical plant and equipment items.
- First aid instructions for treatment of persons after electric shock.
- Location of isolating switch for electricity supply.
- Location of main incoming gas valve serving gas meter.
- Location of sprinkler fire main control valve.
- Emergency operating procedures and telephone numbers for emergency call out service applicable to any system or item of plant and equipment.
- All other items required under Statutory or other regulations.

#### 190.000 EXAMINATION OF DRAWINGS/INFORMATION:

- The CA will examine the propositions submitted for compliance, in principle, with the design intent. Such an examination shall not relieve the Contractor of his responsibilities and obligations under the contract.

#### 200.000 DOCUMENTS PROVIDED ON BEHALF OF THE EMPLOYER

##### 210.000 MAIN CONTRACT PRELIMINARIES:

- Conditions given in Main Contract Preliminaries under the heading 'Documents provided on behalf of Employer' apply to documents relating to this Contract.

#### 300.000 DOCUMENTS TO BE PROVIDED AND DESIGN RESPONSIBILITIES TO BE UNDERTAKEN

##### 310.000 DESIGN AND PRODUCTION INFORMATION:

- Complete the design and detailing of the work and provide complete production information (including, as appropriate, fabrication/installation drawings, design calculations, specifications, etc.) based on the drawings, this specification and other information provided, liaising with the CA, Principal Designer, Contractor and others as necessary to help ensure co-ordination of the work with related building elements and services.
- Certain design responsibilities on the project shall be as detailed in schedule A31-Design responsibilities . The absence of a design activity does not imply it is not required on the project.
- Design responsibilities on the project shall be as detailed in schedule based on the BSRIA BG 6 proformas. The absence of a design activity does not imply it is not required on the project.
- Request additional information as necessary from the CA and/or contractor and provide information as necessary in time to meet the programme.
- Submit sufficient copies of the design/production information to the contractor (or CA if the contractor has not been appointed). The contractor (if he has been appointed) will check the information and submit his comments to the CA.
- The CA will record his comments and those of the Principal Designer and return to the contractor (or subcontractor if contractor has not been appointed).
- Make any necessary amendments without delay. Unless and until it is confirmed that resubmission is not required, resubmit for further checking and comment, and incorporate any necessary amendments all as before.
- If submitted design/production information differs from the requirements of the Subcontract documents each such difference must be the subject of a request for substitution or variation, supported by all relevant information.
- Should any amendment required by the CA be considered to involve a variation which has not already

been acknowledged as a variation by the CA, notify the contractor and/or CA without delay and in any case within 7 days, and do not proceed with ordering, fabrication, or fixing until subsequently instructed. Claims for the extra cost of such work, if made after it has been carried out, may not be allowed.

- Submit sufficient copies of the final design/production information to the contractor (or CA if the contractor has not been appointed) for distribution to all affected parties.

#### 310.005 PERFORMANCE SPECIFICATIONS:

- The specifications for the following specialist systems provide performance requirements only.
- Develop the design and produce installation drawings and design calculations as appropriate
  - Fire alarms
  - Building Energy Management

#### 310.010 SCHEDULES AND CALCULATIONS:

- The contractor shall provide the design information detailed in schedule reference A31-Design calculations and studies
- Format of design deliverables
- Programme for production of design deliverables

#### 311.000 PRODUCTION INFORMATION:

- Liaise with the CA, Contractor and others as necessary to help ensure co-ordination of the work with related building elements and services.
- Provide drawings and other information as specified showing such details of the work as the CA may reasonably require.
- Submit to the CA for comment, make any necessary amendments and resubmit for further comment unless the CA confirms that this is not necessary.
- Submit sufficient copies of final information to the CA for distribution to the Contractor and all affected parties.

#### 312.000 MAIN CONTRACT DESIGN AND PRODUCTION:

#### 313.000 CO-ORDINATION OF ENGINEERING SERVICES:

- Co-ordination of the Engineering Services Installations will be carried out
  - as part of the project in liaison with the CA
- Agree principles of co-ordination with all parties concerned.
- Incorporate details provided by others into the Co-ordination Drawings.
- Provide all necessary details/drawings/schedules etc. required to enable the co-ordination drawings to be prepared by others.
- Ensure the installation drawings make due allowance for all building elements, structure and other services.
- Prior to submission check and approve all drawings, schedules and any other information provided by manufacturers, nominated suppliers or specialist sub-subcontractors to ensure that all the requirements of the contract documentation have been incorporated. Accompany all documents submitted with a

certificate indicating that they have been checked by the Subcontractor.

320.000 DRAWN AND OTHER INFORMATION:

- Provide drawn information for the design team and client in the following forms:-
  - Initial copies for comment
  - Print form
  - PDF format
  - CAD format
    - Comply with BS EN ISO 13567-1.
  - Comply with BS EN ISO 13567-2.
  - Final copies for distribution
    - Print form
    - PDF format
    - CAD format
      - Comply with BS EN ISO 13567-1.
  - Comply with BS EN ISO 13567-2.
  - Provide drawn information for the design team and client in the following numbers
- Concept sketch drawings
  - Initial copies for comment (no)
  - Final copies for design team (no)
- Concept schematic drawings
  - Initial copies for comment (no)
  - Final copies for design team (no)
- Developed schematic drawings
  - Initial copies for comment (no)
  - Final copies for design team (no)
- Developed design drawings
  - Initial copies for comment (no)
  - Final copies for design team (no)
- Technical design drawings
  - Initial copies for comment (no)
  - Final copies for design team (no)
- Co-ordinated working drawings
  - Initial copies for comment (no)
  - Final copies for design team (no)
- Installation drawings
  - Initial copies for comment (no)
  - Final copies for design team (no)
- Installation wiring drawings
  - Initial copies for comment (no)
  - Final copies for design team (no)
- Builder's work information
  - Initial copies for comment (no)
  - Final copies for design team (no)
- Builder's work details
  - Initial copies for comment (no)
  - Final copies for design team (no)
- 
- Manufacturer's drawings

- Initial copies for comment (no)
- Final copies for design team (no)
- Controls logic diagrams
  - Initial copies for comment (no)
  - Final copies for design team (no)
- Switchgear, starter and control instrumentation panel drawings
  - Initial copies for comment (no)
  - Final copies for design team (no)
- As-installed drawings
  - Site record copy
- Record drawings
  - Initial copies for comment (no)
  - 2 preliminary sets for use during commissioning.
  - 1 reduced set incorporated into each operating and maintenance manual.
  - 1 set in PDF format for Client's use.
- Plant room schedules and schematics
  - Initial copies for comment (no)
  - 2 preliminary sets for use during commissioning.
  - 1 framed set for plantrooms.
  - 1 reduced set incorporated into each operating and maintenance manual.
  - 1 set in PDF format for Client's use.
  - Provide drawings for construction in form and number as required by the contractor.

#### 330.000 PREPARATION OF DOCUMENTS:

- Prepare drawings to commonly recognised scales generally on A1 sheets and details and schedules on A4 sheets.
- Agree scales, drawing sheet size and format with the CA before preparing any documents.
- Prepare electrical drawings in accordance with BS EN 61082-1.

#### 340.000 SYMBOLS:

- Use symbols and line conventions in accordance with

#### 350.000 DOCUMENT NUMBERING/REGISTRATION SYSTEM:

- Agree with the CA the document numbering/registration system to be used before preparing any documents.

#### 360.000 BUILDER'S WORK INFORMATION:

- Confirm and amplify any information provided by the CA.
- Builder's work is excluded from the Subcontract.
- Builder's work is included in the Subcontract
- Builder's Work excludes drilling and/or plugging walls, floors, ceilings etc., for fixings for services and such work is included in the Subcontract.
- Provide Builder's Work Information, appropriate to the stage of design development, and include requirements for foundations, bases, and supporting structures for plant and equipment.
- Provide fully dimensioned drawings showing both size and position of builder's work.
- Mark out on-site, all cut holes and chases required, any pockets cast in concrete, any inserts, any built in

sleeves or similar items.

- Holes may not be cut in steelwork, reinforced or precast concrete without written permission from the CA. Under no circumstances will holes be cut in pre-stressed concrete. Permitted holes in steelwork must be drilled - burning by means of welding equipment is prohibited.

#### 370.000 TECHNICAL LITERATURE:

- The Subcontractor is
  - required
- To keep copies of the following on-site, readily accessible for reference by all supervisory personnel
- Manufacturer's current literature relating to all products to be used in the Works.
- Relevant BS Codes of Practice.

#### 380.000 MAINTENANCE INSTRUCTIONS AND GUARANTEES:

- Retain copies delivered with components and equipment (failing which, obtain), register with manufacturer as necessary and hand over to CA on or before Practical Completion.
- Notify CA of telephone numbers for emergency services by Subcontractors after Practical Completion.

## **BS APPENDIX**

BS 1192:2007

Collaborative production of architectural, engineering and construction information. Code of practice

BS 7671:2008+A3:2015

Requirements for electrical installations. IET Wiring Regulations. Seventeenth edition

BS 8541-1:2012

Library objects for architecture, engineering and construction. Identification and classification. Code of practice

BS 8541-2:2011

Library objects for architecture, engineering and construction. Recommended 2D symbols of building elements for use in building information modelling

BS 8541-3:2012

Library objects for architecture, engineering and construction. Shape and measurement. Code of practice

BS 8541-4:2012

Library objects for architecture, engineering and construction. Attributes for specification and assessment. Code of practice

BS EN 61082-1:2015

Preparation of documents used in electrotechnology. Part 1 Rules

BS EN ISO 11091:1999

Construction drawings. Landscape drawing practice

BS EN ISO 13567-1:2002

Technical product documentation. Organization and naming of layers for CAD. Part 1 Overview and principles

BS EN ISO 13567-2:2002

Technical product documentation. Organization and naming of layers for CAD. Part 2 Concepts, format and codes used in construction documentation

BS ISO 29481-1:2010

Building information modeling. Information delivery manual methodology and format

---

## A32 MANAGEMENT OF THE WORKS

### 110.000 MAIN CONTRACT PRELIMINARIES:

- Management of the Works
- Applies to the whole of the Works, including this Subcontract. Comply with the requirements specified therein in so far as they apply to the Subcontract Works, and co-operate with and assist the Main Contractor in complying with them generally.

### 120.000 CO-OPERATE:

- Co-operate with the Contractor, other subcontractors, suppliers, local authorities and statutory undertakings in the execution of their work.
- In particular, the following works carried out by others will require close and careful liaison and co-operation.

### 130.000 PROGRAMME/PROGRESS:

- Provide detailed sub-programmes to assist the Contractor in producing a Master Programme for the Contract Works.
- Due allowance is to be made in the programme(s) for the Works for, but not limited to, the following:
  - Ordering and installation periods.
  - The completion of drawing, etc. including the minimum working days for comment
  - Work resulting from instructions issued in respect to the expenditure of provisional sums.
  - Concurrent work by other trades.
  - Any temporary works necessary for the completion of the engineering services installations.
  - Pre-commissioning, commissioning and performance testing of the engineering services installations.
  - Preparation and provision of Record Drawings and Operating and Maintenance Manuals.
- Provide programme information as
  - critical path network.
- Provide a separate and detailed commissioning programme for agreement with the CA. Make due allowance for the following:
  - Commissioning, demonstration and instruction procedures.
  - Provision of written notice before each (or series of) test, inspection, commissioning or demonstration procedures are to be carried out, not less than
  - Demonstration to the CA that test instruments and equipment are accurate.

### 131.000 COMMISSIONING PROJECT MANAGEMENT:

- Compile a detailed commissioning programme and confirm/agree with the main contractor.
- Compile and submit to the project supervisor the appropriate health and safety method statements and risk assessments.
- Establish a means (such as checklists) of monitoring the progress of the commissioning.
- Ensure that all parties involved on the commissioning process have documentation procedures for dealing with variations to contract. Ensure that a control mechanism is set up which includes documentary back-up of what has been changed, how and why.
- Establish a consistent numbering system to identify work items.
- Ensure the consistent use of mnemonics to identify all BMS components and devices.
- Ensure regular database and configuration back-ups are made throughout all stages of the commissioning process.
- Ensure attendance of all appropriate and responsible parties for interface pre-commissioning tests

(interface between BMS and other plant items/systems).

#### 140.000 ASSESSMENT AND MONITORING:

- Record progress of the Works weekly on a copy of the programme kept on-site. Update or redraft programme without delay if any circumstances arise which affect the progress of the Works.
- Mark up "As Installed" details weekly and before any work is hidden from view.
- Environmental assessment of project to meet the criteria for the target rating under the relevant BREEAM Scheme.
- Environmental performance calculation to follow BS EN 15978.

#### 150.000 INSPECTION AND MEASUREMENT OF WORK:

- Provide all necessary assistance to enable CA to examine or measure the Works.

#### 151.000 BMS WITNESSING REQUIREMENTS:

- The project supervisor's nominated representative will implement the following witnessing requirements. Ensure that on-site commissioning staff facilitate the witnessing process.
- Ensure that the BMS hardware is installed in accordance with Section W60.
- Verify any operator software and associated graphics.
- Witness completely the control of any main and/or critical items of plant along with a random sample of other points.
- If less than 300 points, witness all points. Between 300 and 1,000 points witness 50% (minimum of 300 to be witnessed). If more than 1,000 points witness 20% (with a minimum of 500 points witnessed).
- Reserve the right to witness 100% of the points if the failure rate is greater than 5%.
- Witness a sample of specific functions, eg 10% of alarms and 10% of data logging.
- Witness one of several identical items of plant in detail with the others witnessed on a random basis.
- Verify the system security access.
- Verify that all safety-related functions perform to that specified, eg plant shutdown on fire condition.
- Verify all plant restarts according to that specified after building power failure and local power failure.
- Witness all power meter data-points to ensure that they match the meters.
- Ensure that trend logs are used when witnessing points in order to monitor the performance of control actions.
- Verify the handover of all operating manuals and system documentation.
- Verify the handover of backup copies of software.
- Verify the completion of any specified system operator training.

#### 152.000 BMS - POST HANDOVER CHECKS:

- Ensure that the following post-handover checks are performed:
  - Global level checks
    - Internal air temperature.
    - Relative humidity.
    - Ventilation.
    - Energy consumption (ensure that the pulse-input counters match the meters).
  - Check that each of the above meets the specified requirements.
- System level checks
  - Control strategies. Check that any suspect control strategies are appropriate for the intended application. Check that the suspect control strategy has been implemented and commissioned correctly.

Check that the control strategy is still appropriate for the intended use.

- Network communications. Check that all relevant field controllers communicate properly. Check for correct sharing between controllers of relevant data and correct inter-controller operation.
- Control set-points. Check that the set-points in question are correct and appropriate for the actual operating conditions.
- Control loop settings. Check that the control loop settings result in accurate and stable control. Check that all self-learned characteristics are valid.
- Control zones. Check that the control zones are appropriate.
- Occupant controls. Check that occupant controls work correctly.
- Sub-system/component level
  - Sensors. Check the accuracy and location of any suspect sensors.
  - Actuators. Check that any suspect actuators operate correctly.
  - Dampers and valves. Check that any suspect dampers and valves are not jammed and that they operate as intended.

#### 160.000 COVERING-UP:

- Ensure no section of the Works are covered, concealed or insulated until completion of a witnessed satisfactory test.
- Give notice when Works which are to be covered or concealed are ready for examination and/or measurement, not less than
- Give notice to
  - CA.
- (Services) Engineering Site Staff.

#### 170.000 STATUTORY AUTHORITIES:

- Orders for the incoming services will be placed by
  - the Main Contractor.
  - the Subcontractor.
  - the Employer.
- Liaise with the Statutory Authorities and provide any test notices required to ensure final connections are made in accordance with the requirements of the testing and commissioning programme.

#### 180.000 TEST NOTICES:

- Provide all formalities in connection with Test Notices, Agreement and Application for Supply Forms etc. Ensure all documents requiring the Employer's signature are forwarded to the CA 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 reconnections, re-visits etc., by Supply Authorities or any other officials.

#### 190.000 PHOTOGRAPHS:

- Provide progress photographs of the Subcontract Works
  - in colour.
- Time intervals - monthly
- Number of prints – minimum 20
- Size – as appropriate

## **BS APPENDIX**

BS EN 15978:2011

Sustainability of construction works. Assessment of environmental performance of buildings. Calculation.

---

## **A33 QUALITY STANDARDS / CONTROL**

### **110.000 MAIN CONTRACT PRELIMINARIES:**

- Quality Standards/control
- Applies to the whole of the Works, including this Subcontract. Comply with the requirements stated therein insofar as they relate or apply to the Subcontract Works, and co-operate with and assist the Main Contractor in complying with them generally.

### **120.000 DELEGATION:**

- The CA may delegate certain powers and duties. The CA will indicate the duties and powers of the following:
  - Clerk of Works
  - Resident Engineer (Structural)
  - (Services) Engineering Site Staff

### **130.000 SUBCONTRACTOR'S PERSON-IN-CHARGE:**

- Appoint a foreman-in-charge and/or site agent to ensure constant management and supervision of the Subcontract Works.
- Give maximum possible notice to the Contractor and CA before changing the foreman-in-charge or site agent.

### **140.000 DIMENSIONS:**

- Where installations are dependent upon site dimensions ensure that these are available before proceeding with the Works.
- Do not take dimensions by scaling from the drawings.
- Where dimensions are indicated on drawings check these on-site, as appropriate, to ensure building construction and manufacturing tolerances can be accommodated.
- Do not order or manufacture equipment using dimensions indicated on the Tender drawings, specification or schedules.

### **150.000 SETTING OUT FOR THE SUBCONTRACT WORK:**

- Where this is done by the Main Contractor check its accuracy and obtain his approval before proceeding with the work.

### **160.000 SITE MODIFICATIONS:**

- Do not make site modifications to assemblies without authorisation.
- Where site modifications to assemblies are authorised make in accordance with manufacturer's certified drawings and instructions.
- Ensure that modifications made comply with any type test certificate obtained for arrangement of components.

### **170.000 STANDARDS, REGULATIONS AND BREEAM REQUIREMENTS:**

- Provide all materials and works in accordance with the appropriate British Standard or Code of Practice and where no BS or CP is applicable the Agreement Certificate for the particular item.
- Comply with all statutory instruments and regulations, and local byelaws relating to the area of the site

current at

- the date of tender.
- Comply with the requirements of the Local Authority Building Inspector.
- Comply with all relevant requirements included in the Main Contract Preliminaries Section
  - regarding Statutory Obligations, Section .
- Notify all authorities in accordance with their regulations and obtain any required approvals for the installation.
- Where no specific design, performance or installation standards are quoted the following shall apply.
  - CIBSE, Guide Books A, B and C.
  - CIBSE, Commissioning Codes.
  - CIBSE Code for Lighting.
  - CIBSE, Technical Reports.
  - CIBSE, Technical Memoranda.
- Institute of Plumbing, Plumbing Engineering Services Design Guide.
- Ensure all equipment and systems are designed and installed in accordance with the relevant standards and that operational compatibility exists between the systems and any other system installed at the same location.
- Supply plant and equipment to achieve the specified design conditions and to provide stable control.
- For insulation - Comply with online guide to check long term impact of material selection - [www.thegreenguide.org.uk](http://www.thegreenguide.org.uk)
- Comply with requirements for all targeted BREEAM credits and supply relevant information to the BREEAM Assessor. Targeted credits will be as agreed with the client and BREEAM assessor/advisor.

#### 171.000 STANDARDS AND REGULATIONS:

- Provide all materials and works in accordance with the appropriate British Standard or Code of Practice and where no BS or CP is applicable the Agreement Certificate for the particular item.
- Provide products in accordance with the Construction Products Regulations (CPR). Products covered by harmonised European product standards (hENs) must have a Declaration of Performance (DoP) certificate for the product and be CE marked. Manufacturers of products not fully covered by a hEN or which do not fall within the scope of a hEN shall provide Declaration of Performance documentation in accordance with one of the methods in the CPR.
- Comply with all statutory instruments and regulations, relating to the area of the site current at
  - the date of tender.
- Comply with all Statutory Obligations arising from current legislation and regulations, together with other requirements, including, but not limited to, the following as applicable to particular projects
  - Comply with the requirements of the Local Authority Building Inspector.
  - Statutory Obligations
    - Health and Safety at Work etc Act 1974
      - HSE L8 Legionnaires' Disease. The Control of Legionella Bacteria in Water Systems. ACOP and all parts of HSG 274 (for technical guidance).
      - HSE L5 Control of Substances Hazardous to Health. ACOP.
    - Management of Health & Safety at Work Regulations 1999
      - HSE L8 Legionnaires' Disease. The Control of Legionella Bacteria in Water Systems. ACOP and all parts of HSE 274 (for technical guidance).
      - HSE L5 Control of Substances Hazardous to Health. ACOP.
    - Gas Safety (Installation and Use) Regulations 1998
      - HSE L56 Safety in the Installation and Use of Gas Systems and Appliances: Gas Safety

- (Installation and Use) Regulations 1998. ACOP.
- The Gas Appliances (Safety) Regulations 1995
  - The Gas (Meters) Regulations 1983
  - The Measuring Instruments (Gas Meters) Regulations 2006
  - The Control of Pollution (Oil Storage) Regulations 2001
  - The Pipelines Safety Regulations and amendments
    - HSE L82 Guide to the Pipelines Safety Regulations 1996
  - Pressure Systems Safety Regulations 2000
    - HSE L122 Safety of Pressure Systems. Pressure Systems Safety Regulations 2000. ACOP, 2nd Edition 2014
  - Pressure Equipment Regulations 1999 and Amendment Regulations 2002
    - HSE L122 Safety of Pressure Systems. Pressure Systems Safety Regulations 2000. ACOP, 2nd Edition 2014
  - The Confined Spaces Regulations 1997
    - HSE L101 Safe Work in Confined Spaces. Confined Spaces Regulations. ACOP
  - Building Regulations 2000 and current amendments, and relevant Approved Documents in England and Wales.
  - Building Standards (Scotland) Regulations 1990 and current amendments and relevant Technical Handbooks and supporting Guidance.
  - Building Regulations Northern Ireland 2012 and relevant Technical Booklets.
  - The Energy Performance of Buildings Regulations (England and Wales) Regulations 2012 and amendments.
  - The Ecodesign for Energy-Related Products and Energy Information Regulations 2011 and amendments.
  - The Renewable Heat Incentive Scheme Regulations 2011 and amendments.
  - The Domestic Renewable Heat Incentive Scheme Regulations 2014
  - England and Wales - The Water Supply (Water Fittings) Regulations 1999, as amended by The Water Supply (Water Fittings)(Amendment) Regulations 1999, The Water Act 2003 (Consequential and Supplementary Provisions) Regulations 2005 and The Construction Products Regulations 2013.
  - Scotland - The Water Supply (Water Fittings) Byelaws 2014.
  - Northern Ireland - The Water Supply (Water Fittings) Regulations (Northern Ireland) 2009.
  - London Building Act and/or Building (Inner London) Regulations and amendments
  - Public Health Acts
  - Electricity Acts
  - The Electricity at Work Regulations 1989
    - HSE HSR25 Memorandum of Guidance On the Electricity at Work Regulations 1989
  - The Electricity Safety, Quality and Continuity Regulations 2002
  - Factories Act 1961
  - Clean Air Act 1993
  - The Environmental Protection Act and amendments
  - The Control of Pollution Act 1974 and Amendment Acts
  - Air Quality Standards Regulations 2010
  - The Fluorinated Greenhouse Gases Regulations 2009
  - The Workplace (Health, Safety and Welfare) Regulations 1992
    - HSE L24 Workplace, Health, Safety and Welfare Regulations. ACOP
  - The Construction (Design and Management) Regulations 2015
  - The Health and Safety (Display Screen Equipment) Regulations 1992 as amended by the Health and Safety (Miscellaneous Amendments) Regulations 2002
    - HSE L26 Work with Display Screen Equipment. Guidance on Regulations.
  - The Clean Air (Arrestment Plant) (Exemption) Regulations 1969
  - The Control of Substances Hazardous to Health (COSHH) Regulations 2002, including Amendment

- to the Regulations 2003 and 2004.
  - HSE L5 Control of Substances Hazardous to Health. ACOP
  - HSE L8 Legionnaires' Disease. The Control of Legionella Bacteria in Water Systems. ACOP and all parts of HSG 274 (for technical guidance).
  - Dangerous Substances and Explosive Atmospheres Regulations 2002
    - HSE L138 Dangerous Substances and Explosive Atmospheres. Dangerous Substances and Explosive Atmospheres Regulations 2002. ACOP
  - Chemicals (Hazard Information and Packaging for Supply) Regulations 2009
  - Control of Asbestos Regulations 2012
    - HSE L143 Managing and Working with Asbestos. Control of Asbestos Regulations 2012. ACOP
  - The Provision and Use of Work Equipment Regulations 1998
    - HSE L22 Safe Use of Work Equipment. Provision and Use of Work Equipment Regulations 1998. ACOP
  - Personal Protective Equipment at Work Regulations 1992
    - HSE L25 Memorandum of guidance on the electricity at work regulations 1989. Guidance on regulations. 2nd edition
  - The Lifting Operations and Lifting Equipment Regulations 1998
  - HSE L113 Safe Use of Lifting Equipment. Lifting Operations and Lifting Equipment Regulations 1998. ACOP
  - Public Utility Company and/or Statutory Authority regulations, specifications, and requirements.
  - Other Requirements
    - British Standards and Codes of Practice.
    - BS 7671 - Requirements for Electrical Installations (IET Wiring Regulations).
    - BS EN 50110.
    - Insurance Company Requirements.
    - IEC Standards.
  - Notify all authorities in accordance with their regulations and obtain any required approvals for the installation.
  - Where no specific design, performance or installation standards are quoted the following shall apply.
    - CIBSE Guide Books
      - Guide A Environmental design
      - Guide B Heating, Ventilating, Air Conditioning and Refrigeration
      - Guide C Reference data
    - CIBSE Code for Lighting.
    - CIBSE Technical Memoranda.
    - Institute of Plumbing - Plumbing Engineering Services Design Guide.
  - Ensure all equipment and systems are designed and installed in accordance with the relevant standards and that operational compatibility exists between the systems and any other system installed at the same location.
  - Supply plant and equipment to achieve the specified design conditions and to provide stable control.
  - For insulation: Comply with online guide to check long term impact of material selection - [www.thegreenguide.org.uk](http://www.thegreenguide.org.uk)

#### 180.000 TYPE TESTS:

- Provide certificates of verification of type tests. Ensure that drawings and other documents forming part

of certificate are available prior to any order being placed.

#### 190.000 TEST CERTIFICATES:

- Where testing specific to the project is required, ensure test certificates include
  - Project title.
  - Details and date of test.
  - Instruments used, serial numbers, calibration dates.
  - Signature of those witnessing test.
  - Contractor's name.
  - Specific location of the item in the Works.

#### 200.000 INSPECTION AND TESTS - ON OR OFF-SITE:

- Submit schedules showing those parts of the Works for which inspections and tests are required in the specifications, to substantiate conformity with the Specification and for which records are required to be maintained.
- Should any alternative item be proposed which does not carry appropriate certification, ensure independent testing is carried out at no expense to the Employer to confirm compliance.
- Where required, provide formal method statements supported by risk assessments detailing the procedures for carrying-out on-site tests. Agree in advance with all parties procedures for inspections and tests including periods of notice.
- Where a test indicates non-compliance with the Specification submit immediately details of the non-compliance and proposals for corrective action.
- Arrange access for personnel who require to be in attendance, to manufacturer's or other off site premises when any inspections and tests carried out.
- Attendance or otherwise of the supervisory personnel during specified inspections or tests will not reduce the obligations or restrictions of the Contract.
- Carry out all tests required by legislation under the direction of a competent person.

#### 210.000 INSPECTIONS AND TEST RECORDS:

- Prepare a set of drawings and/or report sheets to record accurately the test and inspection information including the following.
  - Plant identification, section and installation under test.
  - Manufacturer's reference number.
  - Date, time, duration of test, weather conditions.
- Test results with itemised readings including records of all other checks and tests.
- Maintain records of all specified inspections and tests performed including third party and works test certificates.
- Include in records, as appropriate, details of the element, item, batch or lot, the nature, number and date of the inspections and tests, the number and type of deficiencies found, any corrective action taken and other relevant particulars.
- Maintain all records on-site for inspection. On completion of the Works, include copies in the operating and maintenance manuals.
- Submit copies of records within one week of request.

#### 220.000 TESTING AND COMMISSIONING OF SERVICES:

- Agree with the Contractor a programme for pre-commissioning checks, setting to work, commissioning and performance testing, and allow for all costs incurred.
- Where required, provide formal method statements supported by risk assessments detailing all

commissioning procedures.

- Give notice to the Contractor and CA and state any requirements for the attendance and co-operation of others.
  - Not less than fourteen working days.
  - Provide all necessary facilities to enable tests to be witnessed and inspections carried out either on-site or at manufacturer's works.
  - The CA 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 CA will reject such defective parts by written notice, within reasonable time, indicating area of dispute.
  - Appoint an "approved engineer", to supervise the whole of the testing, commissioning, performance testing and instruction of client's staff.
  - Provide all specialised personnel (including manufacturer's representatives) and co-ordinate their activities.
  - Test all equipment, material and systems as detailed in Sections. If an inspection or test fails, repeat the procedure, until satisfactory results are obtained.
  - Complete all tests before any paint, cladding or similar materials are applied or before services are concealed.
  - Ensure all requirements such as cleanliness, protection from harmful external and internal elements etc. are provided prior to commencement of commissioning.
  - Following satisfactory completion of testing and when the installations are in a safe and satisfactory condition, set to work, regulate and adjust, as necessary, to meet the specified design requirements.
  - Provide all necessary instruments and recorders to monitor systems during commissioning and performance testing.
  - Provide test equipment subject to a quality assurance procedure complying with BS EN ISO 10012.
  - 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 CA.
  - 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.
  - Provide all certification documents for approval by the CA before any system is offered for final acceptance.
    - Commissioning of building services as required by ADL2 (Section 5.16 - 5.28).
    - Commissioning of building services as required by Section 6 of Scottish Technical Handbook, Section 6.7.
  - Gas, fuel oil, electricity and water for testing and commissioning will be provided by
    - the client.
    - the main contractor.
- the subcontractor.

#### 230.000 COMMISSIONING PROCEDURES:

- Observe the following requirements when commissioning the Engineering Services.
- Progressive static testing will be witnessed by the CA when work is presented for testing. This will include:
  - Insulation resistance tests.
  - Earth fault loop impedance tests.
  - Earth continuity tests.
  - Pipeline pressure tests.
  - Air Ductline Pressure Tests.
- Finalise commissioning, taking into account site progress and availability of related services, with CA

and Contractor, and agree access required for controls, etc.

- Completion for operational purposes implies the bulk of snagging has been offered to the CA and that remedial work has been completed. All fans, pumps etc, tested for operation, polarity, phase sequence and impedance etc.
- Pre-commissioning examination and testing to ensure that each system or item of equipment is complete, in a safe condition and all notices are displayed.

#### 240.000 OPERATIONAL DEMONSTRATION:

- Provide a written statement to the CA confirming that each installation has been correctly tested and commissioned and that the performance requirements can be achieved.
- Demonstrate to the CA that all system components are operating correctly, and the completely integrated installation will function in accordance with the specified performance requirements.
- Run each plant for
  - Provide a log book and record all hours run.
- Carry out performance testing in both summer and winter conditions.
- Provide equipment to simulate loads to allow for the full testing of the air conditioning system(s) for the following areas

#### 250.000 OUTSTANDING ACCEPTANCE TESTS:

- Any items which have failed their acceptance tests or where such tests are delayed by the client are to be listed and dates agreed, during the defects liability period when reasonable demands for consumer requirements are available.

#### 260.000 SYSTEMS USED BEFORE PRACTICAL COMPLETION:

- Systems may not, without the prior written approval of the CA be used before Practical Completion. Systems to be used before practical completion for the benefit of the Contractor and/or Subcontractor must have all defective consumable elements (including lamps and tubes) replaced by new not more than seven days prior to Practical Completion.
- No system shall be put into use prior to handover to the employer, except for testing and commissioning, unless in accordance with the following procedure:
  - Following the receipt of written instructions, the Subcontractor shall operate designated parts of the Subcontract Works, provided that such operation is practicable and does not prejudice the Subcontractor's responsibilities and obligations under the Subcontract.
  - Additionally and with adjustment to the Subcontract sum, the Subcontractor, shall if instructed, provide:
    - comprehensive insurance including indirect loss for any plant being operated
    - maintenance of the installation
    - re-instatement of the installation to as new condition prior to handover to the Employer
    - allow the defects liability period to commence on handover.

#### 300.000 OPERATION OF SYSTEMS BEFORE THE PRODUCTION OF DRAWINGS AND/OR OPERATING AND MAINTENANCE MANUALS:

- Provide attendance, at no expense to the Employer, to put into service, operate 24 hours a day and maintain the systems to the Employer's requirements, including the provision of suitable competent labour, in the event that the Record Drawings and/or Maintenance Manuals are not available when the Works would, in the opinion of the CA, otherwise qualify for Practical Completion.
- In the event of the Subcontractor failing to provide this service satisfactorily the Employer shall be

---

entitled to make his own arrangements and recover the full cost through the Contract.

**310.000 INSPECTION BY EMPLOYER'S INSURANCE COMPANY:**

- Where indicated in the Work Sections items are to be inspected by a competent person acting for the Employer's Insurance Company appointed under the provisions of the Factories Act or other relevant legislation. The installations concerned shall satisfy the Insurance Company's requirements in all respects.
- Agree a programme for inspection and certification of specified equipment.
- Inform the CA when equipment is to be ready for examination.
- The Employer will place an order with the Insurance Company. Details and nature of the order will be provided to all interested parties.
- Provide all detailed drawings etc. of the equipment to enable the Insurance Company to approve design before manufacture.
- Arrange for the attendance of the Insurance Company's Engineer/Surveyor at each stage of manufacture and installation and provide all necessary access and facilities for inspecting and testing as may be required.
- No plant which is subject to inspection will be accepted on behalf of the employer until a satisfactory certificate has been received by the Employer from the Insurance Company.
- All Insurance Company charges for examination and approval of drawing, inspection of works during construction and inspection and certification of the completed work will be paid by
  - The Employer.
  - The Subcontractor.
  - The Contractor.

## **BS APPENDIX**

BS 7671:2008+A3:2015

Requirements for electrical installations. IET Wiring Regulations. Seventeenth edition

BS EN ISO 10012:2003

Measurement management systems. Requirements for measurement processes and measuring equipment

---

## **A34 SECURITY / SAFETY / PROTECTION**

### 110.000 MAIN CONTRACT PRELIMINARIES:

- Security/safety/protection
- Applies to the whole of the Works, including this Subcontract. Comply with the requirements stated therein insofar as they relate or apply to the Subcontract Works, and co-operate with and assist the Main Contractor in complying with them generally.

### 115.000 CDM REGULATIONS:

- Comply with the requirements of the CDM Regulations by
  - adhering to the rules of the Pre-Construction Information and Construction Phase Plan.
  - reporting accidents, injuries or dangerous occurrences to the main contractor.
  - providing the main contractor with appropriate input to the health and safety plan, including risk assessments, and to the health and safety file.
- providing the main contractor with information on the subcontract works which might affect the health or safety of any person.

### 120.000 DELIVERY:

- Provide an adequate and safe protection for all materials and products during transport to site.
- Deliver all tubes, conduit, trunking and associated equipment with open ends effectively plugged, capped or sealed.
- Deliver all ductwork, tubes, conduit, trunking and associated equipment with open ends effectively plugged, capped or sealed.

### 130.000 HANDLING:

- Offload and transport about the Works all materials and products as recommended by manufacturers.

### 140.000 STORAGE:

- Store all materials and products as recommended by manufacturers.
- Provide sufficient, safe and secure storage for all materials and products.
- Provide racks to prevent distortion for storage of conduits, pipes and similar materials.
- Store all fittings, accessories and sundry items in clean bins or bagged and stowed in racks and maintained under suitable weatherproof cover.

### 150.000 PROTECTION OF SUBCONTRACT WORKS:

- Check regularly the protection provided after installation of equipment and inform the Main Contractor if inadequate.
- Install items such as grilles, diffusers, lighting fittings, switches, accessories etc. as near to completion as practicable.
- Only install filter media when the plant items concerned are being commissioned and tested.
- Leave plant and equipment in a ready to paint condition where specified as part of the Works or to be

carried out by others.

- Paint parts liable to corrosion immediately after removal of any temporary protection.
- Replace material, plant or equipment where deterioration or damage has occurred prior to handover.

#### 151.000 PROTECTION OF SUBCONTRACT WORKS:

- Provide adequate and safe protection for all materials and products after installation.
- Ensure all items are protected against ingress of water and dust, formation of condensation, extremes and rapid changes of temperature, building works and operations of others.
- Protect during erection all easily damaged materials with hardboard covers or heavy duty polythene sheet. Such items include but are not limited to
  - control panels,
  - switchboards,
  - distribution boards,
  - heater batteries,
  - finned pipework,
  - gauge glasses,
- Protect all finished items from damage and paint splashes.
- Install items such as grilles, diffusers, lighting fittings, switches, accessories etc. as near to completion as practicable.
- Only install filter media when the plant items concerned are being commissioned and tested.
- Cover all plant items with polythene sheeting except when being worked upon.
- Cap all open ends of pipes, ducts, conduit and trunking etc except when being worked upon.
- Leave plant and equipment in a ready to paint condition where specified as part of the Works or to be carried out by others.
- Paint parts liable to corrosion immediately after removal of any temporary protection.
- Replace material, plant or equipment where deterioration or damage has occurred prior to handover.

#### 160.000 IDENTIFICATION:

- Where appropriate, ensure that materials, plant and equipment bear the brand name, serial/batch number and any other data required to identify their nature in relation to the Works.

#### 170.000 ROTATING PLANT:

- Immediately prior to Practical Completion adjust, ease and lubricate moving parts as necessary to ensure easy and efficient operation.
- Ensure that, whenever necessary, temporary supplies are provided to enable motive plant items

delivered and/or installed to be run at regular intervals to avoid damage or deterioration.

- Ensure that rotating plant is hand-turned periodically if temporary supplies are not available.

#### 180.000 MAINTENANCE OF EXISTING SERVICES:

- Fully maintain all existing services to existing premises during the progress of the Works.
- Fully maintain the following services to existing premises during the progress of the Works.
  - Gas
  - Water
  - Electricity
  - Telephones
  - Soil and Waste
  - Rainwater
  - Fire Alarms
- Provide any additional work and materials necessary to maintain these services at all times during the duration of the Contract. Any existing services disturbed by the Works are to be reinstated fully in accordance with the standards of quality defined in the specification and to the satisfaction of the CA.
- Make all connections to existing services out of normal working hours.

---

## **A35 SPECIFIC LIMITATIONS ON METHOD / SEQUENCE / TIMING**

### **110.000 MAIN CONTRACT PRELIMINARIES:**

- Specific limitations on method/sequence/timing to be confirmed with the Client before any works commence and with written permission to proceed from the CA.
- Applies to the whole of the Works, including this Subcontract. Work within the limitations stated therein insofar as they relate or apply to the Subcontract Works, and co-operate with and assist the Main Contractor in working within them generally.

### **120.000 SPECIFIC LIMITATIONS:**

- Design constraints – Design is based on non-intrusive , limited visual surveys and there will be the requirement to finalise some aspects of the design once works commence. The Contractor shall work with the Services Engineer to resolve an design related issues as soon as they become apparent.
- Method/sequence of work – refer to the CA documents.
- Access to the site – height limitations within car park.
- Use of the site – site in occupation.
- Working area – areas restricted as site in occupation.
- Use or disposal of material – responsibility of the Contractor.
- Start of work - refer to the CA documents.
- Working hours - refer to the CA documents.

### **130.000 ORDERING OF MATERIALS AND PRODUCTS:**

- Ensure that procurement details of materials are incorporated in the Subcontract programme.
- Avoid delays by submitting details of alternative manufacturers or types of materials/products to the CA in time to comply with the agreed programme of the Works.
- Order all materials/products necessary for the completion of the Works immediately after receipt of comments received and/or instructions to proceed. No delay to practical completion, or completion of any part thereof caused by delays in ordering will be accepted.

---

## **A37 OPERATION / MAINTENANCE OF THE FINISHED BUILDING**

### 101.000 SUBMISSION OF RECORD DOCUMENTS:

- To satisfy the provisions of the Health and Safety at Work Act the Employer will not accept handover of the installations until full and adequate information concerning the installations is in the possession of his operating and maintenance staff.
- Provide Record Documents - being part of the Works - prior, and as a prerequisite, to Practical Completion to the satisfaction of the CA.
- Prepare manuals in draft as the Works progress and make suitable arrangements where the Works are subject to Partial Possession or Sectional Completion.
- Submit draft Record Documents to the CA for comment prior to commissioning.
- Prepare two temporary Manuals with provisional record drawings and preliminary performance data available at commencement of commissioning to enable Employer's staff to familiarise themselves with the installation. These should be of the same format as the final Manuals with temporary insertions for items which cannot be finalized until the installations are commissioned and performance tested.
- Provide the CA with copies of the final Manual prior to Practical Completion. Number of weeks prior

### 102.000 SUBMISSION OF DOCUMENTS FOR HEALTH AND SAFETY FILE:

- To satisfy the provisions of the Health and Safety at Work Act the Employer will not accept handover of the installations until full and adequate information concerning the installations is in the possession of his operating and maintenance staff.
- Provide Record Documents - being part of the Works - prior, and as a prerequisite, to Practical Completion to the satisfaction of the CA.
- Prepare manuals in draft as the Works progress and make suitable arrangements where the Works are subject to Partial Possession or Sectional Completion.
- Submit draft Record Documents to the CA for comment prior to commissioning.
- Prepare two temporary Manuals with provisional record drawings and preliminary performance data available at commencement of commissioning to enable Employer's staff to familiarise themselves with the installation. These should be of the same format as the final Manuals with temporary insertions for items which cannot be finalised until the installations are commissioned and performance tested.
- Provide the CA with copies of the final Manual prior to Practical Completion. Number of weeks before
- Prepare electrical record drawings in accordance with BS EN 61082-1.
- Prepare Operating and Maintenance Manuals for heating systems requiring a trained operator in accordance with BS EN 12170.
- Prepare Operating and Maintenance Manuals for heating systems not requiring a trained operator in accordance with BS EN 12171.

### 110.000 RECORD DOCUMENTS:

- Provide
  - Record Drawings and Schedules.
  - Plant room and switch room drawings, schedules and schematics.
  - Operating and Maintenance Manuals.
  - Blank maintenance logs.
  - Log book
- Ensure record documents clearly record the arrangements of the various sections of the Works as actually installed and identify and locate all component parts.
- Ensure record documents make it possible to comprehend the extent and purpose of the Works and the method of operation thereof.
- Ensure record documents set out the extent to which maintenance and servicing is required and how, in

detail, it should be executed.

- Ensure record documents provide sufficient, readily accessible and proper information to enable spares and replacements to be ordered.
- Correlate record documents so that the terminology and the references used are consistent with those used in the physical identification of the component parts of the installations.
- Demonstrate as required throughout the execution of the Works that complete and accurate records are being maintained and that the record documents are being progressively compiled as the work on-site proceeds.
- Ensure the building log book contains the information outlined in Section 4 of the Building Regulations Part L, Conservation of fuel and power. New buildings other than dwellings.
- Ensure the building log book contains the information outlined in Section 6.8.1 of the Scottish Technical Standard - Energy.

#### 111.000 RECORD DOCUMENTS:

- Provide the system records and full documentation as required in the appropriate standard.
  - Standard
    - BS EN 50131-1 - Intruder alarm systems.
    - BS 5839 - Fire detection and alarms in buildings.
    - BS 6701 - Telecommunications equipment and telecommunications cabling.
    - BS EN 62305 - Protection against lightning.
    - BS 7671 - Requirements for electrical installations (IET Wiring regulations).
- Provide
  - Record Drawings and Schedules
  - Plant room and switch room drawings, schedules and schematics.
  - Operating and Maintenance Manuals.
  - Blank maintenance logs
  - Log book
- Ensure Record Documents clearly record the arrangements of the various sections of the Works as actually installed and identify and locate all component parts.
- Ensure Record Documents make it possible to comprehend the extent and purpose of the Works and the method of operation there of.
- Ensure Record Documents set out the extent to which maintenance and servicing is required and how, in detail, it should be executed.
- Ensure Record Documents provide sufficient, readily accessible and proper information to enable spares and replacements to be ordered.
- Correlate record documents so that the terminology and the references used are consistent with those used in the physical identification of the component parts of the installations.
- Demonstrate as required throughout the execution of the Works that complete and accurate records are being maintained and that the record documents are being progressively compiled as the work on-site proceeds.
- Ensure the building log book contains the information outlined in Section 3 of the Building Regulations Part A, Conservation of fuel and power. New buildings other than dwellings.
- Ensure the building log book contains the information outlined in Section 6.8.1 of the Scottish Technical Standard - Energy.

#### 120.000 RECORD DRAWINGS AND SCHEDULES:

- Prepare Record Drawings and Schedules to a scale not less than 1:50 from the "As Installed Drawings" maintained on-site as the Works progress. Endorse all such documents 'RECORD DRAWINGS'. Where agreed with the CA certain detailed information may be provided in schedule form. Prepare electrical

drawings in accordance with BS EN 61082-1.

- Provide reduced scale copies for inclusion in the operating and maintenance manuals as detailed in clause A37.150.000.
- Record Drawings and Schedules must include, but are not limited to:
  - Location, including level if buried, of Utility Service connections, including those provided by the appropriate Authority, indicating points of origin and termination, size and material of service, pressure and/or other relevant information.
  - Disposition and depth of all underground systems.
- Schematic drawings of each system indicating principal items of plant, equipment, zoning, means of isolation, etc. in sufficient detail to make it possible to comprehend the system operation and the inter-connections between various systems.
- Details of the principles of application of automatic controls and instrumentation.
- Diagrammatic dimensioned plans and sections of each system or service showing sizes and locations of all ancillaries, plant, equipment controls, test points, and means of isolation etc. including any items forming an integral part of the engineering systems provided by others (such as plenum ceilings, builders' work shafts, chimneys etc.).
- Identification of all terminals/cables etc. by size/type and duty/rating as recorded from the approved commissioning results.
- Detailed wiring drawings/diagrams/schedules for all systems, including controls, showing origin, route, cable/conduit size, type, number of conductors, length, termination size and identification, and measured conductor and earth continuity resistance of each circuit.
- Ensure routes indicate if cable/conduit is surface mounted, concealed in wall chase, in floor screed, cast in-situ, above false ceiling etc.
- Details of co-ordination of wiring and connections with cable core identification, notation of fire alarm, security, control and instrumentation and similar systems provided as part of the Works.
- Details to show inter-connections between the Works and equipment or systems provided by others to which wiring and connections are carried out as part of the Works.
- Location and identity of each room or space housing plant, machinery or apparatus.
- Dimensioned plans and sections at a scale of 1:20 of plantrooms, service subways, trenches, ducts and other congested areas where in the opinion of the CA smaller scale drawings cannot provide an adequate record. Indicate the location, identity, size and details of each piece of apparatus.
- Manufacturers' drawings of equipment indicating
  - general arrangement and assembly of component parts which may require servicing.
  - internal wiring diagrams together with sufficient physical arrangement details to locate and identify component parts.
  - schedules as required to locate, reference and provide details of ratings and duty of all items incorporated into the Works together with all fixed and variable equipment settings established during commissioning.
- For each programmable control item, schedules indicating for each input and output point connected, full data in respect of that point including reference, type of input/output, connected equipment reference, set values of temperature or pressure etc., set values of start/stop/speed change times, alarm priority, control specification reference and any other such parameters as are applicable.
- Each spare input and output point including reference, type of input/output and space for future entry of appropriate parameters as listed above.
- Logic flow diagrams for each individual control or monitoring specification and for each building services engineering system to illustrate the logical basis of the software design.
- Schedules setting out details of all initial values of user-defined variables, text statements for alarm

messages etc.

#### 130.000 PLANT ROOM AND SWITCH ROOM DRAWINGS, SCHEDULES AND SCHEMATICS:

- Provide good quality plant and switch room drawings, schedules and schematics.
- Hang the following in each plant room and switch room, any other appropriate location or where directed by the CA.
  - Schematic drawings of circuit layouts showing identification and duties of equipment, numbers and locations, controls and circuits.
  - Schedules in the form of printed sheets showing the number, type, location, application/service and symbol, and normal operating position of each means of isolation.
  - Control schematics.
  - Location of all plant and equipment items including plans and elevations of main switchgear showing physical disposition of switches.
  - First aid instructions for treatment of persons after electrical shock.
  - All other items required under Statutory or other regulations.
  - Location of all incoming service isolating and metering facilities.
  - Emergency operating procedures and telephone numbers for emergency call out service applicable to any system or item of plant and equipment.
- Prepare electrical drawings in accordance with BS EN 61082-1.
- Protect surface of drawings by
  - pressure lamination
- framing under glass or other rigid, transparent, cleanable and protective surface.

#### 140.000 OPERATING AND MAINTENANCE MANUAL SPECIALIST:

- Employ a specialist to prepare manuals.
- Employ one of the following specialists to prepare manuals

#### 145.000 OPERATING AND MAINTENANCE MANUAL FORMAT:

- The operating and maintenance manuals shall be prepared in the following format:
  - Proprietary electronic operation and maintenance manual writing software tool.
- PC based word processing software tool.

#### 150.000 OPERATING AND MAINTENANCE MANUALS:

- The operating and maintenance manuals must include:
  - A full description of each of the systems installed, written to ensure that the Employer's staff fully understand the scope and facilities provided.
  - A description of the mode of operation of all systems including services capacity and restrictions.
  - Diagrammatic drawings of each system indicating principal items of plant, equipment, valves etc.
  - Details of how to re-commission so that complex plant services within the building can be re-commissioned by an engineer without any historic knowledge of the systems.
  - A photo-reduction of all record drawings together with an index. Reduced size
  - Legend of all colour-coded services.
  - Schedules (system by system) of plant, equipment, valves, etc., stating their locations, duties and performance figures. Each item must have a unique number cross-referenced to the record and diagrammatic drawings and schedules.
- The name, address and telephone number of the manufacturer of every item of plant and equipment

together with catalogue list numbers.

- Manufacturer's technical literature for all items of plant and equipment, assembled specifically for the project, excluding irrelevant matter and including detailed drawings, electrical circuit details and operating and maintenance instructions.
- A copy of all Test Certificates, Inspection and Test Records, Commissioning and Performance Test Records (including, but not limited to, electrical circuit tests, corrosion tests, type tests, start and commissioning tests) for the installations and plant, equipment, valves, etc., used in the installations.
- A copy of all manufacturers' guarantees or warranties, together with maintenance agreements offered by subcontractors and manufacturers.
- Copies of Insurance & Inspecting Authority Certificates and Reports.
- Starting up, operating and shutting down instructions for all equipment and systems installed.
- Control sequences for all systems installed.
- Schedules of all fixed and variable equipment settings established during commissioning.
- Procedures for seasonal change-overs and/or precautions necessary for the care of apparatus subject to seasonal disuse.
- Detailed recommendations for the preventative maintenance frequency and procedures which should be adopted by the Employer to ensure the most efficient operation of the systems.
- Details of lubrication systems and lubrication schedules for all lubricated items.
- Details of regular tests to be carried out (e.g. water cooling towers etc.)
- Details of procedures to maintain plant in safe working conditions.
- Details of the disposal requirements for all items in the works.
- A list of normal consumable items.
- A list of recommended spares to be kept in stock by the Employer, being those items subject to wear or deterioration and which may involve the Employer in extended deliveries when replacements are required at some future date.
- A list of any special tools needed for maintenance cross referenced to the particular item for which required.
- Procedures for fault finding.
- Emergency procedures, including telephone numbers for emergency services.
- Hospital Operational Policy.
- Back-up copies of any system software.
- Documentation of the procedures for updating and/or modifying software operating systems and control programmes.
- Instructions for the creation of control procedure routines and graphic diagrams.
- Details of the software revision for all programmes provided.
- Two back-up copies of all software items, as commissioned.
- Copies of relevant HSE/CIBSE/IET Guidance notes etc.
- Contractual and legal information including but not limited to details of local and public authority consents; details of design team, consultants, installation contractors and associated subcontractors; start date for installation, date of practical completion and expiry date for the defects liability period; details of warranties for plant and systems including expiry dates, addresses and telephone numbers.

#### 151.000 OPERATING AND MAINTENANCE MANUALS:

- The Employer will employ direct to prepare manual(s).
- Co-operate with the specialist firm in the compilation of the manuals and provide them with copies of the

following.

- Diagrammatic drawings of each system indicating principal items of plant, equipment, valves etc.
- Record drawings, together with an index.
- Plant room and switch room drawings, schedules and schematics, together with an index.
- Legend for all colour-coded services.
- Schedules (system by system) of plant, equipment, valves, etc., stating their locations within the building, duties and performance figures.
- All Test Certificates, Inspection and Test Records, Commissioning and Performance Test Records (including, but not limited to, electrical circuit tests, corrosion tests, type tests, start and commissioning tests) for the installations and plant, equipment, valves, etc., used in the installations.
- All manufacturers' guarantees or warranties.
- Copies of Insurance & Inspecting Authority Certificates and Reports.
- Schedules of all fixed and variable equipment settings established during commissioning.
- Back-up copies of any system software.
- Two back-up copies of all software items, as commissioned.

#### 152.000 BMS OPERATION AND MAINTENANCE MANUALS:

- Confirm that an initial draft of the O&M manual has been submitted for approval prior to commissioning. Ensure that the O&M documentation is produced as the work proceeds and is updated when necessary. Ensure that this work commences at the start of the contract and is added to/updated as the contract progresses. Confirm that approved final copies of the O&M manuals are provided at handover. Ensure that the O&M manual is properly indexed. Ensure that terminology and references are consistent with the physical identification of component parts.
- Confirm that the O&M manual includes the following and is included in the site health and safety file:
  - A written description of plant operation.
  - Control strategy/logic diagrams recording the final version of configuration software installed at handover.
  - Details of system application software configuration.
  - A points list including hard and soft-points (all points should have a unique mnemonic)
  - A description of user adjustable points.
  - Commissioning record details.
  - Detailed data sheets for all control components and equipment.
  - Wiring circuit details including origin, route and destination of each cable.
  - Basic security access to the system.
  - Comprehensive instructions for switching on, operation, switching off, isolation, fault finding and procedures for dealing with emergency conditions.
  - Instructions for any precautionary measures necessary.
  - Instructions for the routine operation of the control system including simple day-to-day guidance for those operating the control system with limited technical skill.
  - Instructions for servicing and system upkeep.
  - A provision for update and modification.
- Confirm that the O&M manual includes comprehensive system operating instructions.

#### 160.000 PRESENTATION OF THE OPERATING AND MAINTENANCE MANUALS:

- Agree format and contents with the CA.
- Encase the Manuals in A4 size, plastic-covered, loose leaf, four ring binders with hard covers, each indexed, divided and appropriately cover- titled. Fold drawings larger than A4 and include in the binder so

that they may be unfolded without being detached from the rings.

**170.000 RECOMMENDED SPARE PARTS:**

- Before practical completion submit to the CA a schedule of spare parts as called for in individual sections and any others that the Subcontractor recommends should be obtained and kept in stock by the Employer for maintenance of the services installations included in the Subcontract. Time scale
  - Weeks before
- State against each item the manufacturer's current price, including packaging and delivery to site. Identify those items which are additional to those specified for inclusion in individual Sections.

**171.000 INITIAL SUPPLY OF ADDITIONAL SPARE PARTS:**

- Submit to the CA a quotation, priced in detail, for the initial supply to the Employer of the additional spare parts identified under clause A37.170.000, and including for:
  - Checking that each spare part is suitable for the replacement of the corresponding part supplied with the item of plant or equipment.
  - Checking receipt, marking and numbering in accordance with the schedule of spare parts.
  - Referencing to the plant and equipment list in the Operation and Maintenance Manual.
  - Painting, greasing, etc. and packing to prevent deterioration during storage.
- Time scale
- Within number of weeks of request

**180.000 RECOMMENDED TOOLS:**

- Before practical completion submit to the CA a schedule of tools and portable instruments as called for in individual Sections and any others that the Subcontractor recommends should be obtained and kept in stock by the Employer for maintenance of the services installations included in the Subcontract. Time scale
  - Weeks before
- State against each item the manufacturer's current price, including packaging and delivery to site. Identify those items which are additional to those specified for inclusion in individual Sections.

**181.000 SUPPLY OF TOOLS:**

- Provide all tools detailed within individual Sections.
  - Submit to the CA a quotation, priced in detail, for the initial supply to the Employer of the additional tools identified under clause A37.180.000.
  - Include for the following.
    - Checking that each item is suitable for the intended application.
    - Checking receipt, marking and identifying.
    - Referencing, where appropriate, to the plant and equipment list in the Operation and Maintenance Manual.
    - Protecting, greasing, etc. and packing to prevent deterioration.
    - Providing a suitable means of storing and securing same.
- Time scale
- Within number of weeks of request

**190.000 TRAINING OF EMPLOYER'S STAFF:**

- Before practical completion explain and demonstrate the purpose, function and operation of the

installations including all items and procedures listed in the Operation and Maintenance Manual:

- to the Employer's maintenance staff.
- to the operational staff.
- Training:
  - Include for the training of
  - Include for not less than indicated number of operating days for this purpose and demonstrate the safe day to day running and maintenance of all systems, plant and equipment.
- Provide training for the operation of the controls, monitoring or BMS installations for one or more of the following levels of operator.
  - Basic operator
    - Ensure that the operator is trained to:
      - Call up and view point-data from plant schematics and/or points lists.
      - Acknowledge system alarms.
      - View trend logs.
  - Intermediate operator
    - In addition to the requirements for a basic operator, ensure that the operator is trained to make basic alterations to the BMS including changes to:
      - Time and occupancy programmes.
      - Control set-points.
      - Setting up trend logs.
      - Setting up alarm routines.
    - Ensure that the operator is also trained for testing and routine inspection of sensors and actuators.
  - Advanced operator
    - In addition to the requirements for an Intermediate operator, ensure that the operator is trained to:
      - Add or change graphics/schematics.
      - Change control strategies.
      - Add analogue and digital inputs/outputs to the system.
      - Back-up the system and archive logged data.
      - Re-load system software/configuration details.
      - Add/modify passwords/monitor system security.
    - Ensure that training is completed before the BMS is handed over.
    - Ensure that each trained operator signs a training acceptance certificate(s).
    - Provide training off-site at the BMS suppliers training facility. Complement this off-site training with 'hands on' on-site training.
    - Provide appropriate reference and training manuals for the operator.
    - Include for training operating staff (no)
    - Include for not less than indicated number of operating days for this purpose and demonstrate the safe day to day running and
    - maintenance of all systems, plant and equipment

#### 200.000 READING OF METERS:

- Record readings of all water, gas, and electricity meters immediately on completion of the Works and forward, via the Main Contractor, to the CA.

#### 210.000 OBLIGATIONS DURING DEFECTS LIABILITY PERIOD:

- Prepare and submit records of failures or malfunctions of any part of the Subcontract Works during the Defects Liability Period, together with details of remedial action taken, subsequent re-testing and the

results.

- Notify the Main Contractor of damage, failures or malfunctions to the Subcontract Works demonstrably caused by incorrect operation of the installations, vandalism or other actions by a third party.
- Inform the CA, via the Main Contractor, in writing when all defects are finally rectified so that an inspection may be carried out prior to the issue of a Final Certificate.

## **BS APPENDIX**

### **BS 6701:2010**

Telecommunications equipment and telecommunications cabling. Specification for installation, operation and maintenance

### **BS 7671:2008+A3:2015**

Requirements for electrical installations. IET Wiring Regulations. Seventeenth edition

### **BS EN 12170:2002**

Heating systems in buildings. Procedure for the preparation of documents for operation, maintenance and use. Heating systems requiring a trained operator

### **BS EN 12171:2002**

Heating systems in buildings. Procedure for the preparation of documents for operation, maintenance and use. Heating systems not requiring a trained operator

### **BS EN 50131-1:2006+A1:2009**

Alarm systems. Intrusion and hold-up systems. Part 1 System requirements

### **BS EN 61082-1:2015**

Preparation of documents used in electrotechnology. Part 1 Rules

## **C12 UNDERGROUND SERVICES SURVEY**

### **PART 1 SYSTEM OBJECTIVES**

#### 100.010 PERFORMANCE OBJECTIVES:

- Obtain and verify currency of existing survey information.
- Determine the location, nature and condition of existing underground services.
- Undertake a CCTV survey of all below ground drainage systems that relate to these works.

#### 100.030 SYSTEM DESCRIPTION:

- Services to be included
  - Buried internal discharge drainage pipework systems from basement groundwater sump pumps.

#### 106.000 DRAWINGS:

- Limited existing drawings available for information.

---

## **PART 3 SPECIFICATION CLAUSES SPECIFIC TO C12**

### **300.000 GENERAL**

#### **300.010 CONTENT AND PRESENTATION OF SURVEY:**

- Unless stated otherwise in the detail survey requirements clauses (310 series) or elsewhere in this specification, undertake the survey in accordance with PAS 128.
- The type and quality of survey required for each category of underground service is detailed in the relevant requirements clauses (310 series).
- Area to be covered by the survey is indicated on the following drawings
- Content of survey
- Presentation of survey
- Refer to deliverables detailed in clause 340.010 below.

#### **300.015 EXISTING RECORDS:**

- Refer to the following tender documentation
  - Health and Safety file – Intelli Scan

#### **300.020 STANDARDS AND LEGISLATION:**

- Carry out the underground services survey in conjunction with the following documents
  - HSG 47 - Avoiding Danger from Underground Services, 2014.
  - The Health and Safety at Work etc. Act 1974.
  - The Management of Health and Safety at Work Regulations 1999 amended by The Management of Health and Safety at Work and Fire Precautions (Workplace)(Amendment) Regulations 2003 and the Management of Health and Safety at Work (Amendment) Regulations 2006.
  - The Construction (Design and Management) Regulations 2015.
  - HSE L153 CDM Regulations 2015, Guidance on Regulations.
  - The Provision and Use of Work Equipment Regulations 1998.
  - The Electricity at Work Regulations 1989.
  - The Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 2013.
  - The Gas Safety (Management) Regulations 1996.
  - The Pipelines Safety Regulations 1996 (PSR) and The Pipelines Safety (Amendment) Regulations 2003.
  - HSE L101, Confined Spaces Regulations 1997. Approved Code of Practice, Regulations and Guidance.
  - HSE HSG264, Asbestos: The Survey Guide.

#### **300.030 TRAINING AND SUPERVISION:**

- Ensure that persons carrying out the underground services survey have adequate instruction and training in the correct procedures and precautions to be taken.
- Training for persons involved in either supervising or carrying out the surveys to be in accordance with

(but not limited to) the following areas

- Planning of the work.
- Legislation.
- Risk assessment.
- Liaison with utility providers.
- Use of plans and drawings from the various utility providers.
- Identification of services.
- Cable and pipe locating devices.
- Appropriate use of these devices.
- Safe digging.
- Personal protective equipment.
- Safe work in confined spaces.

#### 300.040 RISK ASSESSMENT:

- Carry out risk assessments for the work in accordance with the Construction (Design and Management) Regulations 2015.
- Carry out risk assessments for the works as required under the Health and Safety at Work Act 1974.
- Ensure that risk assessments take into account information provided in the Health and Safety File.
- Operate a permit to work system to include the following
  - Written authorisation to carry out the work.
  - Identification of the work to be carried out.
  - Precautions to be taken.

#### 340.010 DELIVERABLES:

- Ensure that a report is provided in accordance with PAS 128, containing the following
  - Planimetric information
    - Ensure all abbreviations used are in accordance with TSA "Essential guide to utility surveys - Detailed guidance notes for specifying a utility survey".
  - Drawings
    - Hard copies
      - Quantity - 2
      - Scaled
      - Paper size
      - Show each service on a separate sheet.
      - Show all services on the same sheet.
      - Show foul drainage, storm drainage and water services on the same sheet.
      - Show all mechanical and electrical services on the same sheet.
      -
    - Electrical / CAD
      - Format
      - 2D
  - Metadata in accordance with TSA "Essential guide to utility surveys - Detailed guidance notes for

- specifying a utility survey"
- Other metadata
- 
- Ensure reports contain at least the following metadata
  - Date information obtained.
  - Date of existing drawing from which an existing record is taken.
  - Utility type.
  - Quality level of the underground services segment in accordance with Table 1 of PAS 128.
  - Detection method in accordance with Table 2 PAS 128.
- 
- Success of detection methodologies
  - Description of performance of each detection methodology including consequential uncertainties in recorded and marked information.
  - Plans indicating areas where detection methods were not successful.
- 
- List of underground services which were anticipated to be present, but not detectable using the detection methodologies employed
  - Hard copy format
  - Electronic format
- 
- List of unknown underground services detected or identified during the survey
  - Hard copy format
  - Electronic format
- 
- List of buried features and obstructions other than underground services detected during the survey.
  - Hard copy format
  - Electronic format
- 
- Plans indicating conflicts between existing records, site information and detected underground

services

- Included in the planimetric information
- Hard copy format
- Electronic format
- 
- Verification deliverables
  - Photographic evidence
    - Hard copy format
    - Electronic format
    -
  - Video evidence
    - Hard copy format
    - Electronic format
    -
  - Trial pit/split trench data sheet for each underground services exposure, containing as a minimum
    - Type of underground service(s).
    - Depth of underground service(s).
    - Relative details to local datum / detail.
    - Geospatial location of the underground service(s).
    - Digital photographs of location, excavation and exposed underground service(s).
    - Description and location plan of the excavation.
    - Hard copy format
    - Electronic format
    -
  - Recommendations for further survey work
    - Hard copy format
    - Electronic format
    -
- Ensure that all records and data relating to the survey are retained for a minimum of 5 years, including but not limited to
  - Recorded and processed data.
  - Site notes.
  - Metadata.
  -
- Ensure all records and data relating to the survey are made available to the client on request.
-

## **BS APPENDIX**

PAS 128:2014

Specification for underground utility detection, verification and location

## **C14 BUILDING SERVICES SURVEY**

### **PART 1 SYSTEM OBJECTIVES**

#### 100.010 PERFORMANCE OBJECTIVES

- Obtain and verify currency of existing survey information.
- Determine the location, nature and condition of existing services.

#### 100.030 SYSTEM DESCRIPTION

- All services within the scope of these works including any other services that may be effected by these works to familiarise and gain a full understanding of the working operation of all services.

#### 106.000 DRAWINGS:

- Existing drawings available for information are limited and available via Intelli Scan.

---

## **R11 FOUL DRAINAGE ABOVE GROUND**

### **PART 1 SYSTEM OBJECTIVES**

#### 100.010 PERFORMANCE OBJECTIVES:

The new installations shall provide pressure rated drainage discharge pipework from all sump pumps to the existing gravity drainage system.

#### 100.020 DESIGN PARAMETERS:

- Relevant parts of BS EN 12056
- Current Building Regulations Technical Guidance Documents and requirements of the Local Authority

#### 100.030 SYSTEM DESCRIPTION:

New pressure rated pipework is to be installed from new sump pumps and connect to existing steel or cast iron pipework that connects vertically to the existing gravity drainage system.

#### 100.040 CONTROL REQUIREMENTS:

Back flow prevention is to be installed within each sump well.

#### 100.050 SYSTEM SCHEMATICS:

Refer to appendix.

#### 100.060 SYSTEM DRAWINGS:

Refer to appendix.

---

## **PART 2 SELECTION SCHEDULES FOR REFERENCE SPECIFICATIONS**

### **210.000 PIPELINES AND PIPEWORK**

#### 210.010 GENERAL:

- Comply with work section general clauses reference Y10.1000 and those detailed below.
- Supply pressure rated pipework in accordance with drainage specialist and pump manufacturers recommendations.
- Fire stopping
  - Demarcation of responsibilities
    - Main contractor – responsible for all works and fire stopping
    - Services contractor
    - Fire stopping specialist
    - Fire stopping systems manufacturers
  - Install all fire stopping systems in accordance with the manufacturer's written instructions.
  - Install and inspect fire stopping systems in accordance with Building Regulations and ASFP Code of

Practice TDG17.

210.015 SANITARY FITTINGS:

- Comply with work section general clauses reference Y10.1000 and those detailed below.
- Supply pipes and fittings as schedule reference N13-Sanitary appliances and fittings
- As schedule reference

210.020 STEEL PIPES AND FITTINGS:

- Type
- Application
- Fluid conveyed
  - Working pressure
  - Working temperature
- Manufacturer and reference
- Particular specification requirements for grooved pipe system
- Carbon steel pipes to BS EN 10255
  - Heavy, black - reference Y10.2010A
  - Medium, black - reference Y10.2010B
  - Medium, galvanized - reference Y10.2010C
  - Heavy, galvanized - reference Y10.2010D
- Heavy black, grooved ends - reference Y10.2010E
  - Medium, black, grooved ends - reference Y10.2010F
  - Medium, galvanized, grooved ends - reference Y10.2010H
- Carbon steel pipes for push-fit and press-fit systems
  - Light gauge galvanised - reference Y10.2012A
- Carbon steel fittings to BS EN 10255
- Reference Y10.2020A
- Carbon steel fittings to BS EN 10253-1 or BS EN 10253-2.
  - Heavy weight - reference Y10.2060A
  - Medium weight - reference Y10.2060B
- Malleable cast iron fittings, screwed
  - Black - reference Y10.2070A
  - Galvanised - reference Y10.2070B
  - Fittings, grooved for mechanical joints
  - Galvanised cast iron - reference Y10.2080E
  - Painted steel - reference Y10.2080F
- Austenitic stainless steel tubes for pressure purposes
  - Reference Y10.2250A
  - Reference Y10.2250B
- Stainless steel, grooved for mechanical joints
  - Reference Y10.2255A
  - Special materials
  - Light gauge stainless steel for push-fit and press-fit systems to BS EN 10312 - reference Y10.2220
- Jointing materials
  - Circular flanges
    - Flanges to BS EN 1092-1 and BS ISO 7005-1
      - PN
      - Class
    - Welding flanges - reference Y10.3010A

- Screwed flanges - reference Y10.3010B
- Jointing rings for circular flanges
  - Non-metallic flat for flanges to BS EN 1092-1 - reference Y10.3020A
  - Metallic for flanges to BS EN 1092-1 - reference Y10.3020B
- Screwed joints to BS 21 and BS EN 10226-1.
  - Paste and hemp and PTFE tape - reference Y10.3030A
  - PTFE tape - reference Y10.3030B
  - Where chemical cleaning is required - reference Y10.3030C
- Union connections
  - Railroad pattern - spherical seating bronze to iron.
  - Navy pattern - spherical seating bronze to bronze.
- Welding rods
  - Reference Y10.3050A

#### 210.025 STEEL PIPES AND FITTINGS: PIPE-IN-PIPE:

- Type
- Application
- Fluid conveyed
  - Working pressure
  - Working temperature
- Inner pipe
  - Carbon steel pipes to BS EN 10253-1 or BS EN 10253-2
    - Heavy, black - reference Y10.2010A
    - Medium, black - reference Y10.2010B
  - Carbon steel fittings to BS EN 10253-1 or BS EN 10253-2
    - Heavy weight - reference Y10.2060A
    - Medium weight - reference Y10.2060B
  - Malleable cast iron fittings, screwed
  - Black - reference Y10.2070A
  - Jointing materials
    - Screwed joints to BS 21 and BS EN 10226-1.
      - Paste and hemp and PTFE tape - reference Y10.3030A
      - PTFE tape - reference Y10.3030B
      - Where chemical cleaning is required - reference Y10.3030C
    - Union connections
      - Railroad pattern - spherical seating bronze to iron.
      - Navy pattern - spherical seating bronze to bronze.
    - Welding rods
  - Reference Y10.3050A
- Outer pipe
  - Carbon steel pipes to BS EN 10255
    - Heavy, black - reference Y10.2010A
    - Medium, black - reference Y10.2010B
  - Carbon steel fittings to BS EN 10253-1 or BS EN 10253-2
    - Heavy weight - reference Y10.2060A
    - Medium weight - reference Y10.2060B
  - Malleable cast iron fittings, screwed
  - Black - reference Y10.2070A
  - Jointing materials

- Screwed joints to BS 21 and BS EN 10226-1.
  - Paste and hemp and PTFE tape - reference Y10.3030A
  - PTFE tape - reference Y10.3030B
  - Where chemical cleaning is required - reference Y10.3030C
- Union connections
  - Railroad pattern - spherical seating bronze to iron.
  - Navy pattern - spherical seating bronze to bronze.
- Welding rods
- Reference Y10.3050A

#### 210.030 COPPER PIPES AND FITTINGS:

- Type
- Application
- Fluid Conveyed
  - Working pressure
  - Working temperature
- Copper pipe, half hard (Class X)
  - Uncoated - reference Y10.2270A
  - Chromium plated - reference Y10.2270B
- Capillary fittings for copper tubing
  - General potable range - reference Y10.2310A
  - Chrome plated potable range - reference Y10.2310B
- Compression fittings for copper tubing
  - Type A compression fittings - reference Y10.2320A
- Type A, chrome plated compression fittings - reference Y10.2320B
- Jointing materials
  - Welding rods
    - Reference Y10.3050A
  - Brazed joints
    - Use filler metals to BS EN ISO 17672.
    - Use nickel bearing zinc free grades of filler metals to BS EN ISO 17672.
  - Capillary joints
    - Lead free solder - reference Y10.3070A
  - For potable water - reference Y10.3070B

#### 210.040 CAST/DUCTILE IRON PIPES AND FITTINGS:

- Type
- Application
- Manufacturer
  - Or approved equivalent
- Fluid conveyed
  - Working pressure
  - Working temperature
- Cast iron/ductile iron pipes and fittings to BS 416-1
  - Spigot and socket - reference Y10.2350A
- Cast iron/ductile iron pipes to BS 437
  - For flexible joints - reference Y10.2370A
- Cast iron/ductile iron fittings to BS 437

- For flexible joints - reference Y10.2380A
- Cast iron pipes and fittings to BS EN 877
  - Red epoxy finish - reference Y10.2390A
  - Grey epoxy finish - reference Y10.2390B
- Ductile iron pipes to BS EN 545
  - Flanged joints - reference Y10.2410A
  - Spigot and socket joints - reference Y10.2410B
- Ductile iron pipes to BS ISO 2531
  - Flanged joints - reference Y10.2425A
  - Spigot and socket joints - reference Y10.2425B
- Jointing materials
  - Flanges to BS EN 1092-2.
    - Flanges BS EN 1092-2 PN
    - Cast iron flanges - reference Y10.3010C
  - Flange jointing rings
    - For cast iron - reference Y10.3020C
  - Use push-fit joints for cast iron pipe.
  - Couplings for cast iron pipes to BS EN 877
    - Stainless steel - reference Y10.3105A
    - Red ductile iron - reference Y10.3105B
    - Grey ductile iron - reference Y10.3105C
    - Black ductile iron - reference Y10.3105D
  - Spigot/socket caulked joints
    - Reference Y10.3110A
  - Use push-in self anchor joints for ductile iron pipes.
  - Flexible couplings, sleeve type
    - For ductile iron pipework to BS EN 545, BS EN 598, BS EN 969 - reference Y10.3170A
  - Flexible flange adapters, sleeve type
    - For ductile iron pipework to BS EN 545, BS EN 598, BS EN 969 - reference Y10.3180A
  - Internal polyurethane lining
    - Provide internal polyurethane linings for ductile iron pipework in accordance with BS EN 15655.

#### 210.080 GENERAL WORKMANSHIP:

- Type
- Application
- Appearance - reference Y10.4010
- Spacing - reference Y10.4020
- Gradients - reference Y10.4030
- Air venting requirements
  - Air bottles - reference Y10.4040A
  - Automatic air vents - reference Y10.4040B
- Drain requirements - reference Y10.4050
- Expansion and contraction - reference Y10.4060
- Pipe fittings
  - Bends/swept tees - reference Y10.4070A
  - Elbows/square tees - reference Y10.4070B
- Pipes through walls and floors - reference Y10.4110
- Pipe sleeves
  - Reference Y10.4120A

- Insulation carried through - reference Y10.4120B
- Pipe sleeves through fire barriers - reference Y10.4125
- Connect to equipment.
- Use distribution headers.
- Temporary plugs, caps and flanges
  - Reference Y10.4150A.
- Flanged joints general - reference Y10.4160
- Dissimilar metals - reference Y10.4170
- Pipe rings and clips - reference Y10.4180
- Anchors - reference Y10.4190
  - Location
  - As drawing numbers
- Slide guides - reference Y10.4200
  - Location
  - As drawing numbers
- Pipe supports - reference Y10.4205
  - Comply with the manufacturers' installation recommendations for the following proprietary pipe systems:
    - Press-fit and push-fit pipework systems using thin wall carbon steel, stainless steel or copper.
    - Systems using grooved mechanical joints.
    - Pliable corrugated stainless steel gas pipes.
    - Plastic pipe systems.
    -
- Support spacing
  - Tables for steel, copper, iron, PVC and ABS pipes - reference Y10.4220
  - For gas pipework above ground comply with table in the current edition of IGEN/UP/2.
  - Comply with tables in appropriate parts of B&ES (HVCA) TR/20.
  - For the following proprietary pipe systems comply with the manufacturers' installation

recommendations:

- Press-fit and push-fit pipework systems using thin wall carbon steel, stainless steel or copper.
- Systems using grooved mechanical joints.
- Plastic pipe systems.
- 
- Isolation and regulation
  - Reference Y10.4230A
- Maintenance and renewal - reference Y10.4240
- Clean by removing cement and clean off all pipework and brackets.
- Non-ferrous components - thoroughly clean and degrease.

210.090 WORKMANSHIP, STEEL PIPEWORK:

- Type
- Application
- Welding, general
  - Class 1 - reference Y10.5010A
  - Class 2 - reference Y10.5010B
- Welded joints - reference Y10.5020
- Painting welded joints - reference Y10.5030
- Flanged joints - reference Y10.5040
- Screwed joints - reference Y10.5050
- Mechanical joints - reference Y10.5060
- Anchors
  - U-bolts - reference Y10.5070A
- Flanges - reference Y10.5070B
- Pipework painting - reference Y10.5090
- Installation of stainless steel pipework
  - Compression joints - reference Y10.5100
  - Mechanical joints - Y10.5060

210.100 WORKMANSHIP, COPPER PIPEWORK:

- Compression joints - reference Y10.6030
- Capillary joints - reference Y10.6040
- Anchors
  - Flanges - reference Y10.6060A
- Saddle clamps - reference Y10.6060B

210.110 WORKMANSHIP, CAST/DUCTILE IRON:

- Type
- Application
- Flanged joints - reference Y10.7010
- Caulked joints - reference Y10.7020
- Flexible joints - reference Y10.7030

210.120 WORKMANSHIP, PLASTIC PIPES:

- Type
- Application

- Installation of thermoplastic piping for soil and waste discharge inside buildings and buried in ground

within the building - reference Y10.8005

- Solvent welded joints, PVC - reference Y10.8010
- Fusion joints, PE - reference Y10.8020
- Mechanical fittings, PE - reference Y10.8030
- Anchors, PVC - reference Y10.8040
- Jointing polybutylene pipes and fittings - reference Y10.8050
- Plastic pipes and fittings with secondary containment - reference Y10.8070.

#### 210.130 WORKMANSHIP:

- Protection of underground pipework - reference Y10.9030
- Protection of buried pipes
  - Unmarked - reference Y10.9040A
- Marked - reference Y10.9040B
- Steelwork painting
  - Reference Y10.9120A

### 211.000 PIPELINE ANCILLARIES

#### 211.010 GENERAL:

- Comply with work section general clauses reference Y11.1000 and those detailed below.
- Supply valves as schedule reference Y11-Valves
- Supply local controls as schedule reference

#### 211.030 STOP VALVES:

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent
- Service fluid
  - Water
- Operating temperature (°C)
- PN rating
- WRAS approved.
- Kitemark certified.
- Pipe material
  - To suit copper tube.
  - To suit plastic tube.
  - To suit steel tube.
- Stop valves to BS EN 1213 for potable water supplies
  - Compression ends for copper - reference Y11.2015A
  - Capillary - reference Y11.2015C
  - Threaded - reference Y11.2015D
- Gate valves to BS EN 12288
  - Screwed to BS EN ISO 228-1, or ISO 7-1 - reference Y11.2020A
  - Compression to BS EN 1254-2 - reference Y11.2020B
  - Flanged to BS EN 1092-3 - reference Y11.2020C
  - Loose nut/union end - reference Y11.2020D
- Gate valves to BS EN 1171

- Flanged to BS EN 1092-2 - reference Y11.2030A
- Globe valves to BS 5154
  - Screwed to BS 21 and BS EN 10226-1 - reference Y11.2040A
  - Flanged to BS EN 1092-3 - reference Y11.2040B
  - Compression to BS EN 1254-2 - reference Y11.2040C
  - Compression to BS EN 1254-3 - reference Y11.2040D
- Globe valves to BS EN 13789
  - Flanged to BS EN 1092-2 - reference Y11.2050A
- Parallel slide to BS EN 1171
  - Reference Y11.2060A
- Handwheel operated gate type to BS EN 1984
  - Flanged to BS EN 1092-1 - reference Y11.2070A
  - Threaded - reference Y11.2070D
  - Auxiliary connections
- Ball type, copper alloy to BS EN 13828.
  - Screw driver/key operated
    - Screwed to BS 21 and BS EN 10226-1 - reference Y11.2080A
    - Compression to BS EN 1254-2 - reference Y11.2080B
  - Lever operated
    - Screwed to BS 21 and BS EN 10226-1 - reference Y11.2080C
    - Compression to BS EN 1254-2 - reference Y11.2080D
  - Lockshield
    - Screwed to BS 21 and BS EN 10226-1 - reference Y11.2080E
  - Compression to BS EN 1254-2 - reference Y11.2080F
- Servicing valves, copper alloy to BS 6675
  - Handwheel operated
    - Screwed ends - reference Y11.2085A
    - Compression ends - reference Y11.2085B
    - Capillary ends - reference Y11.2085C
  - Lever operated
    - Screwed ends - reference Y11.2085D
    - Compression ends - reference Y11.2085E
    - Capillary ends - reference Y11.2085F
  - Screw driver operated
    - Screwed ends - reference Y11.2085G
    - Compression ends - reference Y11.2085H
    - Capillary ends - reference Y11.2085I
- Butterfly valves to BS EN 593
  - Between flanges to BS EN 1092-2
    - Lever operated - reference Y11.2090A
    - Gear operated - reference Y11.2090B
  - Between mechanical joints
    - Lever operated - reference Y11.2090C
- Gear operated - reference Y11.2090D
- Sluice type to BS 5163-2
- Key operated type A - reference Y11.2110A
- Lubricated plug cock type to BS 5158

#### 211.040 REGULATING VALVES:

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent.
- Service fluid
  - Water
- Operating temperature (°C)
- PN rating
- WRAS approved.
- Kitemark certified.
- Pipe material
  - To suit copper tube.
  - To suit plastic tube.
- To suit steel tube.

211.050 DOUBLE REGULATING VALVES:

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent.
- Service fluid
  - Water
- Operating temperature (°C)
- PN rating
- WRAS approved.
- Kitemark certified.
- Pipe material
  - To suit copper tube.
  - To suit plastic tube.
  - To suit steel tube.
- Butterfly type to BS EN 593
  - Between flanges to BS EN 1092-2
    - Lever operated - reference Y11.2210A
    - Gear operated - reference Y11.2210B
  - Between mechanical joints
    - Lever operated - reference Y11.2210C
    - Gear operated - reference Y11.2210D
- Globe valves to BS 7350, section 3.1.
  - Copper alloy
    - Screwed to BS 21 and BS EN 10226-1 - reference Y11.2220A
    - Flanged to BS EN 1092-2 - reference Y11.2220B
  - Cast iron
- Flanged to BS EN 1092-2 - reference Y11.2220C

211.170 CHECK VALVES:

- Type
- Application

- Manufacturer and reference
  - Or approved equivalent
- WRAS approved.
- Kitemark certified.
- Service fluid
  - Water.
- Operating temperature (°C)
- PN rating
- Pipe material
  - To suit copper tube.
  - To suit plastic tube.
  - To suit steel tube.
- Swing check type to BS 5154
  - Screwed to BS 21 and BS EN 10226-1 - reference Y11.2320A
  - Flanged to BS EN 1092-3 - reference Y11.2320B
  - Grooved for mechanical joints.
- Check valve to BS EN 12334
  - Swing check
    - Flanged - reference Y11.2330A
    - Grooved for mechanical joints.
    - Wafer body - reference Y11.2330B
  - Lift check
    - Flanged - reference Y11.2330C
    - Wafer body - reference Y11.2330D
- Wafer flange fitting type
- Reference Y11.2340A
- Device to prevent contamination of water by backflow to BS EN 14451
  - Combined check and anti-vacuum - reference Y11.2385A
- Anti-back syphonage valve, combined check and anti-vacuum type
  - Reference Y11.2390A
- Anti-back syphonage valve, hose union anti-vacuum type
- Reference Y11.2391A
- Application
- Manufacturer and reference
  - Or approved equivalent

## **220.000 PUMPS**

### **220.010 GENERAL:**

- Comply with general clauses below
  - Pumps generally - reference Y20.1010
  - Pump selection for efficiency - reference Y20.1020
  - Safety guards - reference Y20.1030
  - Pump testing - reference Y20.1040
  -
- Ensure all electrical equipment supplied and installed is suitable for power supply indicated.
- Provide details of electrical input, starting and performance characteristics of all motors above 750W to

an agreed format.

- Where appropriate ensure motors and drives are supplied complete with keys and keyways.
- Design duties
  - Ensure scheduled volume is provided when operating against resistance of system corrected for changes between specified and selected component resistances.
  
  - locking in the open position.
  - Instruction book and parts list.
  
- access door.
- Mount for external access
  - One isolator operating handle.
  - Lamps to provide visual indication of
    - Charger No 1 healthy.
    - Charger No 2 healthy.
    - Battery.
    - Automatic battery failure.
    - Control circuit healthy.
    - Auto-start switched off.
    - Pump on demand.
    - Pump failed to start.
    - Low oil pressure.
  - Operate manual start test button.
  - Two ammeters.
  - Tachometer.
  - Automatic battery selector switch.
  - Hours run meter.
  - Manual start test push button.
  - Alarm mute push button.
  - Fault reset push button.
  - Emergency manual start push button located behind a frangible cover.
- Mount within the enclosure
  - One A.C. main isolator.
  - Two completely independent, fully automatic constant potential battery chargers with current

limiting/short circuit protection and charger failure/battery alarm outputs.

- A main printed circuit board fitted with
  - Auto-start isolation switch.
  - Two heavy duty cranking relays.
  - Voltage regulator.
  - Two control circuit fuses.
  - Two battery main fuses.
  - Set of mains, control, and alarm terminals.
  - Four auxiliary plug-in printed circuit boards.

#### 220.060 WORKMANSHIP:

- General - reference Y20.4010
- Pipeline connections - reference Y20.4020
- Mount motors and pumps for belt drive pumps resiliently.
- Alignment - reference Y20.4040
- Access - reference Y20.4050
- Maintenance requirements for sewage pumps
  - Reference Y20.4060

### **251.000 TESTING AND COMMISSIONING OF MECHANICAL SERVICES**

#### 251.010 GENERAL:

- Comply with work section general clauses reference Y51.1000 and those detailed below.
- Carry out testing and commissioning as specified in section

#### 251.015 BREEAM REQUIREMENTS (REFURBISHMENT):

- All Equipment
- Commissioning must be carried out in line with current Building Regulations and BSRIA and CIBSE guidelines, where applicable.
  - Seasonal commissioning - comply with BREEAM Refurbishment 2008 Issue ID Man 1 and Y51.3025
  - BREEAM Refurbishment and Fit Out 2014 requirements
    - Comply with Issue ID Man 04 Commissioning and Handover
  - Application Guide 20/95 - Commissioning of Pipework Systems.
  - BSRIA Technical Memoranda 1/88.1 - Commissioning HVAC Systems. Guidance on the division of

responsibilities

- BSRIA Guide BG 49/2015 Commissioning Air Systems
- BSRIA Guide BG 29/2012 - Pre-commission Cleaning of Pipework Systems.
- BSRIA Guide BG 2/2010 - Commissioning Water Systems
- BSRIA Guide BG 11/2010 - Commissioning Job Book.
- CIBSE Commissioning Codes: Set of Seven Codes (2003)
- BSRIA Guide 8/2009 - Model Commissioning Plan.
- CIBSE Commissioning Code A: Air Distribution Systems.
- CIBSE Commissioning Code B: Boilers.
- CIBSE Commissioning Code C: Automatic Controls.
- CIBSE Commissioning Code L: Lighting.
- CIBSE Commissioning Code M: Management.
- CIBSE Commissioning Code R: Refrigeration.
- CIBSE Commissioning Code W: Water Distribution Systems.
- Cold Storage and Chilled Rooms
  - Commissioning must be carried out in line with:
    - The criteria for refrigeration equipment as set out in Good Practice Guide 347: Installation and Commissioning of Refrigeration Systems, Carbon Trust, 2003.
    - Guide to Good Commercial Refrigeration Practice, Part 5, Commissioning, British Refrigeration Association, Institute of Refrigeration, Issue 1, October 2008..
- Fume Cupboard
  - Commissioning must be carried out in line with:
    - BS EN 14175-2.
    - DD CEN/TS 14175-5
    - The commissioning principles set by the HEEPI Labs21 programme Commissioning Theme Section 8.
- Microbiological Safety Cabinet
  - Commissioning must be carried out in line with:
    - BS EN 12469.
    - The commissioning principles set by the HEEPI Labs21 programme Commissioning Theme Section 8.
- Building Management System (BMS)
  - These commissioning procedures must be carried out
    - Commissioning of air and water systems is carried out when all control devices are installed, wired and functional.
    - In addition to air and water flow results, commissioning results include physical measurements of room temperatures, off coil temperatures and other key parameters as appropriate.
    - The BMS/controls installation should be running in auto with satisfactory internal conditions prior to handover.
    - All BMS schematics and graphics (if BMS is present) are fully installed and functional to user

interface before handover.

- The occupier will be fully trained in the operation of the system.
- Detailed Requirements
  - Comply with BREEAM Refurbishment 2008 Issue ID Man 1.
  - BREEAM Refurbishment and Fit Out 2014 requirements
    - Comply with Issue ID Man 04 Commissioning and Handover
    - Comply with Issue ID Man 05 Aftercare
    - Comply with Issue ID Ene 02 Energy Monitoring
    - Comply with Issue ID Wat 02 Water Monitoring
    - Comply with Issue ID Wat 03 Water Leak Detection
    - Comply with Issue ID Pol 01 Impact of Refrigerants

#### 251.016 BREEAM REQUIREMENTS (NEW BUILD):

- All Equipment
- Seasonal commissioning, comply with BREEAM New Construction 2011 Issue ID Man 01 and Y51.3025.
- BREEAM New Construction 2014 requirement
  - Comply with Issue ID Man 04 Commissioning and Handover.
- Commissioning must be carried out in line with current Building Regulations and BSRIA and CIBSE guidelines, where applicable.
  - Application Guide 20/95 - Commissioning of Pipework Systems.
  - Technical Memoranda 1/88.1 - Commissioning HVAC Systems. Guidance on the division of responsibilities
  - BSRIA Guide BG 49/2015 Commissioning Air Systems
  - BSRIA Guide BG 29/2012 - Pre-commission Cleaning of Pipework Systems.
  - BSRIA Guide BG 2/2010 - Commission of Water Systems.
  - BSRIA Guide BG 11/2010 - Commissioning Job Book.
  - CIBSE Commissioning Codes: Set of Seven Codes (2003)
  - BSRIA Guide 8/2009 - Model Commissioning Plan.
  - CIBSE Commissioning Code A: Air Distribution Systems.
  - CIBSE Commissioning Code B: Boilers.
  - CIBSE Commissioning Code C: Automatic Controls.
  - CIBSE Commissioning Code L: Lighting.
  - CIBSE Commissioning Code M: Management.
  - CIBSE Commissioning Code R: Refrigeration.
  - CIBSE Commissioning Code W: Water Distribution Systems.
- Cold Storage and Chilled Rooms
  - Commissioning must be carried out in line with:
    - The criteria for refrigeration equipment as set out in Good Practice Guide 347: Installation and Commissioning of Refrigeration Systems, Carbon Trust, 2003.
    - Guide to Good Commercial Refrigeration Practice, Part 5 Commissioning, British Refrigeration Association, Institute of Refrigeration, Issue 1, October 2008.
- Fume Cupboard
  - Commissioning must be carried out in line with:
    - BS EN 14175-2.
    - DD CEN/TS 14175-5
    - The commissioning principles set by the HEEPI Labs21 programme Commissioning Theme Section

8.
  - Microbiological safety cabinet
    - Commissioning must be carried out in line with:
      - BS EN 12469.
      - The commissioning principles set by the HEEPI Labs21 programme Commissioning Theme Section 8.
  - Building Management System (BMS)
    - These commissioning procedures must be carried out
      - Commissioning of air and water systems is carried out when all control devices are installed, wired and functional.
      - In addition to air and water flow results, commissioning results include physical measurements of room temperatures, off coil temperatures and other key parameters as appropriate.
      - The BMS/controls installation should be running in auto with satisfactory internal conditions prior to handover.
      - All BMS schematics and graphics (if BMS is present) are fully installed and functional to user

interface before handover.

The occupier will be fully trained in the operation of the system.

- Detailed Requirements
  - Comply with BREEAM New Construction 2011 Issue ID Man 1.
  - BREEAM New Construction 2014 requirements
    - Comply with Issue ID Man 04 Commissioning and Handover
    - Comply with Issue ID Man 05 Aftercare
    - Comply with Issue ID Ene 02 Energy Monitoring
    - Comply with Issue ID Wat 02 Water Monitoring
    - Comply with Issue ID Wat 03 Water Leak Detection
    - Comply with Issue ID Pol 01 Impact of Refrigerants

#### 251.020 SPECIALIST:

- Use one of the following specialist commissioning engineers
- Or approved equivalent

#### 251.030 STATIC TESTING:

- Type
- Application
- Pressure testing
  - General - reference Y51.2010
  - Water circulating and supply systems and steam and condense lines - reference Y51.2020
    - Underground pipework
  - Water mains - reference Y51.2040
  - Fire risers - reference Y51.2050
  - Refrigerant pipework
    - Strength pressure test - reference Y51.2055A
    - Leak test - reference Y51.2055B
    - Deep vacuum test - reference Y51.2055C
    - Gas pipework
  - Oil pipework - reference Y51.2065
  - Piped medical gases - reference Y51.2070
  - Soil, waste, ventilation, anti-syphon and rainwater pipework - reference Y51.2080
  - Underslab drainage - reference Y51.2090
- Vacuum testing - reference Y51.2100
- Provide an air compressor and subject the pipework to sectional testing by air at low pressure (not exceeding .5 bars) before commencing any flushing or testing with water.
- On completion of all cleaning, flushing and air testing operations, recharge each system with clean water

and subject them to sectional hydraulic tests of one and a half times the working pressure.

- There is to be no loss of pressure for a period of not less than 30 minutes for each test.

#### 251.040 COMMISSIONING:

- Type
- Application
- Commissioning codes - reference Y51.3020
- Commissioning
  - Water distribution
    - Including BSRIA pre-commissioning check list
    - Reference Y51.3030
  - Air distribution
    - Including BSRIA pre-commissioning check list
    - Reference Y51.3040
  - Boiler plant - reference Y51.3050
  - Gas plant and systems - reference Y51.3055
  - Refrigerating systems - reference Y51.3060
  - Automatic control systems - reference Y51.3070
- Instruments and gauges
  - Reference Y51.3090A
- Commissioning records
  - Distribution
    - For air systems
      - To BSRIA Guide BG 49/2015 - reference Y51.3100A
    - For water systems
      - To BSRIA Guide BG 2/2010 - reference Y51.3100B
- BMS commissioning
- Control system specification details required for commissioning - reference Y51.3110
- Pre-commissioning - reference Y51.3120
- Plant ready for control system commissioning
  - Reference Y51.3130A
- Control system requirements for plant commissioning - reference Y51.3140
- Commissioning of building services as required by ADL2 (Section 5.16-5.28).
- Commissioning of building services as required by Scottish Technical Handbook Section 6.7.
- Commissioning - reference Y51.3150

#### 251.042 SEASONAL COMMISSIONING:

- Seasonal commissioning - reference Y51.3025
- The seasonal commissioning shall prove that the operating performance of the following building

services systems and associated equipment is as specified

- Detail requirements to be as schedule reference Y51-Seasonal commissioning requirements
- Environmental assessment method applicable
  - BREEAM
  - LEED
  - DREAM
  - RICS Ska
  - Commissioning codes - reference Y51.3020
- Work to be completed over a minimum 12 month period after building occupation
  - Testing of services under full load conditions
  - Testing of services under part load conditions
  - Testing of services during periods of high and low occupancy
  - Interviews with building occupants to identify problems/concerns regarding the effectiveness of the systems
  - Re-commissioning of systems after any work needed to serve revised loads
  - Updating of record documentation
- Roles and responsibilities
  - Commissioning manager
  - Main contractor
  - M&E services contractor/specialist contractor
- Client

#### 251.050 PERFORMANCE TESTING:

- Type
- Application
- System performance testing - reference Y51.4010
- Testing of residential ventilation systems - reference Y51.4015
- Environmental tests
  - Artificial loads - reference Y51.4020A
  - Ambient Air Quality - reference Y51.4020B
- Recorders - reference Y51.4030
  - Seven day space temperature recorders
    - Number
    - For (weeks)
  - Relative humidity recorders
    - Number
    - For (weeks)
- Testing to specified conditions
- On completion of all static testing carry out a pressure/flow to demonstrate that each system will provide an effective fire fighting jet of 500 litres/min through a 65mm diameter nozzle at a pressure of 4.5 bar measured at the highest outlet.
  - Any inability to sustain this requirement, or any undue pressure loss in the system must be investigated and any remedial work required carried out.
  - Provide temporary pumps and if required, a storage tank to enable all Performance Testing to be carried out.
  - After obtaining and recording the approval of the Fire Officer and the Contract Administrator to the systems, drain down each riser and leave ready for use.
- All performance testing will be witnessed by the Contract Administrator and will consist of
  - Localised smoke puff tests on selected detectors in all zones to ensure all aspects of the electrical

installation, plunger actuation and fire damper operation react as required.

- The gas bottles will be disconnected during all performance testing.

## **254.000 IDENTIFICATION - MECHANICAL**

### 254.010 GENERAL:

- Comply with work section general clauses reference Y54.1000 and those detailed below.
- Provide identification - mechanical as specified in work section

### 254.020 PIPEWORK IDENTIFICATION:

- Reference Y54.2010

### 254.040 PLANT AND EQUIPMENT IDENTIFICATION:

- Type
- Application
  - Lettering
  - Laminated plates, multi-coloured with outer layer removed for lettering - reference Y54.2030B

### 254.090 INSTRUMENT IDENTIFICATION:

- Reference Y54.2080

### 254.100 DANGER AND WARNING NOTICES:

- Reference Y54.2090

### 254.110 SYSTEM IDENTIFICATION INSTALLATION CHARTS:

- Type
- Application
- Perspex sheet glazing with frame - reference Y54.2100A

## **290.000 FIXING TO BUILDING FABRIC**

### 290.010 GENERAL:

- Comply with work section general clauses reference Y90.1000 and those detailed below.
- Carry out fixing to building fabric as specified in work section

### 290.020 FIXINGS:

- Type
- Application
- Standards - reference Y90.2010
- Plugs - reference Y90.2020
- Screws - reference Y90.2030
- Non-penetrative support systems - reference Y90.2080

- Manufacturer and reference
  - Or approved equivalent.

**290.030 WORKMANSHIP:**

- Type
- Application
- Drilling - reference Y90.3010
- Fixing to timber rails - reference Y90.3050
- Fixing to hollow stud/tile/block wall
  - Reference Y90.3060A
- Fixing to concrete, brickwork or blockwork
  - Reference Y90.3070A
- Fixing to metalwork
  - Reference Y90.3080A
- Fixing to structural steelwork and concrete structures
  - Reference Y90.3090A
- Non-penetrative support systems for roof mounted equipment - reference Y90.3100#

**291.000 OFF-SITE PAINTING AND ANTI-CORROSION TREATMENT**

**291.010 GENERAL**

- Comply with work section general clauses reference Y91.1000 and those detailed below.
- Carry-out off-site painting and anti-corrosion treatment as work section

**291.020 PAINT MATERIALS:**

- Type
- Application
- Paint materials
  - Reference Y91.2010A
- Paint quality - reference Y91.2020

### **PART 3 SPECIFICATION CLAUSES SPECIFIC TO R11**

#### **300.000 GENERAL / PRODUCTS / MATERIALS**

##### **300.005 DRAINAGE SPECIALIST:**

- The manufacturer and design specialist shall have visited site and confirmed the sump pump and

discharge pipework arrangement, materials and selection of all equipment before installation commences.

300.010 GALVANIZED STEEL PREFABRICATED STACK UNITS:

300.020 FLOOR GULLIES:

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent.
- Standard
  - Trapped with water seal of at least 50mm - BS EN 1253-1
    - Class
  - Without trap - BS EN 1253-2
    - Class
- Material
  - Cast iron.
  - Copper alloy.
  - Plastic

300.030 TRAPS:

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent.
- Appliance
  - W.C. pan
  - Slop hopper or flush sink
  - Urinal
  - Sink
  - Wash basin
  - Wash fountain or trough
  - Bidet
  - Bath
  - Shower unit
  - Fountain
  - Sanitary macerator
  - Water cooler
- Type
  - Integral with appliance.
  - Bottle.
  - Resealing.
  - Tubular.
- Form
  - P.
  - S.
- Standard
  - Plastic to BS EN 274-1, BS EN 274-2, BS EN 274-3.
  - Cast iron
    - BS 416-1
    - BS EN 877

- Copper alloy
  - Chromium plated.
  - Unplated.
- Characteristics
  - Size
  - Finish and colour

#### 300.080 CAST IRON FITTINGS:

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent.
- Urinal connectors
- Socket reducers

#### 300.090 COPPER ALLOY OVAL ACCESS PIECE:

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent.
- Ensure inner face conforms to internal surface shape of pipes

#### 300.100 THIMBLES AND SLEEVES:

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent.
- Provide copper alloy thimbles and sleeves for use with lead.

#### 300.110 DOMICAL GRATINGS:

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent.
- Material
  - Galvanized steel to manufacturer's standard.
  - Brass to manufacturer's standard.
  - Plastic, (removable).

#### 300.120 COVER PLATES:

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent.
- Type
  - Hinged.

- Snap on.
- Material
  - Rolled steel.
  - Rolled steel - chromium plated.
  - Plastics.

#### 300.140 GRATINGS:

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent.
- Material
  - Galvanized steel wire.
  - Galvanized steel wire, plastic coated.
  - Copper wire.
  - Plastics.

#### 300.150 SINGLE STACK PLUMBING:

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent.
- Ensure that there is a change of gradient at stack connections. Use swept branches on small diameter pipes. Use swept inlet or 45 degree branch connections for pipe 75mm diameter or over.
- Details

#### 300.160 AIR ADMITTANCE VALVES:

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent.
- Standard - BS EN 12380
- Ensure that there is a change of gradient at stack connections. Use swept branches on small diameter pipes. Use swept inlet or 45° branch connections for pipe 75mm diameter or over.
- Details

#### 310.000 WORKMANSHIP

##### 310.010 PERFORMANCE CRITERIA:

- Install pipework fittings and accessories to ensure that:-
- appliances drain quickly, quietly and completely at all times without nuisance or risk to health.
- discharge is conveyed without crossflow, backfall, leakage or blockage.
- air from drainage system does not enter building.
- 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.

- system can be adequately tested, cleaned and maintained.

#### 310.020 ROUTES:

- Ensure pipe routes are shortest practicable, with as few bends as possible and no bends in wet portion of soil stacks, unless indicated otherwise on drawings.

#### 310.030 COATED PIPES:

- Make good damaged coatings and cut ends, or recoat, as recommended by manufacturer.

#### 310.040 INSTALLATION GENERALLY:

- Install pipes, fittings and accessories in accordance with BS 8000-13, BS EN 12056-5 and manufacturer's recommendations.
- Install thermoplastic piping systems in accordance with PD CEN/TR 13801
- Obtain all components for each type of pipework from the same manufacturer, unless otherwise indicated.
- Inspect components carefully before fixing and reject any which are defective.
- Ensure cut ends of pipes to be clean and square with burrs removed.
- Allow for thermal and building movement when jointing and fixing.
- Form junctions using fittings intended for the purpose, ensuring that jointing material does not project into bore of pipes, fittings and appliances.
- Avoid contact between dissimilar metals and other materials which would result in electrolytic corrosion.
- Provide access covers and cleaning eyes as necessary in convenient locations, to permit adequate testing and cleaning of pipework.
- Prevent entry of foreign matter into any part of system by sealing openings during construction. Fit all access covers and cleaning eyes as work proceeds.

#### 310.050 CONNECTIONS BETWEEN PIPES OF DIFFERENT MATERIALS:

- Plastic
  - Connect plastics pipework to pipework of other materials using approved connectors and methods in accordance with plastics pipework manufacturer's recommendations, to form a watertight joint.
- Cast iron
  - Connect cast iron pipework to clay pipework using supersleeve adapters and in accordance with cast iron manufacturer's recommendations.
  - Connect cast iron pipework to clay/concrete sockets with bituminised yarn and 1:3 cement:sand mortar, neatly finished, to form a watertight joint and in accordance with the cast iron manufacturer's recommendations.
- Copper
  - Connect copper pipework to clay/concrete sockets using a caulking bush (brazed on), bituminised yarn and 1:3 cement:sand mortar, neatly finished, to form a watertight joint and in accordance with the copper manufacturer's recommendations.
  - Connect copper pipework to cast iron sockets using a caulking bush (brazed on), bituminised yarn and an approved caulking compound, neatly finished, to form a watertight joint and in accordance with the copper manufacturer's recommendations.
  - Connect copper pipework to cast iron using purpose made copper to iron connectors and in accordance with the copper manufacturer's recommendations.
- Galvanized steel
  - Connect galvanized steel pipework to cast iron sockets with bituminised yarn and molten lead, lead

---

wool or an approved cold caulking compound and in accordance with the galvanized steel manufacturer's recommendations.

- Connect galvanized steel pipework to clay/concrete sockets with bitumenised yarn and 1:3 cement:sand mortar, neatly finished, to form a watertight joint and in accordance with the galvanized steel manufacturer's recommendations.

310.060 FOOT OF PIPE STACKS:

- Fix cast iron rest bends supported on brick-work or concrete bases where indicated on drawings.

310.070 WASTES:

- Bed in waterproof jointing compound and fix with resilient washer between appliance and backnut.

310.080 WASTE CONNECTORS:

- Join to traps as manufacturer's recommendations.

310.100 TRAP TEST REQUIREMENTS:

- Ensure there is a retention of a minimum of 25mm water seal in every trap, and that no air is blown through the trap seal when performance is tested.

310.110 ACCESS POINTS:

- Provide rodding and access points at all changes of direction to enable whole system to be maintained.
- Provide square door type access points as indicated on drawings at foot of all soil and ventilation pipes and at any subsequent floor levels as indicated on the drawings and/or as directed by building control. Where practicable, locate access points and horizontal anti-syphon pipes above fitment flood level a minimum of 1200mm above the respective finished floor level.
- In general make WC connections to drain points and soil pipes via flexible connectors.

## **BS APPENDIX**

**BS 21:1985**

Specification for pipe threads for tubes and fittings where pressure-tight joints are made on the threads (metric dimensions).

**BS 2767:1991**

Specification for manually operated copper alloy valves for radiators

**BS 2879:1980**

Specification for draining taps (screw-down pattern)

**BS 3868:1995**

Specification for prefabricated drainage stack units in galvanised steel

**BS 416-1:1990**

Discharge and ventilating pipes and fittings, sand-cast or spun in cast iron. Part 1 Specification for spigot and socket systems

**BS 437:2008**

Specification for cast iron drain pipes, fittings and their joints for socketed and socketless systems

**BS 4514:2001**

Unplasticized PVC soil and ventilating pipes of 82.4mm minimum mean outside diameter, and fittings and accessories of 82.4mm and of other sizes. Specification

**BS 476-7:1997**

Fire tests on building materials and structures. Part 7 Method of test to determine the classification of the surface spread of flame of products

**BS 5154:1991**

Specification for copper alloy globe, globe stop and check, check and gate valves.  
Partially replaced by BS EN 12288

**BS 5158:1989**

Specification for cast iron plug valves

**BS 5163-2:2004**

Valves for waterworks purposes. Part 2 Stem caps for use on isolating valves and associated water

control apparatus. Specification

BS 5422:2009

Method for specifying thermal insulating materials for pipes, tanks, vessels, ductwork and equipment operating within the temperature range -40°C to +700°C

BS 5627:1984

Specification for plastics connectors for use with horizontal outlet vitreous china WC pans

BS 7350:1990

Specification for double regulating globe valves and flow measurement devices for heating and chilled water systems

BS 8000-13:1989

Workmanship on building sites. Part 13 Code of practice for above ground drainage and sanitary appliances

Partially superseded by BS 8000-0:2014

BS EN 10226-1:2004

Pipe threads where pressure tight joints are made on the threads. Taper external threads and parallel internal threads. Part 1 dimensions, tolerances and designation

BS EN 10253-1:1999

Butt-welding pipe fittings. Part 1 Wrought carbon steel for general use and without specific inspection requirements

BS EN 10253-2:2007

Butt-welding pipe fittings. Part 2 Non alloy and ferritic alloy steels with specific inspection requirements

BS EN 10255:2004

Non-alloy steel tubes suitable for welding or threading. Technical delivery conditions

BS EN 10312:2002

Welded stainless steel tubes for the conveyance of aqueous liquids including water for human consumption. Technical delivery conditions

BS EN 1092-1:2007+A1:2013

Flanges and their joints. Circular flanges for pipes, valves, fittings and accessories, PN designated. Part 1 steel flanges

BS EN 1092-2:1997

Flanges and their joints. Circular flanges for pipes, valves, fittings and accessories, PN designated. Part 2

cast iron flanges

BS EN 1092-3:2003

Flanges and their joints. Circular flanges for pipes, valves, fittings and accessories, PN designated. Part 3  
copper alloy flanges

BS EN 1092-4:2002

Flanges and their joints. Circular flanges for pipes, valves, fittings and accessories, PN designated. Part 4  
aluminium alloy flanges

BS EN 1171:2002

Industrial valves. Cast iron gate valves

BS EN 12056-5:2000

Gravity drainage systems inside buildings. Part 5 Installation and testing, instructions for operation,  
maintenance and use

BS EN 1213:2000

Building valves. Copper alloy stopvalves for potable water supply in buildings. Tests and requirements

BS EN 12288:2010

Industrial valves. Copper alloy gate valves.

BS EN 12334:2001

Industrial valves. Cast iron check valves

BS EN 12380:2002

Air admittance valves for drainage systems. Requirements, test methods and evaluation of conformity

BS EN 12469:2000

Biotechnology. Performance criteria for microbiological safety cabinets

BS EN 1253-1:2015

Gullies for buildings. Trapped floor gullies with a depth water seal of at least 50 mm

BS EN 1253-2:2015

Gullies for buildings. Roof drains and floor gullies without trap

BS EN 1254-2:1998

Copper and copper alloys. Plumbing fittings. Part 2 fittings with compression ends for use with copper

tubes

BS EN 1254-3:1998

Copper and copper alloys. Plumbing fittings. Part 3 Fittings with compression ends for use with plastics pipes

BS EN 13190:2001

Thermal insulation products for buildings. Factory made products of phenolic foam (PF). Specification

BS EN 13789:2010

Industrial valves. Cast iron globe valves

BS EN 13828:2003

Building valves. Manually operated copper alloy and stainless steel ball valves for potable water supply in buildings. Tests and requirements

BS EN 13941:2009+A1:2010

Design and installation of pre-insulated bonded pipe systems for district heating

BS EN 1401-1:2009

Plastics piping systems for non-pressure underground drainage and sewerage. Unplasticized poly(vinylchloride) (PVC-U). Part 1 Specifications for pipes, fittings and the system

BS EN 14175-2:2003

Fume cupboards. Part 2 Safety and performance requirements

BS EN 14303:2009

Thermal insulation products for building equipment and industrial installations. Factory made mineral wool

products (MW). Specification.

BS EN 1434-1:2015  
Heat meters. General requirements

BS EN 1434-2:2015  
Heat meters. Constructional requirements

BS EN 1434-3:2008  
Heat Meters. Data exchange and interfaces

BS EN 1434-4:2015  
Heat meters. Pattern approval tests

BS EN 1434-5:2015  
Heat meters. Initial verification tests

BS EN 1434-6:2015  
Heat meters. Installation, commissioning, operational monitoring and maintenance

BS EN 14419:2009  
District heating pipes. Pre-insulated bonded pipe systems for directly buried hot water networks.  
Surveillance systems

BS EN 14451:2005  
Devices to prevent pollution by backflow of potable water. In-line anti-vacuum valves DN 8 to DN 80.  
Family D, type A

BS EN 15014:2007  
Plastics piping systems. Buried and above ground systems for water and other fluids under pressure.

Performance characteristics for pipes, fittings and their joints

BS EN 1555-1:2010

Plastics piping systems for the supply of gaseous fuels. Polyethylene (PE). Part 1 General

BS EN 1555-2:2010

Plastics piping systems for the supply of gaseous fuels. Polyethylene (PE). Part 2 Pipes.

BS EN 1555-3:2010+A1:2012

Plastics piping systems for the supply of gaseous fuels. Polyethylene (PE). Part 3 Fittings.

BS EN 1555-5:2010

Plastics piping systems for the supply of gaseous fuels. Polyethylene (PE). Part 5 Fitness for purpose of the system.

BS EN 15655:2009

Ductile iron pipes, fittings and accessories. Internal polyurethane lining for pipes and fittings. Requirements and test methods

BS EN 15698-1:2009

District heating pipes. Pre-insulated bonded twin pipe systems for directly buried hot water networks. Part 1 Twin pipe assembly of steel service pipe, polyurethane thermal insulation and outer casing of polyethylene

BS EN 16297-1:2012

Pumps. Rotodynamic pumps. Glandless circulators. . General requirements and procedures for testing and calculation of energy efficiency index (EEI)

BS EN 16297-2:2012

Pumps. Rotodynamic pumps. Glandless circulators. Calculation of energy efficiency index (EEI) for stand-

alone circulators

BS EN 16397-1:2014  
Flexible couplings. Performance requirements

BS EN 16397-2:2014  
Flexible couplings. Characteristics and testing for metal banded flexible couplings, adaptors and bushes

BS EN 1984:2010  
Industrial valves. Steel gate valves

BS EN 545:2010  
Ductile iron pipes, fittings, accessories and their joints for water pipelines. Requirements and test methods

BS EN 593:2009+A1:2011  
Industrial valves. Metallic butterfly valves

BS EN 598:2007+A1:2009  
Ductile iron pipes, fittings, accessories and their joints for sewerage applications. Requirements and test methods

BS EN 60034-5:2001  
Rotating electrical machines. Part 5 Degrees of protection provided by the integral design of rotating electrical machines (IP code). Classification

BS EN 60034-6:1994, IEC 60034-6:1991  
Rotating electrical machines. Part 6 Methods of cooling (IC Code)

BS EN 60038:2011  
CENELEC standard voltages

BS EN 60529:1992+A2:2013  
Degrees of protection provided by enclosures (IP code)

BS EN 60534-4:2006  
Industrial-process control valves. Inspection and routine testing

BS EN 62262:2002  
Degrees of protection provided by enclosures for electrical equipment against external mechanical

impacts (IK code)

BS EN 681-1:1996

Elastomeric seals. Material requirements for pipe joint seals used in water and drainage applications. Part 1 Vulcanized rubber

BS EN 877:1999+A1:2006

Cast iron pipes and fittings, their joints and accessories for the evacuation of water from buildings. Requirements, test methods and quality assurance

BS EN 969:2009

Specification for ductile iron pipes, fittings, accessories and their joints for gas pipelines. Requirements and test methods

BS EN 997:2012

WC pans and WC suites with integral trap

BS EN ISO 1452-1:2009

Plastics piping systems for water supply and for buried and above-ground drainage and sewerage under pressure. Unplasticized poly(vinyl chloride) (PVC U). Part 1 General

BS EN ISO 1452-2:2009

Plastics piping systems for water supply and for buried and above-ground drainage and sewerage under pressure. Unplasticized poly(vinyl chloride) (PVC U). Part 2 Pipes

BS EN ISO 1452-3:2010

Plastics piping systems for water supply and for buried and above-ground drainage and sewerage under pressure. Unplasticized poly(vinyl chloride) (PVC U). Part 3 Fittings

BS EN ISO 1452-5:2009

Plastics piping systems for water supply and for buried and above-ground drainage and sewerage under

---

pressure. Unplasticized poly(vinyl chloride) (PVC U). Part 5 Fitness for purpose of the system

BS EN ISO 17672:2010  
Brazing. Filler metals

BS EN ISO 21003-1:2008  
Multilayer piping systems for hot and cold water installations inside buildings. Part 1 General

BS EN ISO 21003-2:2008+A1:2011  
Multilayer piping systems for hot and cold water installations inside buildings. Part 2 Pipes

BS EN ISO 21003-3:2008  
Multilayer piping systems for hot and cold water installations inside buildings. Part 3 Fittings

BS EN ISO 21003-5:2008  
Multilayer piping systems for hot and cold water installations inside buildings. Part 5 Fitness for purpose of the system

BS EN ISO 228-1:2003  
Pipe threads where pressure-tight joints are not made on the threads. Part 1 Dimensions, tolerances and designation

BS EN ISO 4126-1:2013  
Safety devices for protection against excessive pressure. Part 1 Safety valves

BS EN ISO 4126-7:2013  
Safety devices for protection against excessive pressure. Common data

BS EN ISO 9001:2015  
Quality management systems. Requirements

BS EN ISO 9908:1998+A1:2011  
Technical specifications for centrifugal pumps. Class III

BS ISO 16422:2014  
Pipes and joints made of oriented unplasticized poly(vinyl chloride) (PVC-O) for the conveyance of water under pressure. Specifications

BS ISO 17484-1:2014  
Plastics piping systems. Multi-layer pipe systems for indoor gas installations with a maximum operating

pressure up to and including 5 bar (500 kPa). Part 1 Specifications for systems

BS ISO 2531:2009

Ductile iron pipes, fittings, accessories and their joints for water applications

BS ISO 4437-1:2014

Plastic piping systems for the supply of gaseous fuels. Polyethylene (PE). General

BS ISO 4437-2:2014

Plastic piping systems for the supply of gaseous fuels. Polyethylene (PE). Pipes

BS ISO 4437-3:2014

Plastic piping systems for the supply of gaseous fuels. Polyethylene (PE). Fittings

BS ISO 4437-5:2014

Plastic piping systems for the supply of gaseous fuels. Polyethylene (PE). Fitness for purpose of the system

BS ISO 7005-1:2011

Pipe flanges. Part 1 Steel flanges for industrial and general service piping

DD CEN/TS 14175-5:2006

Fume cupboards. Part 5 Recommendations for installation and maintenance

ISO 17484-2:2009

Plastics piping systems - Multilayer pipe systems for indoor gas installations . Part 2: Code of practice

ISO 7-1:1994

Pipe threads where pressure-tight joints are made on the threads. Part 1 Dimensions, tolerances and designation

## V20 LV DISTRIBUTION

### PART 1 SYSTEM OBJECTIVES

#### 100.010 PERFORMANCE OBJECTIVES:

To provide replacement of distribution panels, boards, isolators and mineral insulated copper cable throughout the area of works and surrounding areas to fulfil the requirements of the International Maritime Organisation.

To include modifications to existing small power services where retained within the refurbishment area as well as areas beyond outside these boundaries.

The aim of this objective is to contribute to a co-ordinated electrical distribution system. New installations and modifications to existing parts of the system could cause adverse consequences to other users within the International Maritime Organisation.

To minimise spares stockholding, provide a uniform installation both in quality and manufacture, also for the maintenance staff equipment familiarity, their safety and to minimise their training on new equipment the manufacturer of various components of the distribution equipment is stated within this specification. This does not preclude other manufacturer's equipment being offered however the contractor will give preference to those offers that include the preferred manufacturers.

All proposed modifications to, or additions to or for additional loads to the electrical distribution system, without exception, must be approved in advance by TB+A and F+G. This includes submission of drawings and calculations in sufficient detail to allow the TB+A and F+G to assess the proposed modification. TB+A and F+G has absolute discretion to accept or decline any proposed modification or to request additional information. Therefore, Contractors, Designers and Consultants should allow adequate time for this process as TB+A and F+G will not allocate resources to this activity to meet external deadlines.

All LV devices down to main isolators on final distribution boards shall have the number of contacts equal to the number of wires in the supply, that is four pole for three phase and neutral supplies, three pole for three phase supplies and two pole for single phase and neutral supplies unless specifically agreed in writing in advance with International Maritime Organisation, TB+A and F+G.

Any making good or fire stopping made necessary by the removal of redundant equipment, cables, containment and fixings is to be included in the scope of the works including making good to finishes.

All equipment to be included in any installation shall be of a type and duty appropriate for the intended use.

#### 100.020 DESIGN PARAMETERS:

The Contractor shall include with his Tender a method statement, in particular the following are to be provided as appropriate:

- a) Full details and descriptions of all proprietary products, and suppliers and Sub-Installers upon which the Tender are based.
- b) Programme, setting out drawings etc. that will be submitted to the Employer's Representative for review and comment.
- c) Schedule of lead-in times for all materials and goods that have long delivery periods.
- d) Schedule of spares to be provided.
- e) Management and Supervision Proposals.
- f) All other drawings, details, samples, documents and/or information which are reasonably necessary to explain and/or amplify the requirements of the Tender or to enable the Installer to execute and complete the works.
- g) Such further information as reasonably may be required by the Employer's Representative in verifying the full detail of the MEP Sub-Contractor Proposals.

The following requirements are mandatory and must not be varied or otherwise relaxed.

Prior to any design being prepared TB+A has prepared a set single line diagram of the existing distribution sourced from Intelli-Scan and shall determine the maximum demand of each point of utilisation. The design shall demonstrate that existing loads and the proposed new load(s) are within the safe working capacity of the system.

Single line diagrams that show any part of the electrical distribution shall have the distribution elements, that is the circuit breakers, switch fuses and distribution boards identified with its reference and asset code, each element shall also have its location shown.

Layout drawings that show the electrical distribution elements, that is the switchboards, MCCs and distribution boards shall show an ident which shall be cross referenced in a table on the same drawing.

For switchboards the table shall include in addition to its system reference and asset code, the voltage e.g. 400Vac; busbar rated current e.g. 2500A; the short circuit level and time e.g. 50kA 3secs;

### General Installation

Where equipment is not floor mounted assemble on a purpose made framework. This is to be fabricated from unistrut or equal and so designed as to enable all fixing lugs on equipment to be secured with nuts and bolts of appropriate size.

All joints to be accurately saw-cut, butt welded and ground as necessary to ensure a smooth face to the frame. Fixing lugs attached to the framework in readily accessible positions, for securing to the building structure.

All trunking and accessories to be of approved type and manufacture and the stipulations laid down in the section of the Specification on cable trunking to apply. All trunking and accessories shall be individually secured to the framework.

All connections between trunking and fuse boards, contactors, etc. to consist of flanged connectors.

Particular attention to be paid to ensure that connectors are completely free from jagged edges and projections likely to damage cables.

Cableways between switching devices and trunking be shielded with thick paxolin sheet drilled to the exact size to receive outgoing cables.

Under no circumstances will open voids be allowed between this equipment.

Factors that affect this recommendation are consideration are the age of the equipment, the availability of spares, the safety of the maintenance engineers when maintaining or operating the equipment, the need to remotely monitor and control plant.

Incoming terminals and the outgoing terminals of every circuit being measured and recorded.

## Distribution Boards

For distribution boards the table shall include in addition to its system reference and asset code, the distribution board configuration e.g. 6W SPN MCB board; Incomer e.g. 2P 125A switch; manufacturer/type e.g. Schneider Electric Ltd. Type A; Supply reference e.g. 05/402046/02L2; Supply device e.g. 2P 50A MCB; Supply cable e.g. 2c 25mm<sup>2</sup> XLPE:LSZH(EB):LSZH:SWA:LSZH. Mount distribution boards so that they are readily accessible and fixed firmly to the building fabric by approved fixing, or to metal framework by nuts, bolts and washers, all in accordance with the Specification. All distribution boards must be mounted in accessible areas and to be accessible without use of access equipment. All distribution boards are to be fitted with locks supplied by International Maritime Organisation.

Distribution Boards shall be Schneider Isobar 4 type.

Ensure all terminations are fully shrouded. Access to busbars and cabling terminals shall only be by removal of fixed screwed cover plates.

Provide distribution boards complete with lockable hinged front covers (side hinge only) to provide access to, fuses, MCBs and RCDs for maintenance and switching. Fix circuit charts inside each distribution board.

Ensure distribution boards shown without local isolating switches are supplied complete with integral two or four pole mains isolator with cable terminations sized to accommodate the specified supply cables.

Ensure that adequate provision is made within the distribution board to receive the specified cabling and that the boards are physically sized to suit the proposed installation location.

Ensure ingress protection is a minimum of IP31 rating and that all cable entries into the board maintain this protection rating.

Provide all distribution boards complete with fully rated neutral and earth termination with one neutral and earth connection for each single phase output distribution way.

Provide distribution boards with adequate earth termination facilities to accommodate the equipotential and supplementary earth requirements for each particular project.

Ensure all distribution boards are manufactured by an approved manufacturer and/or supplier, unless otherwise agreed by the IMO Operations Department.

The distribution boards to be provided with at least 25% spare capacity.

Distribution boards shall be equipped with extension chambers allowing installation of meters. Suitable CT's and shorting links shall be installed from the outset.



## MCB Distribution Boards

Ensure miniature circuit breaker boards are Schneider Isobar 4c and comply with the relevant Standards. Supply complete with MCB's of the sizes detailed on the drawings / schedules and / or in the Particular Project Specification.

Ensure MCB's conform to the relevant Standards and of the type defined in the Particular Project Specification or drawings (e.g. type B, C, D, etc.)

MCB's should have 'trip free' mechanisms and positive contact indication. The MCB dolly should be capable of being locked in the on or off position with a locking device. A minimum of two locking devices to be provided with each distribution board.

Use combined MCB/RCD units where required for project, and ensure compliance with specification.

All MCB distribution boards shall have side hinged lockable doors. These are to accept standard CU DB lock mechanisms which will be fitted by City University Operations Department.

In addition to the requirements of Preliminary clauses ('A' sections) and other requirements within this Work Section, all work to be carried out in accordance with the latest edition of BS 7671 Requirements for Electrical Installations (IEE Wiring Regulations) and with International Maritime Organisation Technical Policy Statements and Standard Specifications.

## Containment

Existing containment that runs along the wall and ceilings of the plant rooms can be utilized; however, some circuits may need to be ran via a different route due to accessibility issues;

## Cabling

Each wire to be clearly identified by a ferrule at each end, permanently numbered in accordance with the schematic control and wiring diagrams. The ferrules may be colour coded or have black numbers on a white background. Ferrules are to be used that completely encircle the conductor or a rigid supporting

bar permanently attached to the conductor. Ferrules to read from the termination outwards. Adhesive markers are not permitted.

Bushes shall be fitted where cables pass through metal partitions.

Auxiliary and control wiring is not to pass through the busbar chamber, without secondary protection.

Extra low voltage control wiring must be segregated from wiring at higher voltage.

Provide removable, gland plates on external surface of each switch panel section, sized to suit the specified cables and bonded to main earth bar.

Where single core main cables are used the gland plates are to be of a nonferrous construction.

Provide unrestricted access to cable routes and terminations and facilities for firmly supporting cables within cubicle type switchboard, with cable sizes and types indicated for the particular project.

Ensure all cable compartments are sized to meet specification requirements and for full cabling/termination access.

Provide terminations suitable for copper cables. Fully rate neutral terminations as phase terminals. Fix, rigidly, all terminations.

All power, control and signal wires to be terminated using compression type crimps.

Terminals for power wiring to be of the clamp or stud type. Terminals for control wiring to be of the pressure clamp type or screw type. Pinch screw terminals, where the screw bears directly onto the conductor, are not permitted.

All wiring to be connected to the same side of an outgoing terminal block, the other side is only to be used for external wiring. Not more than two wires shall be connected to each terminal. Proprietary type cross-connecting links are to be used where conductors are to be commoned together.

Clearly number or identify all terminals.

Provide safety screens and warning labels to all terminals which may be live after switching OFF main incoming unit(s).

Use design and siting of fuse carriers to prevent accidental contact with 'live' metal whilst the fuse carrier is being inserted or withdrawn from the fuse base. All fuse carriers are to be clearly labelled with function and fuse rating.

Ensure adequate shrouding of the fuse base contacts to prevent accidental contact with 'live' metal when the fuse carriers have been withdrawn.

## Earthing

There is to be good earth continuity between all non-current carrying metal parts.

Supply each panel with a suitably sized earth bar installed throughout the full length of the panel. Size with copper earth conductor in accordance with the relevant standards for the fault level, subject to a minimum of 25 x 3 mm.

Bond all equipment which is not specially earthed to main earth conductor by means of earth tapes sized in accordance with the relevant standards. Provide bonding connections to each item of switchgear, and cable gland plates.

Any hinged doors and removal covers to be earthed by a separate flexible earth conductor.

The earth bar shall be drilled to accommodate all the protective conductors and the main incoming supply cable earth.

#### Labelling

A Traffolyte or equivalent designation label having a black legend on a white background to be fitted to:

Each cubicle detailing compartment number, CU designation, rating of device and number of poles or other details of cubicle contents such as metering, name of service.

Font to be Tahoma minimum 3.5mm high. All to be agreed in advance with TB+A, IMO & F+G.

No other information shall be included on the label.

Labels that advertise persons, companies, services or any information not required in this specification shall not be affixed to any part of the switchboard.

#### Warning

All covers doors and complete assembly to be provided with suitable labelling to comply with Health and Safety requirements, colour coded to suit.

#### Circuit breakers

Circuit breakers to be two pole, three or four pole either 'Air Circuit Breakers' or 'Moulded Case Circuit Breakers' as specified. The circuit breakers shall have the number of contacts equal to the number of wires in the supply that is four pole for three phase and neutral supplies, three pole for three phase supplies and two pole for single phase and neutral supplies unless specifically agreed in writing with International Maritime Organisation Fault rated to a minimum level equivalent to that of the busbar system.

MCCB's to be fixed, plug-in or withdrawable. Suitable for the functions of isolation and switching; marked with the disconnect symbol accordingly. They are to utilise a trip free mechanism and be capable of onsite

adaptation of auxiliaries and protective elements. All devices shall be installed so as to allow future replacement if the device fails, with electrical isolation only, no disassembly of the panel shall be required.

#### Fuse - Switch – Disconnecter

Fuse switch equipment to be of the fault making, load breaking type. Fault rated to a minimum level equivalent to that of the busbar system and be fitted with HRC fuses to BS 88 and shall break all the conductors of the circuit.

Switch suitable for utilisation category AC23.

#### Switch Disconnectors

The switch is to be fault rated, to operate at full load, capable of interrupting total stalled loads, safely and without damage and shall break all the conductors of the circuit.

Switch suitable for utilisation category AC23.

#### Testing

Every installation shall be tested as required by the IEE Regulations and the specifications issued by TB+A and the tests listed below and the relevant test certificates issued. The International Maritime Organisation and TB+A shall be given the opportunity to witness every test.

As panel boards are assembled on site the panel boards shall be tested as any other site assembled equipment with the addition of a milli-ohmeter test of every circuit, where every switch and MCCB in the distribution board is closed and then the resistance between the incoming terminals and the outgoing terminals of every circuit being measured and recorded.

As distribution boards are assembled on site the boards shall be tested as any other site assembled equipment with the addition of a milli-ohmeter test of every circuit, where every switch and MCB in the distribution board is closed and then the resistance between the incoming terminals and the outgoing terminals of every circuit being measured and recorded.

#### Redundant Equipment

Redundant equipment, cables and cable containment shall be removed from site only after the International Maritime Organisation have been given the opportunity to identify components to be retained for spares.

The method of disposal of any electrical equipment shall comply in every respect with the WEEE Directive of 2006 as amended in 2009.

### 100.030 SYSTEM DESCRIPTION:

#### OVERVIEW

The LV Distribution System consists of following:

- LV Distribution Board (Maintained Supply adjacent TB1 & TB3) complete with Changeover Contactor unit
- LV Distribution Board                      Core 'B' – TB1 & TB3
- LV Distribution Board                      Core 'C' – TC2
- Basement Panel
- Chiller Switchboard
- Kitchen Panel board

- Low Voltage Rising Busbars
- Distribution Panels/Distribution Boards
- 20kVA Static Transfer Switches for Comms Room Sub Boards with dual supplies
- Isolators
- Protection Relays
  - Over Current and Earth fault protection
  - Phase Failure Relay
- Automatic Power Factor Correction Unit (PFC)
- Castell Key interlocking

Note: Main Boards TB2 & TC1 are obsolete/have been removed.

The main LV Switchboards derive LV power from respective 800kVA, 11/0.433kV Step Down oil filled sealed transformer.

The LV Distribution board outgoing ways are provided with KWHR (Kilowatt-hour) status is monitored by the Building Management System (BMS). The electrical distribution boards are installed with a metering complying with Part L 2006, L2B & CIBSE TM 39.

The ACB are provided with Over Current and Earth fault protection. The LV Distribution Board outgoing ways are protected by MCCB (MCCB-OPEN/CLOSE) status is monitored by the BMS. ACBs are provided with control unit Micrologic 5.0A overcurrent short circuit instantaneous relay. Some of the outgoing circuits are provided with ammeters and selector switches as detailed on the record drawings

The input breakers are provided with 'ammeter plus selector switch' voltmeter and selector switch' and 'power factor meter'.

Castell keys locks and the key exchange boxes are provided as detailed on the record drawings and the Sapphire Switchgear drawings.

Emergency Stop Buttons is installed on the wall in the LV Switchroom Basement to trip HV and LV circuit breaker (Intertrip).

Each section of the switchboard has been provided with 'surge protection' equipment.

## LV Distribution Board (Maintained Supply) (Adjacent TB1 & TB3)

The “Sapphire Controls Ltd” LV Distribution Board (Maintained Supply) is located at the Basement Level has dual supply source via Changeover Contactor.

The Changeover contactor, 600A TP&N MCCB is fed from main LV Distribution Board Core ‘B’ located at the Ground Floor as shown on the Main Schematics and 400A TP&N MCCB derives LV supply from the Generator (standby) located at the Basement via Circuit Breaker.

The 4 pole changeover contactor status is monitored by the BMS.

The LV Distribution Board (Maintained Supply) outgoing ways are protected by TP&N MCCBs feeds to the following:

100A TP&N Isolator-MSBL1, MSBTP1, Basement  
100A SP&N Isolator-PABX Operator room, M1BLP2, Basement  
100A SP&N Isolator -Telex and Security-M1BLP1, Basement  
60A SP&N Isolator Telex and Security-MGBLP1, Ground Floor  
Conference Hall, Emergency Lighting, Battery Cubicle  
100A TP Switch Fuse Unit (SFU)-Lift L6 Core C, Ninth Floor  
100A TP Switch Fuse Unit (SFU)-Lift L7 Core C, Ninth Floor  
Eight Floor Comms Room  
100A TP&N Isolator -PABX Room Equipment Supply, First Floor  
100A TP&N Isolator-MBBTP2, Basement  
Third Room Comms Room  
100A TP&N Isolator-Lift L3 Core C Ninth Floor, Lift L4 Core C Ninth Floor, Lift L5 Core C Ninth Floor,  
Controls  
100A TP&N Isolator-MBBTP1  
100A TP-Lift L2- Fireman’s  
100A TP-Lift L1  
100A TP, Hydraulic Lift L8

## LV Distribution Board-Core ‘B’ (TB1 & TB3)

The “Sapphire Controls Ltd” LV Distribution Board (Core ‘B’) is located at the Basement Level has dual supply source.

The LV Distribution Board (Core ‘B’) is fed from the 800kVA transformer (TB1) and 800kVA transformer (TB3) and coupled via 1250Amps 4Pole, Non-Auto, Bus Coupler Switch as shown on record drawing. The Core ‘B’ LV Distribution Board, 1200Amp, 4Pole, ACB Incomer 2 nos and 1250Amp, 4Pole, Non-Auto, Bus Coupler Switch are operated via Castell Key (A).

The LV Distribution Board comprises of following sections:

- Section fed from transformer (TB1)
- Section fed from transformer (TB3)
- Bus Coupler/Section Switch (BSS)

Both sections are controlled via power factor controller (PFC).

The Section fed from transformer (TB1) outgoing ways are protected by TP&N MCCB, feeds to the following:

- LV/HV Battery Trip- Basement
- 1 BTP1- 1<sup>st</sup> Floor
- 50Amps Escalator-1<sup>st</sup> Floor
- 50Amps Escalator-2<sup>st</sup> Floor
- 50Amps Escalator-2<sup>st</sup> Floor

- 800Amp 4 pole Rising Main- Core 'B'
- Space provided for-200/100Amp TPN 3/1 no- Basement
- 300kVAR power Factor Unit, Section 'B' Basement
- 3BTP1-distribution board, Plantroom -20kVA Static transfer switch-DB Board 'A' and 'B' Third Floor
- GBTP1 Reprographics DB-Ground Floor
- Spare-TP&N Supply to Eight floor riser core B
- 9 BTP1 Plantroom DB-Roof Floor

The Section fed from transformer (TB3) outgoing ways are protected by TP&N MCCB, feeds to the following:

- 300kVAR power Factor Unit, Section 'E8' Basement
- Conference Block- CHTP2 Roof Plant Room
- 800Amp 4 Bar Rising Main- Core 'A'
- BBTP1, DB Basement Chiller Plantroom
- SBTP1, DB Smiths Basement
- CHTP3, DB Conference Centre, Level 2
- 200Amp Bus Bar- BBL1-24way SP+N, DB & BBP1, 12way SP+N, DB
- 7ATP1 Plantroom DB, Seventh floor
- Smith Humidifier
- 3BTP2, DB North plantroom, Third floor
- 200TPN (SFU)-PREP/1D/A, CONT/1B-Core 'B' First floor Electrical riser
- 300TPN (SFU)-KIT/4B/A-Core 'B' Fourth floor Electrical riser

## LV Distribution Board-Core 'C' (TC2)

The "Sapphire Controls Ltd" LV Distribution Board (Core 'C') is located at the Basement Level has dual supply source.

The LV Distribution Board (Core 'C') derives main LV power from the 800kVA; 11/0.433kV transformer (TC2) and secondary LV power from the 800kVA; 11/0.433kV transformer (TC1) via Basement panel Chiller plant room.

The LV Distribution Board (Core 'C') incomer's 1250Amp ACB 4pole transformer (TC2) and 1250Amp ACB 4pole transformer (TC1) are operated with Castell key (B).

The LV Distribution Board (Core 'C') outgoing ways are protected by MCCB ways feeds to the following:

- 100A TP&N Isolator-3CTP1, Main Floor Lighting
- 100A TP&N Isolator-BCL3, Entrance Floor Lighting
- 600Amp 4 Bar Rising Main- Core 'C'
- 200Amp TP&N Isolator -BCL1, BCP1 & BCL2, Basement
- 630Amp, TPN Non-Auto, Kitchen Panel Board Fourth Floor.
- 1CTP1 & 1CTP2, DB Plantroom, First Floor
- 2CTP2 DB Plantroom Second Floor
- 3CTP2 DB Plantroom Third Floor
- 4CTP2 DB Plantroom Fourth Floor
- 3CTP3 DB Plantroom Third Floor
- 1CTP3 DB Plantroom First Floor
- 9CTP1, DB Plantroom, Ninth Floor
- 4CTP3 DB South Plantroom Fourth Floor
- 2CTP3 DB South Plantroom Fourth Floor
- Space provided for-250Amp, TP&N, Basement
- 160Amp TP&N G/PLEN, Ground Floor
- 20Amps DP Switch Isolator-HV/LV Battery Trip
- 200Amp TP&N Isolator-CHL2-8, SP&N, DP&N Switchboard
- 20kVA Static transfer switch-DB Board Eight floor
- 200TPN (SFU)-Core 'C' First floor Electrical riser-PREP 1E/A, AV/IT/1C, CONT/1C
- 300TPN (SFU)-Core 'C' Fourth floor Electrical riser-4CL1, 4CL2, 4CP1

## Strip Out Works

### Basement

#### Distribution Board: SBTP1

- + Strip out existing isolator and distribution board.
- + Strip out 1no. MICC Cable from SBTP1 to Control Panel 8.
- + Strip out 1no. MICC Cable from SBTP1 feeding AHU 20 Extract Fan isolator.
- + Strip out 1no. MICC Cable from AHU 20 Extract Fan isolator to inverter.
- + Strip out 1no. MICC Cable from AHU 20 Extract Fan inverter to Extract Fan.
- + Strip out 1no. MICC Cable from SBTP1 feeding AHU 20 Supply Fan Isolator.
- + Strip out 1no MICC Cable from SBTP1 feeding AHU 20 Light Switch
- + Remove Light Switch.
- + Strip out 1no. MICC Cable from SBTP1 to AHU20 Heat Recovery Pump.

#### Distribution Board: MSBL1/P1

- + Strip out existing isolator and distribution board.
- + Remove and retain circuit 5L1 to connect to DB SBTP1 (Fan Coil Unit 19 & 20 Circuit)
- + Strip Out ELV Circuits
- + Strip out existing 240 socket outlet cables.

#### Distribution Board: MSBTP1

- + Strip out existing isolator and distribution board.
- + Isolated Circuits to be identified & stripped out if not in use.
- + Remove Lights Lamp Posts Lambert Street Circuit.

#### Distribution Board: BBL1/P1

- + Strip out existing isolators, busbar chamber feeding BBP1 & BBL1.

#### Distribution Board: MBBTP1

- + Strip out existing isolator, and distribution board.
- + Strip out FCU contactor
- + Strip out 1no. MICC Cable from MBBTP1 feeding Car Park Sump Pump.
- + Strip out 1no. MICC Cable from MBBTP1 feeding Car Park Sump Pump.
- + Strip out 1no. MICC Cable from MBBTP1 feeding Car Park Extract Fan no. 1
- + Strip out 1no. MICC Cable from MBBTP1 feeding Car Park Extract Fan no. 2

#### Distribution Board: BBTP1 (1+2)

- + Strip out Distribution panel for BBTP1 (1+2)
- + Strip out SWA cable from BBTP1/1 to AHU 25 supply fan.
- + Strip out SWA cable from BBTP1/1 to AHU 25 extract fan.
- + Strip out 1no. MICC cable from BBTP1/1 to CP1 Outstation.
- + Strip out Cable Link from CP1 to AFP01.
- + Strip out 1no. MICC Cables from BBTP1/1 feeding HWS Pump 1 isolator.
- + Strip out 1no. MICC Cables from BBTP1/1 feeding HWS Pump 2 Isolator

#### Distribution Board: BCL1, BCL2 & BCP1

- + Strip out existing 2 core 95mm SWA cable
- + Strip out existing isolators, busbar chamber feeding BCL1, BCP1 & BCL2

#### Distribution Board: MBBTP2

- + Strip out existing isolator, and distribution board.

## Ground Floor

Distribution Board: LV Panel Conference Hall

- + Strip out 1no. 200amp TP&N distribution panel containing 9no. SP&N isolators each rated at 100amps and 2no. Distribution boards.

## First floor

Distribution Board: 1BTP1

- + Strip out existing isolator and distribution board.
- + Strip out 1no. MICC Cable from 1BTP1 to Control Panel 2.
- + Strip out 1no MICC Cable from 1BTP1 feeding AHU 1 Light Switch
- + AHU 1 - Remove Light Switch.
- + Strip out 1no. MICC Cable from 1BTP1 feeding AHU 1 Supply Fan Isolator.
- + Strip out 1no. MICC Cable from 1BTP1 feeding AHU 1/ Foyer extract fan isolator.
- + Strip out 1no. MICC Cable from 1BTP1 feeding AHU 2 Supply Fan Isolator.
- + Strip out 1no MICC Cable from 1BTP1 feeding AHU 2 Light Switch
- + AHU 2 - Remove Light Switch.
- + Strip out 1no. MICC Cable from 1BTP1 to Toilet Extract Fan A
- + Strip out 1no. MICC Cable from 1BTP1 to Toilet Extract Fan B

Distribution Board: 1CTP1 (1+2)

- + Strip out existing isolator and distribution boards 1CTP1 (1+2)
- + Strip out 1no. MICC Cable from 1CTP1/2 to Control Panel 3.
- + Strip out 1no. MICC Cable from 1CTP1/2 feeding AHU 5 inverter Isolator.
- + Strip out 1no MICC Cable from 1CTP1/1 feeding AHU 4 Light Switch.
- + AHU 4 - Remove Light Switch.
- + Strip out 1no. MICC Cable from 1CTP1 feeding AHU 4 Supply Fan Isolator.
- + Strip out 1no. MICC Cable from 1CTP1 feeding Fan 4 meeting room Isolator.
- + Strip out 1no MICC Cable from 1CTP1/1 feeding AHU 3 Light Switch
- + AHU 4 - Remove Light Switch.
- + Strip out 1no. MICC Cable from 1CTP1 feeding AHU 4 Supply Fan Isolator.
- + Strip out 1no. MICC Cable from 1CTP1 feeding Fan 4 meeting room Isolator.
- + Strip out 1no. MICC Cable from 1CTP1/2 feeding toilet extract fan F05/a
- + Strip out 1no. MICC Cable from 1CTP1/2 feeding toilet extract fan F05/b

## Second Floor

### Distribution Board: 2CTP2

- + Strip out existing isolator and distribution boards 2CTP2
- + Strip out 1no. MICC Cable from 2CTP2 to Control Panel 4.
- + Strip out 1no MICC Cable from 2CTP2 feeding AHU 7 Light Switch
- + AHU 7 - Remove Light Switch.
- + Strip out 1no. MICC Cable from 2CTP2 feeding AHU 7 Supply Fan Isolator.
- + Strip out 1no. MICC Cable from 2CTP2 feeding AHU 7 extract fan isolator.
- + Strip out 1no MICC Cable from 2CTP2 feeding AHU 6 Light Switch
- + AHU 6 - Remove Light Switch.
- + Strip out 1no. MICC Cable from 2CTP2 feeding AHU 6 Supply Fan Isolator.
- + Strip out 1no. MICC Cable from 2CTP2 feeding AHU 6 extract fan isolator.

### Distribution Board: CHTP2

- + Strip out existing isolator and distribution boards CHTP2 (1+2)
- + Strip out 1no. MICC Cable from CHTP2/2 to Control Panel 9.
- + Strip out 1no MICC Cable from CHTP2/2 feeding AHU 22 Light Switch
- + AHU 22 - Remove Light Switch.
- + Strip out 1no. MICC Cable from CHTP2/2 feeding AHU 22 Supply Fan Isolator.
- + Strip out 1no. MICC Cable from CHTP2/2 feeding AHU 22 extract fan isolator.
- + Strip out 1no. MICC Cable from CHTP2/2 feeding AHU 22 Heat Recovery Pump Isolator.
- + Strip out 1no MICC Cable from CHTP2/2 feeding AHU 23 Light Switch.
- + AHU 23 - Remove Light Switch.
- + Strip out 1no. MICC Cable from CHTP2/2 feeding AHU 23 Supply Fan Isolator.
- + Strip out 1no. MICC Cable from CHTP2/2 feeding AHU 23 extract fan isolator.
- + Strip out 1no. MICC Cable from CHTP2/2 feeding AHU 23 Heat Recovery Pump Isolator.
- + Strip out 1no MICC Cable from CHTP2/1 feeding AHU 21 Light Switch
- + AHU 21 - Remove Light Switch.
- + Strip out 1no. MICC Cable from CHTP2/1 feeding AHU 21 Supply Fan Isolator.
- + Strip out 1no. MICC Cable from CHTP2/1 feeding AHU 21 extract fan isolator.
- + Strip out 1no. MICC Cable from CHTP2/1 feeding AHU 21 Heat Recovery Pump Isolator.
- + Strip out 1no MICC Cable from CHTP2/1 feeding AHU 24 Light Switch
- + AHU 24 - Remove Light Switch.
- + Strip out 1no. MICC Cable from CHTP2/1 feeding AHU 24 Supply Fan Isolator.
- + Strip out 1no. MICC Cable from CHTP2/1 feeding AHU 24 extract fan isolator.

## Third Floor

### Distribution Board: 3BTP1 (1+2)

- + Strip out existing isolator and distribution boards 3BTP1 (1+2)
- + Strip out 1no. MICC Cable from 3BTP1/ feeding AHU 10 extract fan isolator.
- + Strip out 1no. MICC Cable from 3BTP1 feeding AHU 10 Supply Fan Isolator.
- + Strip out 1no. MICC Cable from 3BTP1/1 feeding AHU 8 Supply Fan Isolator.
- + Strip out 1no. MICC Cable from 3BTP1/1 feeding AHU 8 extract fan isolator.
- + Strip out 1no MICC Cable from 3BTP1 /2 feeding AHU 8 Light Switch
- + AHU 8 - Remove Light Switch.
- + Strip out 1no. MICC Cable from 3BTP1/1 feeding AHU 9 Supply and Extract Starter Panel Isolator.
- + Strip out 1no MICC Cable from 3BTP1 /2 feeding AHU 9 Light Switch
- + AHU 9 - Remove Light Switch.
- + Strip out 1no. MICC Cable from 3BTP1/1 feeding AHU 8 toilet extract fan standby isolator.
- + Strip out 1no. MICC Cable from 3BTP1/1 feeding AHU 8 Heat Recovery Pump isolator.
- + Strip out 1no. MICC Cable from 3BTP1/2 to Plant Room lighting.

### Distribution Board: 3CTP2 (1+2)

- + Strip out existing isolator and distribution boards 3CTP2 (1+2)
- + Strip out 1no MICC Cable from 3CTP2 /1 feeding AHU 11 Light Switch
- + AHU 11 - Remove Light Switch
- + Strip out 1no. MICC Cable from 3CTP2/1 feeding AHU 11 Supply Fan Isolator.
- + Strip out 1no. MICC Cable from 3CTP2/1 feeding AHU 11 Extract Fan isolator.
- + Strip out 1no. MICC Cable from 3CTP2/2 feeding Control Panel 6 Outstation
- + Strip out 1no. MICC Cable from 3CTP2/2 feeding AHU 11 Heat Recovery Pump
- + Strip out 1no MICC Cable from 3CTP2 feeding AHU 12 & 13 Light Switch
- + AHU 12 & 13- Remove Light Switch.
- + Strip out 1no. MICC Cable from 3CTP2/1 feeding AHU 12 Supply Fan Isolator.
- + Strip out 1no. MICC Cable from 3CTP2/1 feeding AHU 12 extract fan isolator.
- + Strip out 1no. MICC Cable from 3CTP2/1 feeding AHU 13 Supply Fan Isolator.
- + Strip out 1no. MICC Cable from 3CTP2/2 feeding AHU 13 extract fan isolator.

## Lift Isolators

- + Strip out isolator for Lift 1 & associated containment on the 7<sup>th</sup> floor plant room core A
- + Strip out isolator for Lift 2 & associated containment on the 9<sup>th</sup> floor plant room core B
- + Strip out isolator for Lift 3 & associated containment on the 9<sup>th</sup> floor plant room core B
- + Strip out isolator for Lift 4 & associated containment on the 9<sup>th</sup> floor plant room core B
- + Strip out Isolator for Lift 5 & associated containment on the 9<sup>th</sup> floor plant room core B
- + Strip out controls fuse switch, busbar chamber & associated containment on the 9<sup>th</sup> floor plant room core B
- + Strip out isolator for Lift 6 & associated containment on the 9<sup>th</sup> floor plant room core C
- + Strip out isolator for Lift 7 and associated containment on the 9<sup>th</sup> floor plant room core C
- + Strip out isolator for Hydraulic Lift and associated containment in the basement core B

## Recommendations

- + Location of new distribution boards to go where existing distribution board is.
- + Existing outgoing cables to be re-used due to no requirements for replacement unless stated..
- + Unless stated, existing incoming SWA from switchboard to Isolator/Distribution Panel is to be used.
- + A separate CPC to be installed to all distribution panels.

## Basement

### Distribution Board: SBTP1 -

- + Install 1no. Schneider Electric 12 Way 3 phase Acti9 Isobar Type B Distribution Board. Label board SBTP1.
- + Install 2.5mm 2Core SWA cable from SBTP1 to Control Panel 8.
- + Install 4mm 4Core SWA cable from SBTP1 feeding AHU 20 Extract Fan isolator.
- + Install 4mm 4Core SWA cable from AHU 20 Extract Fan isolator to inverter.
- + Install 4mm 4Core SWA cable from AHU 20 Extract Fan inverter to Extract Fan.
- + Install 4mm 4Core SWA cable from SBTP1 feeding AHU 20 Supply Fan Isolator.
- + Install 2.5mm 2Core SWA cable from SBTP1 feeding AHU 20 Light Switch.
- + Replace Light Switch with IP65 rated light switch.
- + Install 4mm 4Core SWA cable from SBTP1 to AHU20 Heat Recovery Pump.
- + New cables might be required to connect each distribution board from its associated 63A isolator the newly installed distribution panel.
- + Existing containment that runs along the wall of the plant room can also be utilized.

### Distribution Board: MSBL1/P1

- + Install 1no. Schneider Electric panel board with a 100amp isolator containing a 63amp fused switch feeding an 18 Way 3phase Acti9 Isobar Type B Distribution Board. Label Board MSBL1/P1
- + Relocate supply for Fan Coil Units 19 & 20 to distribution board SBTP1
- + Rewire socket outlets

### Distribution Board: MSBTP1

- + To become part of new MSBL1/P1 18 Way board.
- + Retain circuits still required.
- + Relocate supply from distribution board SBTP1 - Existing to be extended.
- + Install 2 separate 13A supplies to fused spurs outlets from MSBTP1 to the water Tank Room

### Distribution Board: BBL1/P1

- + Install 1no. Schneider Electric 3Phase TP&N Panel board with a 125amp isolator containing 1no. 100Amp fused switch to feed distribution board BBL1 and 1no. 63amp fused switch to feed distribution board BBP1.

### Distribution Board: MBBTP1

- + Install new 18 Way 3 phase TP&N Acti9 Isobar Type B Distribution Board with a 100Amp Isolator
- + Install 1no. 4mm 4Core SWA cable from MBBTP1 feeding Car Park Sump Pump
- + Install 1no. 4mm 4Core SWA cable from MBBTP1 feeding Car Park Extract Fan no. 1
- + Install 1no. 4mm 4Core SWA cable from MBBTP1 feeding Car Park Extract Fan no. 2

**Distribution Board: BBTP1 (1+2)**

- + Install new Schneider electric panel board next to new CHW Panel with 2no. Isolators (x1 600A and x1 300A), 1no new Schneider electric 12 Way 63Amp TP&N DB, 4no. 200amp fused switches (fused @ 100amps each), 1no. 200amp fused switch fused at 160amps.
- + Move existing fluorescent light fitting above the new panel/distribution boards.
- + Install 1no new length of 2.5mm 4Core SWA Cable from new Panel/Distribution board to AHU 25 supply fan isolator
- + Install 1no. new length of 4mm 4Core SWA Cable from new Panel/Distribution board to AHU 25 extract fan isolator
- + Install 1no. 2.5mm 2Core SWA cable from new BBTP1 distribution board to CP1 Outstation
- + Install 1no. 2.5mm 2Core SWA cable from new BBTP1 distribution board to AFP01
- + Install 1no. 4mm 4Core SWA cable from new BBTP1 distribution board to H.W.S pump 1 isolator.
- + Install 1no. 4 mm 4Core from SWA cable new BBTP1 distribution board to H.W.S pump 2 isolator
- + All circuits to be moved over to new distribution panel BBTP1
- + 240mm 4core SWA cable for BBTP1/2 shall be retained in new panel board with a 300A isolator
- + Install 2no. 4mm 4Core from new BBTP1 distribution board to Chilled Water Pumps 5&6 isolators
- + Move trace heating circuit to new BBTP1 distribution board

**Distribution Boards: BCL1, BCL2 & BCP1**

- + Install 4 Core 95mm Cable from Switchboard to new BCL1&P1 Panel board
- + Install new Schneider Panel Board with 200Amp isolator with 3no 63 amp fused switches to feed independent distribution boards BCL1, BCP1 & BCL2
- + Install new 1no. Schneider Electric 12 Way TP&N Acti9 Isobar Type B Distribution Board.

**Distribution Board: MBBTP2**

- + Install new 1no. Schneider 12 Way TP&N Distribution board with 63Amp Isolator.

**Ground**

**Distribution Board: LV Panel Conference Hall**

- + Install new Schneider panel board with 9no. SP &N 100amp isolators
- + Install 1no. 18 way SP&N & distribution board. Label CHL2 - Conference Hall Misc. Lighting
- + Install 1no. 18 way SP&N & distribution board. Label CHP2 - Conference Hall General Purpose Power.

## First Floor

### Distribution Board: 1BTP1

- + Install 1no. Schneider Electric panel board with a 100amp isolator feeding a 12 Way TP&N 3phase Acti9 Isobar Type B Distribution Board. Label 1BTP1.
- + Install 2.5mm 2Core SWA cable from 1BTP1 to Control Panel 8.
- + Install 1.5mm 2Core SWA cable from 1BTP1 feeding AHU 1 Light Switch.
- + AHU 1 - Replace Light Switch with IP65 rated light switch.
- + Install 4mm 4Core SWA cable from 1BTP1 feeding AHU 1 Supply Fan Isolator.
- + Install 4mm 4Core SWA cable from 1BTP1 feeding AHU 1 Extract Fan isolator.
- + Install 4mm 4Core SWA cable from 1BTP1 feeding AHU 2 Supply Fan Isolator.
- + Install 1.5mm 2Core SWA cable from 1BTP1 feeding AHU 2 Light Switch.
- + AHU 2 - Replace Light Switch with IP65 rated light switch.
- + Install 4mm 4Core SWA cable from 1BTP1 to Toilet Extract Fan A
- + Install 4mm 4Core SWA cable from 1BTP1 to Toilet Extract Fan B

### Distribution Board: 1CTP1 (1+2)

- + Install 1no. Schneider Electric panel board with a 200amp TP&N isolator feeding a 24 Way 3phase Acti9 Isobar Type B Distribution Board. Label 1CTP1.
- + Install 2.5mm 2Core SWA cable from 1CTP2 to Control Panel 3.
- + Install 4mm 4Core SWA cable from 1CTP1 feeding AHU 5 inverter Isolator.
- + Install 1.5mm 2Core SWA cable from 1CTP1 feeding AHU 4 Light Switch.
- + AHU 4- Replace Light Switch with IP65 rated light switch.
- + Install 4mm 4Core SWA cable from 1CTP1 feeding AHU 4 inverter Isolator.
- + Install 4mm 4Core SWA cable from 1CTP1 feeding Fan 4 meeting room Isolator.
- + Install 1.5mm 2Core SWA cable from 1CTP1 feeding AHU 3 Light Switch.
- + AHU 3 - Replace Light Switch with IP65 rated light switch.
- + Install 4mm 4Core SWA cable from 1CTP1 feeding AHU 4 inverter Isolator.
- + Install 4mm 4Core SWA cable from 1CTP1 feeding Fan 4 meeting room Isolator.
- + Install 4mm 4Core SWA cable from 1CTP1 feeding toilet extract fan F05/a
- + Install 4mm 4Core SWA cable from 1CTP1 feeding toilet extract fan F05/b

## Second Floor

### Distribution Board: 2CTP2

- + Install 1no. Schneider Electric panel board with a 100amp isolator feeding a 12 Way TP&N 3phase Acti9 Isobar Type B Distribution Board. Label 2CTP2.
- + Install 2.5mm 2Core SWA cable from 2CTP2 to Control Panel 4.
- + Install 1.5mm 2Core SWA cable from 2CTP2 feeding AHU 7 Light Switch.
- + AHU 7 - Replace Light Switch with IP65 rated light switch.
- + Install 4mm 4Core SWA cable from 2CTP2 feeding AHU 7 Supply Fan Isolator.
- + Install 4mm 4Core SWA cable from 2CTP2 feeding AHU 7 Extract Fan isolator.
- + Install 1.5mm 2Core SWA cable from 2CTP2 feeding AHU 6 Light Switch.
- + AHU 6 - Replace Light Switch with IP65 rated light switch.
- + Install 4mm 4Core SWA cable from 2CTP2 feeding AHU 6 Supply Fan Isolator.
- + Install 4mm 4Core SWA cable from 2CTP2 feeding AHU 6 Extract Fan isolator.

### Distribution Board: CHTP2

- + Install 1no. Schneider Electric panel board with a 200amp isolator feeding a 24 Way TP&N 3phase Acti9 Isobar Type B Distribution Board. Label CHTP2.
- + Install 2.5mm 2Core SWA cable from CHTP2 to Control Panel 9.
- + Install 1.5mm 2Core SWA cable from CHTP2 feeding AHU 22 Light Switch.
- + AHU 22 - Replace Light Switch with IP65 rated light switch.
- + Install 4mm 4Core SWA cable from CHTP2 feeding AHU 22 Supply Fan Isolator.
- + Install 4mm 4Core SWA cable from CHTP2 feeding AHU 22 Extract Fan isolator.
- + Install 4mm 4Core SWA cable from CHTP2 feeding AHU 22 Heat recovery Pump isolator.
- + Install 1.5mm 2Core SWA cable from CHTP2 feeding AHU 23 Light Switch.
- + AHU 23 - Replace Light Switch with IP65 rated light switch.
- + Install 4mm 4Core SWA cable from CHTP2 feeding AHU 23 Supply Fan Isolator.
- + Install 4mm 4Core SWA cable from CHTP2 feeding AHU 23 Extract Fan isolator.
- + Install 4mm 4Core SWA cable from CHTP2 feeding AHU 23 Heat recovery Pump isolator.
- + Install 1.5mm 2Core SWA cable from CHTP2 feeding AHU 21 Light Switch.
- + AHU 21 - Replace Light Switch with IP65 rated light switch.
- + Install 4mm 4Core SWA cable from CHTP2 feeding AHU 21 Supply Fan Isolator.
- + Install 4mm 4Core SWA cable from CHTP2 feeding AHU 21 Extract Fan isolator.
- + Install 4mm 4Core SWA cable from CHTP2 feeding AHU 21 Heat recovery Pump isolator.
- + Install 1.5mm 2Core SWA cable from CHTP2 feeding AHU 24 Light Switch.
- + AHU 24 - Replace Light Switch with IP65 rated light switch.
- + Install 4mm 4Core SWA cable from CHTP2 feeding AHU 24 Supply Fan Isolator.
- + Install 4mm 4Core SWA cable from CHTP2 feeding AHU 24 Extract Fan isolator.

## Third Floor

### Distribution Board: 3BTP1 (1+2)

- + Install 1no. Schneider Electric panel board with a 100amp isolator feeding an 18 Way TP&N 3phase Acti9 Isobar Type B Distribution Board. Label 3BTP1.
- + Install 4mm 4Core SWA cable from 3BTP1 feeding AHU 10 Extract Fan isolator.
- + Install 4mm 4Core SWA cable from 3BTP1 feeding AHU 10 Supply Fan Isolator.
- + Install 4mm 4Core SWA cable from 3BTP1 feeding AHU 8 Supply Fan Isolator.
- + Install 4mm 4Core SWA cable from 3BTP1 feeding AHU 8 Extract Fan isolator.
- + Install 1.5mm 2Core SWA cable from 3BTP1 feeding AHU 8 Light Switch.
- + AHU 8 - Replace Light Switch with IP65 rated light switch.
- + Install 4mm 4Core SWA cable from 3BTP1 feeding AHU 9 Supply and Extract Starter Panel Isolator.
- + Install 1.5mm 2Core SWA cable from 3BTP1 feeding AHU 9 Light Switch.
- + AHU 9 - Replace Light Switch with IP65 rated light switch.
- + Install 4mm 4Core SWA cable from 3BTP1 feeding AHU 8 toilet Extract Fan standby isolator.
- + Install 4mm 4Core SWA cable from 3BTP1 feeding AHU 8 Heat Recovery Pump isolator.
- + Install 1.5mm 2Core SWA cable from 3BTP1 to Plant Room lighting.

### Distribution Board: 3CTP2 (1+2)

- + Install 1no. Schneider Electric panel board with a 100amp isolator feeding an 18 Way TP&N 3phase Acti9 Isobar Type B Distribution Board. Label 3CTP2.
- + Install 1.5mm 2Core SWA cable from 3CTP2 feeding AHU 11 Light Switch.
- + AHU 11 - Replace Light Switch with IP65 rated light switch.
- + Install 4mm 4Core SWA cable from 3CTP2 feeding AHU 11 Supply Fan Isolator.
- + Install 4mm 4Core SWA cable from 3CTP2 feeding AHU 11 Extract Fan isolator.
- + Install 2.5mm 2Core SWA cable from 3CTP2 feeding Control Panel 6 Outstation
- + Install 4mm 4Core SWA cable from 3CTP2 feeding AHU 11 Heat Recovery Pump
- + Install 1.5mm 2Core SWA cable from 3CTP2 feeding AHU 12 & 13 Light Switch.
- + AHU 12 & 13 - Replace Light Switch with IP65 rated light switch.
- + Install 4mm 4Core SWA cable from 3CTP2 feeding AHU 12 Supply Fan Isolator.
- + Install 4mm 4Core SWA cable from 3CTP2 feeding AHU 12 Extract Fan isolator.
- + Install 4mm 4Core SWA cable from 3CTP2 feeding AHU 13 Supply Fan Isolator.
- + Install 4mm 4Core SWA cable from 3CTP2 feeding AHU 13 Extract Fan isolator.

## Lift Isolators

- + Install 1no. 100amp fused switch TP&N Fused at 40amps for Lift 1
- + Install 1no. 100amp fused switch TP&N Fused at 100amps for Lift 2
- + Install new 300amp T.P isolating switch.
- + Install 1no. 100amp fused switch TP&N Fused at 100amps for lift 3
- + Install 1no. 100amp fused switch TP&N Fused at 100amps for lift 4
- + Install 1no. 100amp fused switch TP&N Fused at 100amps for lift 5
- + Install 1no. 100amp fused switch TP&N Fused at 63 amps for lift controls DB
- + Install 1no. 100amp fused switch TP&N Fused at 40amps for lift 6
- + Install 1no. 60amp fused switch TP&N Fused at 16 amps for lift 7
- + Install 1no. 200amp fused switch TP&N Fused at 160amps for hydraulic Lift 8

100.050 SYSTEM SCHEMATICS:

- Appendix Two

100.060 SYSTEM DRAWINGS:

- Appendix Two

---

## **PART 2 SELECTION SCHEDULES FOR REFERENCE SPECIFICATIONS**

### **260.000 CONDUIT AND TRUNKING**

#### **260.010 GENERAL:**

- Comply with work section general clauses reference Y60.1000 and those detailed below.
- Any conduit or trunking must support the function of the cabling system and provide protection, adequate separation distance and presentation as required by the cabling and EMC design.
- IT, BMS, security, data and voice cabling should be secured without deformation of the outer jacket and with a non-compressive securing tie. Zip ties should not be used unless written approval has been obtained.
- Zip ties should not be cut off to form a sharp end.
- Zip ties should not compress the cable jacket.
- Velcro, hook and eye ties or other non invasive ties must be used where possible.
- All cable routes must carry a permanent and visible identifier which is coded as part of the administration system.
- Supply conduit and cable trunking as specified in section
- Fire stopping
  - Demarcation of responsibilities
    - Main contractor
    - Services contractor
    - Fire stopping specialist
    - Fire stopping systems manufacturers
    -
  - Install all fire stopping systems in accordance with the manufacturer's written instructions.
  - Install and inspect fire stopping systems in accordance with Building Regulations and ASFP Code of

Practice TGD 17.

•

260.020 CONDUIT SYSTEMS:

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent.
- Drawing reference
- Schedule reference
- Metal
  - Rigid
    - Class 2 - reference Y60.2010A
      - Fittings
        - Reference Y60.2020A
    - Class 4 - reference Y60.2010B
      - Fittings
      - Reference Y60.2020A
  - Non-metallic
    - Rigid - reference Y60.2010E
      - Fittings - reference Y60.2030A
    - Flexible - reference Y60.2010F
  - Fittings - reference Y60.2050A
  - Support and fixing - reference Y60.2170

260.030 METAL TRUNKING:

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent.
- Drawing reference
- Schedule reference
- Cable trunking and fittings
  - Reference Y60.2080A
- Trunking Type
  - Standard cable trunking.
  - Floor trunking.
  - Skirting trunking.
  - Wall/dado trunking.
  - Cornice trunking.
  - Bench trunking.
  - Lighting trunking.
  - With compartments.
- Installation
  - Surface.
  - Flush.
  - Trunking
  - Class 1/3 - reference Y60.2090B

- Flush floor trunking - reference Y60.2090D
- Steel Dado trunking - reference Y60.2090E
- Underfloor trunking
  - Reference Y60.2100A
- Service outlet boxes
  - Reference Y60.2110A
  - Recess lids
- Service poles
  - Reference Y60.2120A
- Separate or multi-compartment trunking
  - Reference Y60.2150A
- Support and fixing - reference Y60.2170

#### 260.040 TRUNKING OF INSULATING MATERIAL:

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent.
- Drawing reference
- Schedule reference
- Cable trunking and fittings
  - Reference Y60.2080A
- Trunking type
  - Standard cable trunking.
  - Floor trunking.
  - Skirting trunking.
  - Wall/dado trunking.
  - Cornice trunking.
  - Bench trunking.
  - Lighting.
  - With compartments.
- Surface trunking
  - PVC general purpose - reference Y60.2130A
  - PVC skirting trunking - reference Y60.2130B
- Underfloor trunking
  - PVC - reference Y60.2140A
- Service outlet boxes
  - Reference Y60.2110A
    - Recess lids
- Service poles
  - Reference Y60.2120A
- Separate or multi-compartment trunking
  - Reference Y60.2150A
- Wall/Dado Trunking
  - PVC - reference Y60.2130C
- Support and fixing - reference Y60.2170

#### 260.050 GENERAL WORKMANSHIP:

- General
  - Reference Y60.3010A
- Layout - reference Y60.3020
- Spacing - reference Y60.3030
- Condensation prevention - reference Y60.3040
- Protection and repair of steel components
  - Reference Y60.3050A
- Equipment connections - reference Y60.3060
- Cleaning before wiring - reference Y60.3070
- Wiring
  - Reference Y60.3080A
- Builderswork - reference Y60.3090

#### 260.070 WORKMANSHIP FOR CONDUIT:

- Type
- Application
- Draw-in boxes - reference Y60.4010
- Installation of cast in or buried conduit - reference Y60.4020
- Conduit boxes - reference Y60.4030
- Fixing conduit - reference Y60.4040
- Flexible and pliable conduit - reference Y60.4050
  - Screwed steel conduit - reference Y60.4060
- Underground installation - reference Y60.4080

#### 260.080 WORKMANSHIP FOR TRUNKING:

- Type
- Application
- Access - reference Y60.5020
- Fixing trunking
  - Reference Y60.5030A
- Steel trunking
  - Reference Y60.5040A
- Underfloor and flush floor trunking installation - reference Y60.5050

### **261.000 CABLES AND WIRING**

#### 261.010 GENERAL:

- Comply with work section general clauses reference Y61.1010, Y61.1020, Y61.1030 and those detailed

below.

- Supply cables and wiring as Work Section
- Cables as schedule reference Y61-Cables technical details by application
  - Cables design data as schedule reference Y61-Main and Sub-main cables design data
- Supply cables and wiring as schedule reference
  - Location
    - At end of this work section.
    - On drawing number
    -
- Supply cables and wiring as drawing reference
  - Location
    - Separation distance for EMC and lighting surge protection compliance.
    - At end of this work section.
    -
- Fire stopping
  - Demarcation of responsibilities
    - Main contractor
    - Service contractor
    - Fire stopping specialist
    - Fire stopping systems manufacturers
    -
  - Install all fire stopping systems in accordance with the manufacturer's written instructions.
  - Install and inspect fire stopping systems in accordance with Building Regulations and ASFP Code of

Practice TGD 17.

- 
- Identify cables using
  - Structured numbering scheme
- 
- Provide cable management package
  - Software
- 

261.020 STANDARD FLEXIBLE CORDS AND INDUSTRIAL CABLES:

- Type
- Application
- Manufacturer and reference
- Or approved equivalent.
- Standard ordinary flexible cords - multi copper cores - reference Y61.2010D

261.030 STANDARD MEDIUM VOLTAGE POWER CABLES:

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent.
- LSOH sheathing - reference Y61.2005
- Standard 3.3 kV armoured and sheathed cables, with copper conductors - reference Y61.2030A
- Standard 3.3kV armoured and LSF sheathed cables, with copper conductors - reference Y61.2030B
- Standard 11kV armoured and sheathed cables, with copper conductors - reference Y61.2030C
- Standard 11kV armoured and LSF sheathed cables, with copper conductors - reference Y61.2030D
- Reference Y61.2030#

261.040 MINERAL INSULATED WIRING AND POWER CABLES:

- Type
- Application
- Manufacture and reference
- Or approved equivalent.
  - Light duty mineral insulated cables
  - LSF outer covering - reference Y61.2040B
  - Heavy duty mineral insulated cables
- Sheath colour

261.050 STANDARD WIRING AND POWER CABLES:

- Type
- Application
- Manufacturer and reference
- Or approved equivalent.
- Standard power supply cables
  - Thermosetting insulation and copper conductors
    - Sheathed - reference Y61.2020A

- Sheathed and armoured - reference Y61.2020B
- PVC insulation and copper conductors
  - Sheathed - reference Y61.2020C
- LSF sheathed and armoured - reference Y61.2020E
- Standard wires for conduit and trunking
- LSF insulated, with copper conductors - reference Y61.2020G
- Standard flat cables 2-core or 3-core, with copper conductors; with or without CPC
- LSF insulated, sheathed - reference Y61.2020J
- Standard power supply cables, LSF insulation, sheathed - reference Y61.2020K
- Standard cables with definite fire performance - reference Y61.2020M
- Standard cables where penetration by sharp objects is a high risk - reference Y61.2020N

261.060 CONTROL AND AUXILIARY CABLES:

- Type
- Application
- Manufacturer and reference
- Or approved equivalent.
- Paired, screened control cables with or without metallic protection - reference Y61.2050B
- Multi-core unarmoured LSF sheathed auxiliary cables - reference Y61.2050G

261.070 PAPER INSULATED CABLES:

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent.
- LSOH sheathing - reference Y61.2005

261.080 STANDARD COMMUNICATIONS CABLES:

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent.
- LSOH sheathing - reference Y61.2005
- Standard communications cables, for indoor use - reference Y61.2070B

261.090 STANDARD COAXIAL CABLES:

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent.
- For broadcast receiving - reference Y61.2080A

261.100 OPTICAL FIBRE CABLES:

- Type
- Application
- Manufacturer and reference

- Or approved equivalent.
- Standard fibre optic cables for data communications to BS EN 60794-2-11 and BS EN 187103 - reference Y61.2090A
- Fibre optic cables other than those for data communications to BS EN 60794-2-11 and BS EN 187103 -

reference Y61.2090#

- Conductors for optical fibre cables - reference Y61.2120#
- Conductor insulation for optical fibre cables - reference Y61.2130#
- Braiding, screens, taping and moisture barriers for optical fibre cables - reference Y61.2160#
- Inner sheath for optical fibre cables - reference Y61.2140#
- Bedding for optical fibre cables - reference Y61.2140#
- Armour for optical fibre cables - reference Y61.2150#
- Outer sheath for optical fibre cables - reference Y61.2140#

261.110 INFORMATION TECHNOLOGY CABLES:

- Type
- Category of performance
- Manufacturer and reference
  - Or approved equivalent.
- Structured wiring
  - Category 5 - reference Y61.2100A
  - Category 5e - reference Y61.2100A
  - Category 6 - reference Y61.2100B
  - Category 6a - reference Y61.2100B
  - HBES Class 1 twisted pair - reference Y61.2100C
- Multi-pair cables for high bit rate digital access telecommunications networks - reference Y61.2100D
  - Conductors for information technology cables.
  - Reference Y61.2120#
    - Sheaths for information technology cables
    - Armour for information technology cables
    - Outer sheath for information technology cables

261.120 NON-STANDARD CABLES:

- Type
- Application
- Manufacturer and reference
- Or approved equivalent.

261.130 CABLE GLANDS:

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent.
- Unarmoured cables, indoors - reference Y61.3010A
- Unarmoured cables, outdoors - reference Y61.3010B
- Armoured cables, dry indoors - reference Y61.3010C
- Armoured cables, indoors - reference Y61.3010D
- Armoured cables, outdoors - reference Y61.3010E

261.140 CABLE SEALS AND GLANDS - MINERAL INSULATED CABLES:

- Type
- Application

- Manufacturer and reference
- Or approved equivalent.
- Heavy and light duty mineral insulated cables - protected 'e' for hazardous areas - reference Y61.3020B

261.150 VOLTAGE SURGE SUPPRESSORS FOR CABLES:

- Type
- Application
- Manufacturer and reference
- Or approved equivalent.

261.160 CABLE TERMINATING AND JOINTING SOCKETS:

- Manufacturer and reference

261.170 INSULATING TAPE:

- Type
- Application
- Manufacturer and reference
- Or approved equivalent.

261.180 CABLE JOINTS AND TERMINATIONS:

261.200 CONNECTORS FOR COAXIAL CABLES:

- Standard
  - BS 3041-7 - Type C.
  - BS 3041-12 - Type UHF.
  - BS EN 60169-21 - Type SC-A.
  - BS EN 60169-21 - Type SC-B.
  - BS EN 61169-8 - Type BNC.
  - BS QC 221100 - Type SMA.
  - BS QC 221300 - Type SMB.
  - BS QC 221400 - Type SMC.
  - BS QC 222000 - Type TNC.
  - BS EN 61169-2 - 'Belling' or 'Standard 75Ohm TV' connector.
  - BS EN 60169-24 or BS EN 61169-24 - Type F.
- Type
- Application
- Manufacturer and reference
  - Or approved equivalent.
- Connectors to match equipment
- Connectors and associated termination method, sleeving and sealing to be suitable for the prevailing

environmental conditions including dust and moisture ingress.

261.210 OPTICAL FIBRE TERMINATIONS:

- Standard
  - Relevant parts of BS EN 50173
  - BS EN 62148-17
- Format
- Loss performance
- Optical fibre type
- Presentation
- Type
- Function
- Application
- Manufacturer and reference
  - Or approved equivalent.
- Reference Y61.3090#
- As shown on drawing ref

261.220 OPTICAL FIBRE CABLE JOINTS:

- Type
- Application
- Loss performance
- Manufacturer and reference
  - Or approved equivalent.
- Reference Y61.3100#
- As shown on drawing reference

261.230 CABLE DUCTS:

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent.
- Reference Y61.3110A

261.240 CABLE SLEEVES:

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent.
- Reference Y61.3120A

261.250 CABLE COVERS AND MARKERS:

- Type
- Application
- Manufacturer and reference

- Or approved equivalent.
- Reference Y61.3130A

#### 261.260 WORKMANSHIP

- Cable installation - general - reference Y61.4010
- Cable installation in low temperatures - reference Y61.4020
- Installation of LSF cable - reference Y61.4030
- Installation of LSZH and LSOH cable - reference Y61.4030A
- Installation of unarmoured cables - reference Y61.4040
- Cable installation in trenches - reference Y61.4060
- Cable installation in conduit and trunking.
- Reference Y61.4090A
- Cable surface installation.
  - Reference Y61.4110A
- Cable embedded installation.
  - Reference Y61.4120A
- Cable installation - mineral insulated cables
  - Reference Y61.4130A
- Cable installation - flexible cords - reference Y61.4140
- Cable jointing and terminating generally.
- Reference Y61.4150A
- Terminating - mineral insulated cables.
  - Reference Y61.4180A
- Cable joints - mineral insulated cables.
  - Reference Y61.4190A
- Communications coaxial, optical fibre and IT cable installation, jointing and terminating.
  - Reference Y61.4200A

#### 262.000 BUSBAR TRUNKING

##### 262.010 GENERAL:

- Comply with work section general and clause reference Y62.1000 and those detailed below.
- Supply busbar trunking as specified in Section
- Supply busbar trunking as schedule reference
  - Location
    - At the end of this work section.
    -
- Fire stopping
  - Demarcation of responsibilities
    - Main contractor
    - Services contractor
    - Fire stopping specialist
    - Fire stopping systems manufacturers
    -
  - Install all fire stopping systems in accordance with the manufacturer's written instructions.
  - Install and inspect fire stopping systems in accordance with Building Regulations and ASFP Code of

Practice TGD 17.

- 

262.020 BUSBAR SYSTEM:

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent.
- General purpose busbar except wall/dado
  - Reference Y62.2010A
- Current rating
- As indicated on drawings/schedules

262.030 BUSBAR TRUNKING:

- Type
- Application
- General purpose steel busbar trunking, except wall/dado - reference Y62.2020A
  - Trunking with LV sockets
  - Thermoplastic
    - Colour
  - Compartments
    - Busbar
    - Data
  - Information technology, data and telephone communications
- Tap-off units
  - Intervals
  - Current rating, number of poles and phases
  - Fuses - Current rating, class and type
  - Isolating switch with number of poles
- Protective conductors
  - Internal - reference Y62.2040A

262.040 WORKMANSHIP:

- General - reference Y62.3010
- Bonding - reference Y62.3020
- Expansion - reference Y62.3030
- Fire barriers - reference Y62.3050

**263.000 SUPPORT COMPONENTS - CABLES**

263.010 GENERAL:

- Comply with work section general clauses reference Y63.1000 and those detailed below.
- Supply support components as specified in Section
- Fire stopping
  - Demarcation of responsibilities

- Main contractor
- Services contractor
- Fire stopping specialist
- Fire stopping system manufacturers
- 
- Install all fire stopping systems in accordance with the manufacturer's written instructions.
- Install and inspect fire stopping systems in accordance with Building Regulations and ASFP Code of

Practice TGD 17.

- 

**263.020 CABLE SUPPORT AND FINISHES:**

- Type
- Application
- Cable supports and finishes
  - Reference Y63.2010A

**263.030 CABLE SUPPORT SYSTEM:**

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent.
- Perforated tray - reference Y63.2020A
- Cable rack - reference Y63.2020B
- Proprietary cable ties - reference Y63.2025A
- Two way saddles - reference Y63.2025C
- Cable basket - reference Y63.2025D

**263.040 WORKMANSHIP**

- Cable tray installation - reference Y63.3010
- Cable cleats, ties, saddles and clips installation
  - Reference Y63.3020A

**271.000 LV SWITCHGEAR AND DISTRIBUTION BOARDS**

**271.010 GENERAL:**

- Comply with work section general clauses reference Y71.1000 and those detailed below.
- Supply switchboards and distribution boards as schedule reference Y71-Distboards
  - Location
- Supply switchboards and distribution boards as schedule reference
  - Location
    - At end of this work section.
    - On drawing number

**271.020 CO-ORDINATION STUDY:**

- Application
- Co-ordination study - reference Y71.1010#
- Electricity supply - reference Y71.1020#

**271.030 SWITCHBOARDS:**

- Type

- Application
- Manufacturer and reference
  - Or approved equivalent.
- Electrical supply
- LV switchgear and controlgear assembly
  - Cubicle switchboard - reference Y71.2010A
  - Cubicle control panel - reference Y71.2010B
  - Multi-box switchboard - reference Y71.2010C
  - Multi-box control panel - reference Y71.2010D
  - Details of equipment
    - As shown on drawing/schedules
  - Rated current and rated prospective short - circuit withstand current for indicated seconds
- Assembly construction
  - Floor mounted - reference Y71.2020A
  - Wall mounted - reference Y71.2020B
  - Access for cabling - Front, top, bottom or rear
  - As shown on drawings/schedules
- Enclosures finish
  - Reference Y71.2030A
- Type tests
- Site built assemblies - reference Y71.2060
- Site modification - reference Y71.2070

#### 271.040 BATTERY CHARGER AND BATTERY UNIT:

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent.
- Tripping unit
  - Wall mounted, top entry - reference Y71.2080A
  - Wall mounted, bottom entry - reference Y71.2080B
  - Floor standing, top entry - reference Y71.2080C
  - Floor standing, bottom entry - reference Y71.2080D
  - Details of equipment
    - As shown on drawings/schedules
    - Current
- Battery over-discharge protection, MCB's for outgoing circuits

#### 271.050 CIRCUIT BREAKERS, TRANSFER SWITCHES AND CONTROL AND PROTECTIVE SWITCHES:

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent.
- Air circuit breaker
  - Utilisation A, withdrawable (without intentional time delay and a short time withstand current rating) - reference Y71.2090A
  - Utilisation A, demountable MCCB (without intentional time delay and a short time withstand current

rating) - reference Y71.2090B

- Utilisation B, withdrawable (with intentional time delay and a short time withstand current rating) - reference Y71.2090C
- Utilisation B, demountable MCCB (with intentional time delay and a short time withstand current rating)

- reference Y71.2090D
- Characteristics of circuit breakers, transfer switches and control and protective switches:
  - As shown on drawings/schedules
  - Number of poles
  - Circuit breaker and CBR operating condition, method of operation and control
  - Rated operational, current (Amps)
  - Short-circuit characteristics, rated service short-circuit breaking current (Amps)
  - Control circuits
  - Auxiliary circuits
  - Relays and releases, type and characteristics
- Co-ordination with short-circuit protective devices

#### 271.060 SWITCHES, DISCONNECTORS AND FUSE COMBINATION UNITS:

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent.
- Switch-disconnector - reference Y71.2100A
- Fuse combination unit - reference Y71.2100B
- Details of equipment
  - As shown on drawings/schedules
  - Number of poles
  - Rated operational current (Amps)
  - Normal load and overload characteristics
    - Motor switching overload current withstand (Amps)
    - Rated making capacity (Amps)
    - Rated breaking capacity (Amps)
  - Short-circuit characteristics
    - Rated short-time withstand current (Amps)
  - Auxiliary circuits
- Co-ordination with short-circuit protective devices

#### 271.070 PROTECTION DEVICES INTERPOSING RELAYS AND INTER-TRIPPING RELAYS:

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent.
- Automatic reset - reference Y71.2110A
- Manual reset - reference Y71.2110B
- Details of equipment
  - As shown on drawings/schedules
  - Contacts
- Protection relays features

#### 271.080 VOLTAGE SENSING RELAYS:

- Reference Y71.2120
- Application

271.090 TRIP/CLOSE SWITCHES AND CONTROL SELECTOR SWITCHES:

- Reference Y71.2130
- Application

271.100 CURRENT TRANSFORMERS:

- Reference Y71.2140
- Application

271.110 INSTRUMENTS AND METERS (REFURBISHMENT):

- Type
- Application
- Reference Y71.2150A
- Details as shown on drawings/schedules
- BREEAM 2008 requirements
  - Comply with BREEAM 2008 Issue ID Ene 02 and 03.
- BREEAM New Construction 2014 requirements
  - Comply with Issue ID Man 04 Commissioning and Handover
  - Comply with Issue ID Man 05 Aftercare
  - Comply with Issue ID Ene 02 Energy Monitoring
  - Comply with Issue ID Wat 02 Water Monitoring
  - Comply with Issue ID Wat 03 Water Leak Detection
  - Comply with Issue ID Pol 01 Impact of Refrigerants

271.112 INSTRUMENTS AND METERS (NEW BUILD):

- Type
- Application
- Reference Y71.2150A
- Details as shown on drawings/schedules
- BREEAM 2011 requirements
  - Comply with BREEAM 2011 Issue ID Ene 02 .
- BREEAM New Construction 2014 requirements
  - Comply with Issue ID Man 04 Commissioning and Handover
  - Comply with Issue ID Man 05 Aftercare
  - Comply with Issue ID Ene 02 Energy Monitoring
  - Comply with Issue ID Wat 02 Water Monitoring
  - Comply with Issue ID Wat 03 Water Leak Detection
  - Comply with Issue ID Pol 01 Impact of Refrigerants

271.120 ELECTRICAL RECORDING INSTRUMENTS:

- Type
- Application
- Reference Y71.2160A
- Details
  - As shown on drawings/schedules

- Parameter recorded
- Channels
- Chart
  - Scale
  - Speed
- Type

271.130 INDICATOR LIGHTS:

- Type
- Application
- Reference Y71.2170A
- Details
  - As shown on drawings/schedules
  - Lamp wattage
  - Provide neon indicators
- Mounting

271.140 LOW VOLTAGE COILS RATING:

- Reference Y71.2180

271.150 FRAMEWORK:

- Type
- Application
- Reference Y71.2190A

271.160 FUSES:

- Application
- Reference Y71.2200A
- Use motor circuit fuses
- As shown on drawings/schedules

271.170 DISTRIBUTION BOARDS:

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent.
- Reference Y71.2210A
- Provide spare ways
- As shown on drawings/schedules

271.180 CONSUMER UNITS:

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent.

- Reference Y71.2220A
- As shown on drawings/schedules

271.190 MINIATURE CIRCUIT BREAKERS:

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent.
- Reference Y71.2230A
- As shown on drawings/schedules

271.200 RESIDUAL CURRENT DEVICE:

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent.
- RCCD's
  - Reference Y71.2240A
  - As shown on drawings/schedules
- RCBO's - reference Y71.2245

271.210 CABLE TERMINATIONS:

- Reference Y71.2250

271.220 STATIC CAPACITOR:

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent.
- Free standing, wall mounted - reference Y71.2260A
- Free standing, floor mounted - reference Y71.2260B
- Wall mounted within switchboard - reference Y71.2260C
- Floor mounted within switchboard - reference Y71.2260D
- Capacitor rating - Output (VAR)
- As shown on drawings/schedules

271.230 AUTOMATICALLY CONTROLLED CAPACITOR BANKS:

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent.
- Free standing wall mounted - reference Y71.2270A
- Free standing floor mounted - reference Y71.2270B
- Wall mounted within switchboard - reference Y71.2270C
- Floor mounted within switchboard - reference Y71.2270D
- Single cubicle within switchboard - reference Y71.2270E

- Capacitor rating - Output (VAR)
  - As shown on drawings/schedules
- Relay stages
- As shown on drawings/schedules

**271.240 HARMONIC FILTER:**

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent.
- Reference Y71.2280A
- Rating
- As shown on drawings/schedules

**271.250 MEDIUM VOLTAGE IRON CORE FILTER REACTOR:**

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent.
- Reference Y71.2290A

**271.260 SWITCHGEAR AND CONTROLGEAR ACCESSORIES:**

- Type
- Application
- As shown on drawings/schedules

**271.270 WORKMANSHIP**

- Fixing - reference Y71.3010
- Mounting height - reference Y71.3020
- Access - reference Y71.3030
- Marking and drawing
  - Reference Y71.3040A
- Cable terminations - reference Y71.3050
- Installation and commissioning
  - Reference Y71.3060A

**272.000 CONTACTORS AND STARTERS**

**272.010 GENERAL:**

- Comply with work section general clauses reference Y72.1000 and those detailed below.
- Supply contactors and starters as specified in work section
- Supply contactors and starters as schedule reference
- Location
  - At end of this work section.
  - On drawing number

#### 272.020 CONTROL PANEL:

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent.
- Electrical supply
  - 3-phase - reference Y72.1010A
  - Single-phase - reference Y72.1010B
  - Surge suppressors
  - Installer fitted - reference Y72.1020B
- Transient suppressors
  - Manufacturer fitted - reference Y72.1030A
- Controlgear assembly
  - Reference Y72.2010A
  - Electrical characteristics
    - As shown on drawings/schedules
    - Rated current
    - Rated prospective short-circuit withstand current
    - Prospective short-circuit current arising from rotating machine
    - Co-ordinate short-circuit protection devices
  - Provide facilities to allow future extension of switchboard
- Assembly construction
  - Reference Y72.2020A
  - Access for cabling
    - As shown on drawings/schedules
- Enclosure finish
  - Manufacturer's standard - reference Y72.2030A
- Site modification - reference Y72.2040

#### 272.030 LV CONTACTORS AND MOTOR STARTERS:

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent.
- Electrical supply
  - 3-phase - reference Y72.1010A
  - Single-phase - reference Y72.1010B
- LV contactors
  - Continuous - reference Y72.2050C
- Details of equipment
  - As shown on drawings/schedules
  - Number of poles
  - Rated operational current (Amps)
  - Utilisation category
  - Relays and releases, type
- Short circuit protection devices

272.040 CONTROL CIRCUIT DEVICES:

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent.
- Electrical supply
  - 3-phase - reference Y72.1010A
  - Single-phase - reference Y72.1010B
- Reference Y72.2060A
- Details
  - As shown on drawings/ schedules
  - Number of poles
  - Rated operational current (Amps)
  - Utilisation category
- Electrically separate contact elements

272.050 ISOLATING SWITCHES:

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent.
- Electrical supply
  - 3-phase - reference Y72.1010A
  - Single-phase - reference Y72.1010B
- Reference Y72.2070A
- Isolation as shown on drawings/schedules

272.060 CONTROL SELECTOR SWITCHES:

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent.
- Electrical supply
  - 3-phase - reference Y72.1010A
  - Single-phase - reference Y72.1010B
- Reference Y72.2080A

272.070 IN-BUILT PUSH BUTTONS:

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent.
- Electrical supply
  - 3-phase - reference Y72.1010A
  - Single-phase - reference Y72.1010B
- Reference Y72.2090A

272.080 INDICATOR LIGHTS:

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent.
- Electrical supply
  - 3-phase - reference Y72.1010A
  - Single-phase - reference Y72.1010B
- Reference Y72.2100A

272.090 CONTACTOR CONTROL RELAYS:

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent.
- Electrical supply
  - 3-phase - reference Y72.1010A
  - Single-phase - reference Y72.1010B
- Reference Y72.2110A

272.100 CONTROL AND INDICATOR LIGHT CIRCUIT FUSES:

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent.
- Electrical supply
  - 3-phase - reference Y72.1010A
  - Single-phase - reference Y72.1010B
- Reference Y72.2120A

272.110 MOTOR STARTERS AND VARIABLE SPEED DRIVES (VSD'S):

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent.
- Electrical supply
  - 3-phase - reference Y72.1010A
  - Single-phase - reference Y72.1010B
  - 3-phase and neutral - reference Y72.1010C
- General
  - Motors below 0.37kW - reference Y72.2130A
  - Motors above 0.37kW - reference Y72.2130B
- Direct-on-line type - reference Y72.2150
  - Star delta type - reference Y72.2160
- VSD
  - VSD tailor made for HVAC application.
  - Located in control panel or exposed wall frame mounted - reference Y72.2190A
  - Located in Motor Control Centre (MCC) - reference Y72.2190B

- Select drives to meet design duty at Hz.
- Demarcation of responsibilities and location
  - Integrated with motor / prime mover.
  - Integrated with motor, supplied and selected by fan, pump or AHU manufacturer to suit design duty and for installation by controls specialist
  - Supplied and selected by fan, pump or AHU manufacturer to suit design duty and provided as part of a local plant control panel for integration with the BMS
  - Supplied and selected by the controls specialist to suit fan or pump duty and provided as part of a local plant control panel for integration with the BMS
  - Supplied and selected by the controls specialist to suit fan or pump duty and built into a Motor

Control Centre (MCC) for integration with the BMS

- Located remotely from fan motor.
- Degree of protection from drive enclosure in accordance with BS EN 60529
  - IP 21.
  - IP 54.
- IP

272.120 AUTOMATIC CHANGEOVER FOR RUN/STANDBY DUTY:

- Application
- Single power supply - reference Y72.2200
  - Provide system malfunction audible alarm
- Dual power supply - reference Y72.2210
  - Provide system malfunction audible alarm

272.130 CONTROL CIRCUIT TRANSFORMERS:

- Reference Y72.2220
- Application

272.140 SWITCHING AND INDICATION:

- Type
- Application
- Reference Y72.2230A
- As shown on drawings/schedules

272.150 AUDIBLE ALARMS:

- Reference Y72.2240
- Application

272.160 PROGRAMMABLE LOGIC CONTROLLERS:

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent.
- Electrical supply
  - 3-phase - reference Y72.1010A
  - Single-phase - reference Y72.1010B
- Reference Y72.2250A

272.180 STARTER AND CONTROL PANEL INTERNAL WIRING:

- Type
- Application
- Reference Y72.2260A

272.190 COMPONENT MOUNTING:

- Type
- Application
- Reference Y72.2270A

272.200 CONTROL SYSTEM FUNCTION CHARTS:

- Type
- Application
- Reference Y72.2280A

272.210 WORKMANSHIP:

Reference Y72.3010

**274.000 ACCESSORIES FOR ELECTRICAL SERVICES**

274.010 GENERAL:

- Comply with work section general clauses reference Y74.1000 and those detailed below.
- Supply accessories for electrical services as section
- Supply accessories for electrical services in accordance with schedule reference

274.020 SAMPLES:

- Provide samples of the following items

274.030 ACCESSORIES COMMON REQUIREMENTS:

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent.
- White plastic plates, flush installation - reference Y74.2010A
- Matt finish metal plates, flush installation - reference Y74.2010B
- Metal clad plates, surface steel conduit installation - reference Y74.2010D
- Surface, steel conduit, weatherproof installation - reference Y74.2010E
- Surface, plastic, weatherproof installation - reference Y74.2010F
- Accessories details
  - As shown on drawings/schedules
  - Coverplate architrave
  - Fuses
  - Switch rocker bar colour
- Plastic coverplate colour

274.040 INTERIOR LIGHTING SWITCHES:

- Type
- Application
- Manufacturer and reference

- Or approved equivalent.
- General purpose moulded plastic - reference Y74.2020A
- Grid moulded plastic - reference Y74.2020B
- Pull cord - reference Y74.2020C
- General purpose secret key - reference Y74.2020D
- Grid secret key - reference Y74.2020F
- Switch details
  - As indicated on drawings/schedules
  - Gangs
- Pole characteristics

#### 274.050 EXTERIOR LIGHTING SWITCHES:

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent.
- Metal clad rotary - reference Y74.2030A
- Sealed rocker bar - reference Y74.2030B
- Switch details
  - As indicated on drawings/schedules
  - Gangs
- Pole characteristics

#### 274.060 TIME SWITCHES:

- Type
- Application
- Manufacturer and reference
- Or approved equivalent.
- 7 day - reference Y74.2040B

#### 274.070 LUMINAIRE CONNECTORS:

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent.
- General and emergency lighting - reference Y74.2050A
- General lighting - reference Y74.2050B
- Cord grip general and emergency lighting.
  - Reference Y74.2050C
- Luminaire supporting coupler as shown on drawings/schedules

#### 274.080 LAMPHOLDERS:

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent.
- BC type - reference Y74.2060A

- ES type - reference Y74.2060B
- Details
  - As indicated on drawings/schedules
  - Fixings
- Ancillaries

#### 274.090 ISOLATING SWITCHES:

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent.
- Reference Y74.2070A
- Reference Y74.2070B
- Details
  - As indicated on drawings/schedules
  - Utilisation category
  - Making capacity
  - Rating
- Pole configuration

#### 274.100 FUSE CONNECTION UNITS:

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent.
- Switched - reference Y74.2080A
- Unswitched - reference Y74.2080B
- Details
  - As indicated on drawings/schedules
- Ancillaries

#### 274.110 SOCKET-OUTLETS:

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent.
- Single, switched - reference Y74.2090A
- Single with integral RCD, switched.  
Reference Y74.2090B
- Double, switched - reference Y74.2090C
- Single, unswitched - reference Y74.2090D
- Details
  - As indicated on drawings/schedules
  - Mains trip failure sensitivity
- Fused

#### 274.120 COOKER CONTROL UNIT

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent.
- With integral socket - reference Y74.2100A
- Without socket - reference Y74.2100B

274.130 CORD OUTLETS:

- Type
- Application
- Manufacturer and reference
- Or approved equivalent.

274.140 CABLE AND APPLIANCE COUPLERS:

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent.
- 16A, 230V Single-phase, general purpose - reference Y74.2120A
- Details
  - As indicated on drawings/schedules
- Ancillaries

274.150 TELEPHONE AND DATA OUTLET SOCKETS:

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent.
- General purpose - reference Y74.2130A
- Details
  - As indicated on drawings/schedules
- Circuit configurations

274.160 TELEPHONE CORD OUTLETS:

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent.
- General purpose - reference Y74.2140A
- Details
  - As indicated on drawings/schedules
- Circuit configurations

274.210 SHAVER POINTS:

- Type
- Application

- Manufacturer and reference
  - Or approved equivalent.
- Bath and washroom use - reference Y74.2190A

274.220 INDICATOR LAMPS:

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent.
- General purpose neon - reference Y74.2200A

274.240 WORKMANSHIP:

- Earthing - reference Y74.3010
- Protection - reference Y74.3020
- Fixing - reference Y74.3030
- Measuring mounting heights - reference Y74.3040
- Accessories mounting heights
  - As indicated on Architects drawings.
  - As indicated on the drawings/schedules.
  - Standard - reference Y74.3050
- For the disabled - reference Y74.3070

**280.000 EARTHING AND BONDING COMPONENTS**

280.010 GENERAL:

- Comply with work section general clauses reference Y80.1000 and those detailed below.
- Supply earthing and bonding components as specified in section
- Where there is copper cabling requirement for voice and/or data, the contractor shall give consideration to the provision of a MESH-BN (Bonded Network) or equipotential bonding of the components within the communication rooms and distributors and state what has been included with the tender. Requirements

and further guidance are set out in

- BS EN 50310
- BS EN 50174
- Supply MESH-BN (Bonded Network)

#### 280.020 CONDUCTORS:

- Type
- Application
- Manufacturer
- Conductors for lightning protection system
  - Horizontal air terminations - reference Y80.2010A
    - Covering colour
  - Self supporting air terminations - reference Y80.2010B
- Conductors for earthing systems
  - Reference Y80.2010C
- Conductor joints
  - Lightning protection - reference Y80.2020A
  - Earthing systems - reference Y80.2020B
- Tape fixing devices
  - Reference Y80.2030A

#### 280.030 EARTH ELECTRODES:

- Type
- Application
- Manufacturer
- Drawing/schedule
  - Earth electrodes for lightning protection systems
- Earth electrodes for system earthing.
  - Rod - reference Y80.2040B
- Building or structural element - reference Y80.2040D
- Earth electrode clamps
  - Reference Y80.2060A
- Earth electrode inspection facilities
  - Reference Y80.2070A
  - Earth electrode tank penetration seal

#### 280.040 EQUIPOTENTIAL BONDING:

- Where there is a copper cabling requirement for voice and/or data, the contractor shall give consideration to the provision of a MESH-BN (Bonded Network) or equipotential bonding of the components within the communication rooms and distributors and state what has been included with the

tender. Requirements and further guidance are set out in BS EN 50174 and BS EN 50310

- Type
- Application
- Main equipotential bonds
  - Reference Y80.2090A
- Supplementary equipotential bonds
  - Reference Y80.2100A

#### 280.050 EARTHING:

- Type
- Application
- Circuit protective conductors
  - Reference Y80.2110A
- Earthing clamps - reference Y80.2120
- Earth busbars
  - Reference Y80.2130A
- Test links - reference Y80.2140
- Lugs/tags - reference Y80.2150
- Protective cable terminations - reference Y80.2160
- Protective conductor warning notices/labels
  - Reference Y80.2170
- Main earth conductor - reference Y80.2180
- Earth bar label - reference Y80.2190

#### 280.060 WORKMANSHIP:

- Low noise earth distribution - reference Y80.3010
- Dissimilar metals - reference Y80.3020
- Tape joints
  - Application
  - Copper - reference Y80.3030A
  - Aluminium - reference Y80.3030B
- Stranded conductor joints - reference Y80.3040
- Protective cable terminations
  - Reference Y80.3050A
- Earth electrodes
  - Application
  - Reference Y80.3060A

### **281.000 TESTING AND COMMISSIONING OF ELECTRICAL SERVICES:**

#### 281.010 GENERAL:

- Comply with work section general clauses reference Y81.1000 and those detailed below.
- Carry out testing and commissioning of electrical services as section

#### 281.020 TESTING AND COMMISSIONING:

- Incorporated equipment characteristics

- Reference Y81.2010A
- Prospective short circuit current ( $I_p$ )
  - Reference Y81.2020A
- Initial verification
  - Reference Y81.2030A
- Test equipment and consumables
  - Reference Y81.2040A
- Testing
  - Reference Y81.2050A
  - Continuity of protective conductors
- Earth fault loop impedance (ZS)
  - Reference Y81.2070A
- Settings and adjustments - reference Y81.2080
- Standby generators
  - Reference Y81.2090A
- HV and LV switchgear
  - Reference Y81.2100A
- HV power transformers
  - Reference Y81.2110A
- Specialist installations
  - Fire detection and alarm systems.
    - Reference Y81.2120A
  - Lightning and surge protection - reference Y81.2120B
  - Emergency lighting installations
    - Reference Y81.2120E
- Calibration - reference Y81.2130
- Certification and reporting
  - Reference Y81.2140A
- Completion certificates
  - Reference Y81.2150A
- Records - reference Y81.2160

#### 281.030 WORKMANSHIP:

- Conductive parts - reference Y81.3010
- High voltage tests
  - Reference Y81.3030A
  - Reference Y81.3030#
- Cables
  - LV buried cables - reference Y81.3040A

### **282.000 IDENTIFICATION - ELECTRICAL**

#### 282.010 GENERAL:

- Comply with work section general clauses reference Y82.1000 and those detailed below.
- Supply identification - electrical as specified in section

#### 282.020 LABELS AND NOTICES:

- Reference Y82.2010A
- Fit labels and notices as shown on
  - Contract drawings.
  - Schedules
  - Drawings

#### 282.030 LABELS AND NOTICES MATERIALS:

- Type
- Application
- Material
  - Reference Y82.2020A
- Fixing
  - Reference Y82.2030A
- Arrangement
  - Reference Y82.2040A
- Lettering and size of labels and notices
  - Reference Y82.2050A

#### 282.040 CONDUCTOR ARRANGEMENT:

- Reference Y82.2060A

#### 282.045 GRAPHICAL SYMBOLS FOR USE ON EQUIPMENT IN ACCORDANCE WITH BS EN 80416:

#### 282.050 EQUIPMENT SIGNS AND LABELS:

- Safety signs
  - Reference Y82.2070A
- Plant and equipment labels
  - Reference Y82.2080A
- Maintenance notices - reference Y82.2090
  - Equipment
- Colour corrected light fittings - reference Y82.2100
- Motors and starters labels
  - Reference Y82.2110A
- Engraved accessory plates
  - Reference Y82.2120A
- Switchgear
  - Reference Y82.2130A
- Distribution boards - reference Y82.2140

#### 282.055 GRAPHICAL SYMBOLS FOR USE ON EQUIPMENT IN ACCORDANCE WITH BS EN 80416:

#### 282.060 SCHEMATIC DIAGRAMS:

- Type
- Application
- Reference Y82.2150A

282.070 SPECIAL PURPOSE EARTHING:

- Type
- Application
- Reference Y82.2160A

282.080 INDICATOR LAMPS AND PUSH BUTTONS FOR POWER SYSTEMS:

- Type
- Application
- Reference Y82.2170A

282.090 CONDUIT AND TRUNKING COLOUR CODING:

- Type
- Application
- Reference Y82.2180A

282.100 CABLE IDENTIFICATION:

- Cable identification
  - Reference Y82.2190A
- Terminal marking and conductor identification
  - Reference Y82.2200A
- Underground cable identification
  - Reference Y82.2210A
- Cable conductor colour coding
  - Reference Y82.2220A
- Cable jointing and termination - reference Y82.2230
  - Cable sheath identification - internal
- Cable sheath identification - external

282.110 ADDITIONAL SAFETY SIGNS:

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent.
- Reference Y82.2260A

**290.000 FIXING TO BUILDING FABRIC**

290.010 GENERAL:

- Comply with work section general clauses reference Y90.1000 and those detailed below.
- Carry out fixing to building fabric as specified in work section

290.020 FIXINGS:

- Type
- Application
- Standards - reference Y90.2010
- Plugs - reference Y90.2020
- Screws - reference Y90.2030
- Non-penetrative support systems - reference Y90.2080
  - Manufacturer and reference
  - Or approved equivalent.

290.030 WORKMANSHIP:

- Type
- Application
- Drilling - reference Y90.3010
- Fixing to timber rails - reference Y90.3050
- Fixing to hollow stud/tile/block wall
  - Reference Y90.3060A
- Fixing to concrete, brickwork or blockwork
  - Reference Y90.3070A
- Fixing to metalwork
  - Reference Y90.3080A
- Fixing to structural steelwork and concrete structures
  - Reference Y90.3090A
- Non-penetrative support systems for roof mounted equipment - reference Y90.3100#

---

## **PART 3 SPECIFICATION CLAUSES SPECIFIC TO V20.**

### **300.000 PRODUCTS/MATERIALS**

#### **300.010 METERING (REFURBISHMENT):**

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent
- Check metering of energy use.
- Make provision for check metering of electricity for potential individual tenancy areas. Provide submetering of consumption of total electricity use for lettable area
- Make provision for check metering to comply with Building Regulations AD L2A - L2B as appropriate.
- Make provision for check metering to comply with Scottish Technical Handbook, Section 6.10 as appropriate.
- BREEAM Refurbishment 2008 requirements
  - Comply with Issue ID Ene 02 and Ene 03.
- BREEAM Refurbishment and Fit out 2014 requirement
  - Comply with Issue ID Ene 02 Energy Monitoring

---

## **BS APPENDIX**

### **BS 3041-12:1981**

Radio-frequency connectors. Part 12 Specification for r.f. coaxial connectors with screw coupling, unmatched (type UHF)

### **BS 3041-7:1996**

Radio-frequency connectors. Part 7 R.F. coaxial connectors with inner diameter of output conductor 9,5 mm (0,374 in) with bayonet lock. Characteristic impedance 50 Ohms (Type C)

### **BS 381C:1996**

Specification for colours for identification, coding and special purposes

### **BS EN 187103:2003**

Harmonized system of quality assessment for electronic components. Family specification. Optical fibre cables for indoor applications

### **BS EN 50310:2010**

Application of equipotential bonding and earthing in buildings with information technology equipment

### **BS EN 60169-21:1997**

Radio-frequency connectors. Part 21 Two types of radio-frequency connectors with inner diameter of outer conductor 9,5 mm (0,374 in) with different versions of screw coupling. Characteristic impedance 50 Ohms (types SC-A and SC-B)

### **BS EN 60169-24:1994**

Radio-frequency connectors. Part 24 Radio-frequency coaxial connectors with screw coupling, typically for use in 75 ohm cable distribution systems (Type F)

### **BS EN 60529:1992+A2:2013**

Degrees of protection provided by enclosures (IP code)

### **BS EN 60794-2-11:2012**

Optical fibre cables. Part 2-11 Indoor optical cables. Detailed specification for simplex and duplex cables for use in premises cabling

### **BS EN 61169-2:2007**

Radio-frequency connectors. Sectional specification. Radio frequency coaxial connectors of type 9,52

### **BS EN 61169-24:2009**

Radio-frequency connectors. Sectional specification. Radio frequency coaxial connectors with screw

coupling, typically for use in 75 ohm cable networks (type F)

**BS EN 61169-8:2007**

Radio-frequency connectors. Sectional specification. RF coaxial connectors with inner diameter of outer conductor 6,5 mm (0,256 in) with bayonet lock. Characteristic impedance 50 ohms (type BNC)

**BS EN 62148-17:2014**

Fibre optic active components and devices. Package and interface standards. Transmitter and receiver components with dual coaxial RF connectors

**BS QC 221100:1997**

Radio-frequency connectors. RF coaxial connectors with inner diameter of outer conductor 4,13 mm (0,163 in) with screw coupling. Characteristic impedance 50 Ohms (Type SMA)

**BS QC 221300:1997**

Radio-frequency connectors. RF coaxial connectors with inner diameter of outer conductor 6,5 mm (0,256 in) with screw coupling. Characteristic impedance 50 Ohms. (Type TNC)

**BS QC 221400:1997**

Radio-frequency connectors. RF coaxial connectors with inner diameter of outer conductor 3 mm (0,12 in) with screw coupling. Characteristic impedance 50 Ohms (Type SMC)

**BS QC 222000:1996**

Radio-frequency connectors. RF coaxial connectors with inner diameter of outer conductor 6,5 mm (0,256 in) with screw coupling. Characteristic impedance 50 Ohms. (Type TNC)

---

## V40 EMERGENCY LIGHTING

### PART 1 SYSTEM OBJECTIVES

#### 100.010 PERFORMANCE OBJECTIVES:

To verify and provide an emergency lighting scheme throughout the refurbishment area that will provide a sufficient level of light in all areas in order for occupants to safely evacuate the building in the event of a power failure. This objective will be supported by regular tests conducted with the addition of new test switches. In addition to this the implementation of new fluorescent emergency light fittings installed within specified electrical risers.

The emergency luminaires shall be provided as part of the main lighting scheme, in accordance with BS5266 Emergency Lighting: Code of Practice for the Emergency Lighting of Premises, with Enhancements as required by IMO policy documents Fire Lighting, Lighting: Escape Routes and the Fire Strategy Report requirements.

They shall incorporate maintained or non-maintained type rechargeable inverter/battery packs integral to the luminaires. The battery/inverter power packs shall provide a no-break supply to the luminaire in the event of power failure and be able to maintain the full emergency load of the luminaire for a minimum period of 3 hours. The emergency power pack shall be provided by the manufacturer of the luminaire. Each emergency luminaire shall incorporate a green LED indicator to confirm charging status of the battery pack.

Self-illuminated, maintained exit signs shall be provided at exits from principal rooms, along designated escape routes and at final exits from the building.

Generally, emergency lighting test key switches for open plan areas and common parts shall be located adjacent to the sub-distribution board from where the circuits originate. Test key switches for emergency lighting in individual rooms shall be located within the room or adjacent area, and shall be suitable for the particular environment. All key switches shall be labelled accordingly.

Emergency luminaires shall be provided, integrated into the main lighting scheme and including self-illuminated escape signage, as shown on drawings.

The contractor shall provide the necessary emergency lighting test certificates upon completion of the works.

## Key Test Switches

- + The installation of emergency lighting test switches within all the electrical risers of core A (1st to the 6th floor)
- + The installation of emergency lighting test switches within all the electrical risers of core C (1st to the 8th floor)
- + The installation of emergency lighting test switches throughout the basement floor.
- + A Test Switch has to be provided for each group of emergency fittings.
- + These are located adjacent in the relevant sub distribution board to simulate a mains/local circuit failure.
- + Each test switch comprises a key operated grid mounting type incorporated within the same switchboxes as the general lighting switches.

### Areas which require test switches

#### Core A

- + 6<sup>th</sup> Floor - 14no Switches (15 with the inclusion of new light fitting within riser cupboard)
- + 5<sup>th</sup> Floor - 13no Switches (14 with the inclusion of new light fitting within riser cupboard)
- + 4<sup>th</sup> Floor - 13no Switches (14 with the inclusion of new light fitting within riser cupboard)
- + 3<sup>rd</sup> Floor - 13no Switches (14 with the inclusion of new light fitting within riser cupboard)
- + 2<sup>nd</sup> Floor - 7no switches (8 with the inclusion of new light fitting within riser cupboard)
- + 1<sup>st</sup> Floor – 13no Switches (14 with the inclusion of new light fitting within riser cupboard) (5no circuits need to be verified with a live test)

#### Core C

- + 8<sup>th</sup> Floor - 7no Switches (8 with the inclusion of new light fitting within riser cupboard)
- + 7<sup>th</sup> Floor - 7no Switches (8 with the inclusion of new light fitting within riser cupboard)
- + 6<sup>th</sup> Floor - 7no Switches (8 with the inclusion of new light fitting within riser cupboard)
- + 5<sup>th</sup> Floor - 7no Switches (8 with the inclusion of new light fitting within riser cupboard)
- + 4<sup>th</sup> Floor - 11no Switches (12 with the inclusion of new light fitting within riser cupboard)
- + 3<sup>rd</sup> Floor - 9no Switches (15 with the inclusion of new light fitting within riser cupboard)
- + 2<sup>nd</sup> Floor - 13no Switches (14 with the inclusion of new light fitting within riser cupboard)
- + 1<sup>st</sup> Floor – 13no Switches (14 with the inclusion of new light fitting within riser cupboard)

#### Basement

Throughout all areas, no light switches presently, there is an estimated 24 lighting circuits fed from distribution boards BBL1+2 (Core B LV Switch room) & BCL1+2 (Core C LV Switch room).

Please refer to Basement Electrical Services Lighting Layout Drawing 199/E/63/B/01 on Intelli-scan.

#### Emergency Light Fittings

- + The installation of fluorescent light fittings within all the electrical risers of core A (1st to 6th floor)
- + The installation of fluorescent light fittings within all the electrical risers of core C (1st to 8th floor)
- + Ensure the right selection of luminaire for the lighting design levels for all emergency lighting systems in accordance with the recommendations of all relevant Regulations, Standards, Codes of Practice to suit the particular project location requirements.

## 100.020 DESIGN PARAMETERS:

The emergency lighting system will have to provide at least 3 hours of uninterrupted lighting throughout the building. All luminaires shall be fitted with green LED indicators in order to confirm the charging status of the battery packs. Refer also to section V21 - General Lighting.

### **Wiring Installation**

Provide wiring installations to the external lighting for each particular project, in accordance with 'Cabling Systems' of the Specification, and in accordance with the project design requirements.

Ensure that generally, below ground cables originate from external lighting distribution boards and are run via underground pipe ducts to draw pit locations close to the luminaires positions.

Ensure all cables not enclosed in pipe ducts are protected by cable tiles with marker tape and route markers, as detailed in 'Cabling Systems' of the Specification.

Ensure wiring to column mounted luminaires is buried PVC/SWA/PVC cables as detailed in 'Cabling Systems'.

Ensure the cable is looped to terminal/fuse units mounted in the bases of the columns. Provide suitable brackets for fixing the cable glands in the column bases. Ensure connections from the terminal/fuse units to the luminaire are PVC/PVC cable with earth protective conductor.

Provide 3 core, copper, PVC/SWA/polythene sheathed cable where high water table levels occur. Use the third core as the protective conductor.

### **Emergency Luminaire Installation and Testing**

Provide final connections to emergency luminaires in accordance with the following: -

Self-contained luminaires to be via concealed plug-in ceiling rose or in the case of wall-mounted units, fuse connection units. Provide final connections with multicore butyl flexible cable of the appropriate size indicated in the General Lighting Section of the Specification.

Integral control gear to be via 4-pin ceiling rose outlet of different pattern to conventional 3-pin ceiling roses, mounted adjacent to 'mains' connection arrangement controlling 'mains' supplies to luminaires. Provide final connections with multicore butyl flexible cable of the appropriate size indicated in 'General lighting' Section of the Specification. Provide appropriate warning labels, fitted externally to luminaires stating emergency source connection. Provide pin configuration for 4-pin ceiling roses as follows: -

- + Pin 1 - switched live
- + Pin 2 – neutral
- + Pin 3 - earth (separate CPC)
- + Pin 4 - unswitched live

## Testing

Following a 100% contractor / consultant witness test, offer the total emergency lighting installation(s), for testing at their discretion, in the presence of IMO and their appointed Fire Officer, together with 100% sign off documentation, confirming the whole installation is in accordance with the equipment manufacturers' recommendations and the requirements of the relevant Standards.

Provide, upon satisfactory completion of the above tests, the equipment manufacturers and installation completion/test certificates for the system, as outlined in the relevant Standards.

Provide for completing all required commissioning and system demonstration tests to the Specification of International Maritime Organisation operations department. Allow a minimum of 10 days' notice of the proposed test dates to enable the International Maritime Organisation operations department / Fire Officer to witness tests.

Provide a full system load test to verify operation of all emergency luminaires for the required battery support period of 3 hours, followed by full recharging within 24 hours.

Provide for all tests to be fully recorded and issued with the 'As Fitted' drawings and operating and maintenance manuals, as detailed in 'Testing' section of the Specification.

Ensure all positions, numbers and types of installed emergency luminaires are detailed on the 'As Fitted' drawings and in the operating and maintenance manuals.

Provide for central battery emergency lighting systems the following additional testing requirements: -

Prior to connecting the sine wave inverter to the distribution system perform full load test using a resistive load bank suitable to prove the ampere hour capacity of the batteries.

Record the outgoing volts and amps at 5 minute intervals up to 3 hours. Take the first readings before the main isolator is closed and then immediately after at periods of one minute up to 5 minutes.

Reset the system at the end of the test and prove recovery time of batteries.

Test whole system, with luminaires installed, by interruption of the mains supply to the luminaires. Include testing each key switch operation and also a full load test at the main isolator for the full 3-hour duration.

Record outgoing voltage and current readings at 5 minute intervals. Take first reading before the load is connected, the second immediately after the load is connected, and then at 1 minute intervals for the first 5 minutes.

Carry out the functional tests to fully satisfy functional operation of system before demonstration of the complete system to the satisfaction of the International Maritime Organisation operations department. Provide full method statements for the demonstration.

Issue fully tabulated test results prior to the demonstration for comment by the International Maritime Organisation prior to inclusion in the Operation and Maintenance Manual.

In addition to the requirements of Preliminary clauses ('A' sections) and other requirements within this Work Section, all work to be carried out in accordance with the latest edition of BS 7671 Requirements for Electrical Installations (IEE Wiring Regulations), BS5266 Part 1 Code of Practice for the Emergency Lighting of Premises, and with the International Maritime Organisation Policy Statements and Standard

Specifications.

100.030 SYSTEM DESCRIPTION:

Type of System

The Emergency luminaires are served from an Inverter Battery Pack or Central Battery Unit on failure of mains supply for a period of 3 hours.

<b>MAIN PLANT &amp; EQUIPMENT</b>	
<b>Item</b>	<b>Location</b> (See Drawings for exact location)
Test Key Switches .....	Adjacent to the Relevant Sub Distribution Board. Core B.
“ESCAPEZONE” Emergency Circuit Central Control Panel/PC (Installed in 2007).....	Security Room, First Floor
Interface Unit .....	Ref. to the Associated Record Drawing
Normal/Emergency Luminaires (complete with 3 Hour Battery Inverter Packs) .....	Ground Floor to Fourth Floor
Central Battery System.....	Ref. to the Associated Record Drawing

An independent emergency lighting monitoring system is installed in the building to comply with the BS 5266-1 2005 for the Emergency Escape Lighting.

The existing Central Battery System is retained but within the refurbished areas new luminaires with three-hour battery inverter packs have been installed.

The Emergency Lighting consists of the following:

- + Emergency Circuit Central Control Panel/PC
- + Interface Unit
- + Normal Luminaires (3 Hour Battery Inverter Packs)
- + Emergency Luminaires (Self-Contained, Non maintained Type)
- + Exit Signage Luminaires
- + Central Battery System
- + Test Key Switch

The current system comprises of a central monitoring and self-testing circuit control system. The system

Central Control Panel is located within the First Floor Security Room complete with an interface panel. The Emergency lighting is installed to all areas including the Ground Floor Reception. The Emergency luminaires are 3-hour battery inverter packs fitted to General Lighting Luminaires. The Emergency lighting is installed to all areas including the Ground Floor Reception. The Emergency luminaires are 3-hour battery inverter packs fitted to General Lighting Luminaires. Elsewhere emergency lighting luminaires are self-contained non maintained type. The emergency lighting installation is monitored by a central monitoring and self-testing circuit control system. Luminaires within the plasterboard area of the Fourth Floor Restaurant are independent non-maintained units providing lighting within the area of the plasterboard ceiling. The emergency luminaires are tested by the Lighting Control System.

100.040 CONTROL REQUIREMENTS:

- Manual testing by key switch only.

100.050 SYSTEM SCHEMATICS:

- Appendix Three

100.060 SYSTEM DRAWINGS:

- Appendix Three

---

## PART 2 SELECTION SCHEDULES FOR REFERENCE SPECIFICATIONS

### 260.000 CONDUIT AND TRUNKING

#### 260.010 GENERAL:

- Comply with work section general clauses reference Y60.1000 and those detailed below.
- Any conduit or trunking must support the function of the cabling system and provide protection, adequate separation distance and presentation as required by the cabling and EMC design.
- IT, BMS, security, data and voice cabling should be secured without deformation of the outer jacket and with a non-compressive securing tie. Zip ties should not be used unless written approval has been obtained.
- Zip ties should not be cut off to form a sharp end.
- Zip ties should not compress the cable jacket.
- Velcro, hook and eye ties or other non invasive ties must be used where possible.
- All cable routes must carry a permanent and visible identifier which is coded as part of the administration system.
- Supply conduit and cable trunking as specified in section
- Fire stopping
  - Demarcation of responsibilities
    - Main contractor
    - Services contractor
    - Fire stopping specialist
    - Fire stopping systems manufacturers
    -
  - Install all fire stopping systems in accordance with the manufacturer's written instructions.
  - Install and inspect fire stopping systems in accordance with Building Regulations and ASFP Code of

Practice TGD 17.

•

260.020 CONDUIT SYSTEMS:

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent.
- Drawing reference
- Schedule reference
- Metal
  - Rigid
    - Class 2 - reference Y60.2010A
      - Fittings
        - Reference Y60.2020A
    - Class 4 - reference Y60.2010B
      - Fittings
      - Reference Y60.2020A
  - Non-metallic
    - Rigid - reference Y60.2010E
      - Fittings - reference Y60.2030A
    - Flexible - reference Y60.2010F
  - Fittings - reference Y60.2050A
  - Support and fixing - reference Y60.2170

260.030 METAL TRUNKING:

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent.
- Drawing reference
- Schedule reference
- Cable trunking and fittings
  - Reference Y60.2080A
- Trunking Type
  - Standard cable trunking.
  - Floor trunking.
  - Skirting trunking.
  - Wall/dado trunking.
  - Cornice trunking.
  - Bench trunking.
  - Lighting trunking.
  - With compartments.
- Installation
  - Surface.
  - Flush.
  - Trunking
    - Class 1/3 - reference Y60.2090B

- Flush floor trunking - reference Y60.2090D
- Steel Dado trunking - reference Y60.2090E
- Underfloor trunking
  - Reference Y60.2100A
- Service outlet boxes
  - Reference Y60.2110A
  - Recess lids
- Service poles
  - Reference Y60.2120A
- Separate or multi-compartment trunking
  - Reference Y60.2150A
- Support and fixing - reference Y60.2170

#### 260.040 TRUNKING OF INSULATING MATERIAL:

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent.
- Drawing reference
- Schedule reference
- Cable trunking and fittings
  - Reference Y60.2080A
- Trunking type
  - Standard cable trunking.
  - Floor trunking.
  - Skirting trunking.
  - Wall/dado trunking.
  - Cornice trunking.
  - Bench trunking.
  - Lighting.
  - With compartments.
- Surface trunking
  - PVC general purpose - reference Y60.2130A
  - PVC skirting trunking - reference Y60.2130B
- Underfloor trunking
  - PVC - reference Y60.2140A
- Service outlet boxes
  - Reference Y60.2110A
    - Recess lids
- Service poles
  - Reference Y60.2120A
- Separate or multi-compartment trunking
  - Reference Y60.2150A
- Wall/Dado Trunking
  - PVC - reference Y60.2130C
- Support and fixing - reference Y60.2170

#### 260.050 GENERAL WORKMANSHIP:

- General
  - Reference Y60.3010A
- Layout - reference Y60.3020
- Spacing - reference Y60.3030
- Condensation prevention - reference Y60.3040
- Protection and repair of steel components
  - Reference Y60.3050A
- Equipment connections - reference Y60.3060
- Cleaning before wiring - reference Y60.3070
- Wiring
  - Reference Y60.3080A
- Builderswork - reference Y60.3090

**260.070 WORKMANSHIP FOR CONDUIT:**

- Type
- Application
- Draw-in boxes - reference Y60.4010
- Installation of cast in or buried conduit - reference Y60.4020
- Conduit boxes - reference Y60.4030
- Fixing conduit - reference Y60.4040
- Flexible and pliable conduit - reference Y60.4050
  - Screwed steel conduit - reference Y60.4060
- Underground installation - reference Y60.4080

**260.080 WORKMANSHIP FOR TRUNKING:**

- Type
- Application
- Access - reference Y60.5020
- Fixing trunking
  - Reference Y60.5030A
- Steel trunking
  - Reference Y60.5040A
- Underfloor and flush floor trunking installation - reference Y60.5050

**261.000 CABLES AND WIRING**

**261.010 GENERAL:**

- Comply with work section general clauses reference Y61.1010, Y61.1020, Y61.1030 and those detailed

below.

- Supply cables and wiring as Work Section
- Cables as schedule reference Y61-Cables technical details by application
  - Cables design data as schedule reference Y61-Main and Sub-main cables design data
- Supply cables and wiring as schedule reference
  - Location
    - At end of this work section.
    - On drawing number
    -
- Supply cables and wiring as drawing reference
  - Location
    - Separation distance for EMC and lighting surge protection compliance.
    - At end of this work section.
    -
- Fire stopping
  - Demarcation of responsibilities
    - Main contractor
    - Service contractor
    - Fire stopping specialist
    - Fire stopping systems manufacturers
    -
  - Install all fire stopping systems in accordance with the manufacturer's written instructions.
  - Install and inspect fire stopping systems in accordance with Building Regulations and ASFP Code of

Practice TGD 17.

- 
- Identify cables using
  - Structured numbering scheme
- 
- Provide cable management package
  - Software
- 

261.020 STANDARD FLEXIBLE CORDS AND INDUSTRIAL CABLES:

- Type
- Application
- Manufacturer and reference
- Or approved equivalent.
- Standard ordinary flexible cords - multi copper cores - reference Y61.2010D

261.030 STANDARD MEDIUM VOLTAGE POWER CABLES:

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent.
- LSOH sheathing - reference Y61.2005
- Standard 3.3 kV armoured and sheathed cables, with copper conductors - reference Y61.2030A
- Standard 3.3kV armoured and LSF sheathed cables, with copper conductors - reference Y61.2030B
- Standard 11kV armoured and sheathed cables, with copper conductors - reference Y61.2030C
- Standard 11kV armoured and LSF sheathed cables, with copper conductors - reference Y61.2030D
- Reference Y61.2030#

261.040 MINERAL INSULATED WIRING AND POWER CABLES:

- Type
- Application
- Manufacture and reference
- Or approved equivalent.
  - Light duty mineral insulated cables
  - LSF outer covering - reference Y61.2040B
  - Heavy duty mineral insulated cables
- Sheath colour

261.050 STANDARD WIRING AND POWER CABLES:

- Type
- Application
- Manufacturer and reference
- Or approved equivalent.
- Standard power supply cables
  - Thermosetting insulation and copper conductors
    - Sheathed - reference Y61.2020A

- Sheathed and armoured - reference Y61.2020B
- PVC insulation and copper conductors
  - Sheathed - reference Y61.2020C
- LSF sheathed and armoured - reference Y61.2020E
- Standard wires for conduit and trunking
- LSF insulated, with copper conductors - reference Y61.2020G
- Standard flat cables 2-core or 3-core, with copper conductors; with or without CPC
- LSF insulated, sheathed - reference Y61.2020J
- Standard power supply cables, LSF insulation, sheathed - reference Y61.2020K
- Standard cables with definite fire performance - reference Y61.2020M
- Standard cables where penetration by sharp objects is a high risk - reference Y61.2020N

261.060 CONTROL AND AUXILIARY CABLES:

- Type
- Application
- Manufacturer and reference
- Or approved equivalent.
- Paired, screened control cables with or without metallic protection - reference Y61.2050B
- Multi-core unarmoured LSF sheathed auxiliary cables - reference Y61.2050G

261.070 PAPER INSULATED CABLES:

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent.
- LSOH sheathing - reference Y61.2005

261.080 STANDARD COMMUNICATIONS CABLES:

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent.
- LSOH sheathing - reference Y61.2005
- Standard communications cables, for indoor use - reference Y61.2070B

261.090 STANDARD COAXIAL CABLES:

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent.
- For broadcast receiving - reference Y61.2080A

261.100 OPTICAL FIBRE CABLES:

- Type
- Application
- Manufacturer and reference

- Or approved equivalent.
- Standard fibre optic cables for data communications to BS EN 60794-2-11 and BS EN 187103 - reference Y61.2090A
- Fibre optic cables other than those for data communications to BS EN 60794-2-11 and BS EN 187103 -

reference Y61.2090#

- Conductors for optical fibre cables - reference Y61.2120#
- Conductor insulation for optical fibre cables - reference Y61.2130#
- Braiding, screens, taping and moisture barriers for optical fibre cables - reference Y61.2160#
- Inner sheath for optical fibre cables - reference Y61.2140#
- Bedding for optical fibre cables - reference Y61.2140#
- Armour for optical fibre cables - reference Y61.2150#
- Outer sheath for optical fibre cables - reference Y61.2140#

261.110 INFORMATION TECHNOLOGY CABLES:

- Type
- Category of performance
- Manufacturer and reference
  - Or approved equivalent.
- Structured wiring
  - Category 5 - reference Y61.2100A
  - Category 5e - reference Y61.2100A
  - Category 6 - reference Y61.2100B
  - Category 6a - reference Y61.2100B
  - HBES Class 1 twisted pair - reference Y61.2100C
- Multi-pair cables for high bit rate digital access telecommunications networks - reference Y61.2100D
  - Conductors for information technology cables.
  - Reference Y61.2120#
    - Sheaths for information technology cables
    - Armour for information technology cables
    - Outer sheath for information technology cables

261.120 NON-STANDARD CABLES:

- Type
- Application
- Manufacturer and reference
- Or approved equivalent.

261.130 CABLE GLANDS:

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent.
- Unarmoured cables, indoors - reference Y61.3010A
- Unarmoured cables, outdoors - reference Y61.3010B
- Armoured cables, dry indoors - reference Y61.3010C
- Armoured cables, indoors - reference Y61.3010D
- Armoured cables, outdoors - reference Y61.3010E

261.140 CABLE SEALS AND GLANDS - MINERAL INSULATED CABLES:

- Type
- Application

- Manufacturer and reference
- Or approved equivalent.
- Heavy and light duty mineral insulated cables - protected 'e' for hazardous areas - reference Y61.3020B

#### 261.150 VOLTAGE SURGE SUPPRESSORS FOR CABLES:

- Type
- Application
- Manufacturer and reference
- Or approved equivalent.

#### 261.160 CABLE TERMINATING AND JOINTING SOCKETS:

- Manufacturer and reference

#### 261.170 INSULATING TAPE:

- Type
- Application
- Manufacturer and reference
- Or approved equivalent.

#### 261.180 CABLE JOINTS AND TERMINATIONS:

#### 261.200 CONNECTORS FOR COAXIAL CABLES:

- Standard
  - BS 3041-7 - Type C.
  - BS 3041-12 - Type UHF.
  - BS EN 60169-21 - Type SC-A.
  - BS EN 60169-21 - Type SC-B.
  - BS EN 61169-8 - Type BNC.
  - BS QC 221100 - Type SMA.
  - BS QC 221300 - Type SMB.
  - BS QC 221400 - Type SMC.
  - BS QC 222000 - Type TNC.
  - BS EN 61169-2 - 'Belling' or 'Standard 75Ohm TV' connector.
  - BS EN 60169-24 or BS EN 61169-24 - Type F.
- Type
- Application
- Manufacturer and reference
  - Or approved equivalent.
- Connectors to match equipment
- Connectors and associated termination method, sleeving and sealing to be suitable for the prevailing

environmental conditions including dust and moisture ingress.

261.210 OPTICAL FIBRE TERMINATIONS:

- Standard
  - Relevant parts of BS EN 50173
  - BS EN 62148-17
- Format
- Loss performance
- Optical fibre type
- Presentation
- Type
- Function
- Application
- Manufacturer and reference
  - Or approved equivalent.
- Reference Y61.3090#
- As shown on drawing ref

261.220 OPTICAL FIBRE CABLE JOINTS:

- Type
- Application
- Loss performance
- Manufacturer and reference
  - Or approved equivalent.
- Reference Y61.3100#
- As shown on drawing reference

261.230 CABLE DUCTS:

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent.
- Reference Y61.3110A

261.240 CABLE SLEEVES:

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent.
- Reference Y61.3120A

261.250 CABLE COVERS AND MARKERS:

- Type
- Application
- Manufacturer and reference

- Or approved equivalent.
- Reference Y61.3130A

#### 261.260 WORKMANSHIP

- Cable installation - general - reference Y61.4010
- Cable installation in low temperatures - reference Y61.4020
- Installation of LSF cable - reference Y61.4030
- Installation of LSZH and LSOH cable - reference Y61.4030A
- Installation of unarmoured cables - reference Y61.4040
- Cable installation in trenches - reference Y61.4060
- Cable installation in conduit and trunking.
- Reference Y61.4090A
- Cable surface installation.
  - Reference Y61.4110A
- Cable embedded installation.
  - Reference Y61.4120A
- Cable installation - mineral insulated cables
  - Reference Y61.4130A
- Cable installation - flexible cords - reference Y61.4140
- Cable jointing and terminating generally.
- Reference Y61.4150A
- Terminating - mineral insulated cables.
  - Reference Y61.4180A
- Cable joints - mineral insulated cables.
  - Reference Y61.4190A
- Communications coaxial, optical fibre and IT cable installation, jointing and terminating.
  - Reference Y61.4200A

#### 263.000 SUPPORT COMPONENTS - CABLES

##### 263.010 GENERAL:

- Comply with work section general clauses reference Y63.1000 and those detailed below.
- Supply support components as specified in Section
- Fire stopping
  - Demarcation of responsibilities
    - Main contractor
    - Services contractor
    - Fire stopping specialist
    - Fire stopping system manufacturers
    -
  - Install all fire stopping systems in accordance with the manufacturer's written instructions.
  - Install and inspect fire stopping systems in accordance with Building Regulations and ASFP Code of

Practice TGD 17.

- 

**263.020 CABLE SUPPORT AND FINISHES:**

- Type
- Application
- Cable supports and finishes
  - Reference Y63.2010A

**263.030 CABLE SUPPORT SYSTEM:**

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent.
- Perforated tray - reference Y63.2020A
- Cable rack - reference Y63.2020B
- Proprietary cable ties - reference Y63.2025A
- Two way saddles - reference Y63.2025C
- Cable basket - reference Y63.2025D

**263.040 WORKMANSHIP**

- Cable tray installation - reference Y63.3010
- Cable cleats, ties, saddles and clips installation
  - Reference Y63.3020A

**271.000 LV SWITCHGEAR AND DISTRIBUTION BOARDS**

**271.010 GENERAL:**

- Comply with work section general clauses reference Y71.1000 and those detailed below.
- Supply switchboards and distribution boards as schedule reference Y71-Distboards
  - Location
- Supply switchboards and distribution boards as schedule reference
  - Location
    - At end of this work section.
    - On drawing number

**271.020 CO-ORDINATION STUDY:**

- Application
- Co-ordination study - reference Y71.1010#
- Electricity supply - reference Y71.1020#

**271.030 SWITCHBOARDS:**

- Type

- Application
- Manufacturer and reference
  - Or approved equivalent.
- Electrical supply
- LV switchgear and controlgear assembly
  - Cubicle switchboard - reference Y71.2010A
  - Cubicle control panel - reference Y71.2010B
  - Multi-box switchboard - reference Y71.2010C
  - Multi-box control panel - reference Y71.2010D
  - Details of equipment
    - As shown on drawing/schedules
  - Rated current and rated prospective short - circuit withstand current for indicated seconds
- Assembly construction
  - Floor mounted - reference Y71.2020A
  - Wall mounted - reference Y71.2020B
  - Access for cabling - Front, top, bottom or rear
  - As shown on drawings/schedules
- Enclosures finish
  - Reference Y71.2030A
- Type tests
- Site built assemblies - reference Y71.2060
- Site modification - reference Y71.2070

#### 271.040 BATTERY CHARGER AND BATTERY UNIT:

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent.
- Tripping unit
  - Wall mounted, top entry - reference Y71.2080A
  - Wall mounted, bottom entry - reference Y71.2080B
  - Floor standing, top entry - reference Y71.2080C
  - Floor standing, bottom entry - reference Y71.2080D
  - Details of equipment
    - As shown on drawings/schedules
      - Current
- Battery over-discharge protection, MCB's for outgoing circuits

#### 271.050 CIRCUIT BREAKERS, TRANSFER SWITCHES AND CONTROL AND PROTECTIVE SWITCHES:

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent.
- Air circuit breaker
  - Utilisation A, withdrawable (without intentional time delay and a short time withstand current rating) - reference Y71.2090A
  - Utilisation A, demountable MCCB (without intentional time delay and a short time withstand current

rating) - reference Y71.2090B

- Utilisation B, withdrawable (with intentional time delay and a short time withstand current rating) - reference Y71.2090C
- Utilisation B, demountable MCCB (with intentional time delay and a short time withstand current rating)

- reference Y71.2090D
- Characteristics of circuit breakers, transfer switches and control and protective switches:
  - As shown on drawings/schedules
  - Number of poles
  - Circuit breaker and CBR operating condition, method of operation and control
  - Rated operational, current (Amps)
  - Short-circuit characteristics, rated service short-circuit breaking current (Amps)
  - Control circuits
  - Auxiliary circuits
  - Relays and releases, type and characteristics
- Co-ordination with short-circuit protective devices

#### 271.060 SWITCHES, DISCONNECTORS AND FUSE COMBINATION UNITS:

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent.
- Switch-disconnector - reference Y71.2100A
- Fuse combination unit - reference Y71.2100B
- Details of equipment
  - As shown on drawings/schedules
  - Number of poles
  - Rated operational current (Amps)
  - Normal load and overload characteristics
    - Motor switching overload current withstand (Amps)
    - Rated making capacity (Amps)
    - Rated breaking capacity (Amps)
  - Short-circuit characteristics
    - Rated short-time withstand current (Amps)
  - Auxiliary circuits
- Co-ordination with short-circuit protective devices

#### 271.070 PROTECTION DEVICES INTERPOSING RELAYS AND INTER-TRIPPING RELAYS:

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent.
- Automatic reset - reference Y71.2110A
- Manual reset - reference Y71.2110B
- Details of equipment
  - As shown on drawings/schedules
  - Contacts
- Protection relays features

#### 271.080 VOLTAGE SENSING RELAYS:

- Reference Y71.2120
- Application

271.090 TRIP/CLOSE SWITCHES AND CONTROL SELECTOR SWITCHES:

- Reference Y71.2130
- Application

271.100 CURRENT TRANSFORMERS:

- Reference Y71.2140
- Application

271.110 INSTRUMENTS AND METERS (REFURBISHMENT):

- Type
- Application
- Reference Y71.2150A
- Details as shown on drawings/schedules
- BREEAM 2008 requirements
  - Comply with BREEAM 2008 Issue ID Ene 02 and 03.
- BREEAM New Construction 2014 requirements
  - Comply with Issue ID Man 04 Commissioning and Handover
  - Comply with Issue ID Man 05 Aftercare
  - Comply with Issue ID Ene 02 Energy Monitoring
  - Comply with Issue ID Wat 02 Water Monitoring
  - Comply with Issue ID Wat 03 Water Leak Detection
  - Comply with Issue ID Pol 01 Impact of Refrigerants

271.112 INSTRUMENTS AND METERS (NEW BUILD):

- Type
- Application
- Reference Y71.2150A
- Details as shown on drawings/schedules
- BREEAM 2011 requirements
  - Comply with BREEAM 2011 Issue ID Ene 02 .
- BREEAM New Construction 2014 requirements
  - Comply with Issue ID Man 04 Commissioning and Handover
  - Comply with Issue ID Man 05 Aftercare
  - Comply with Issue ID Ene 02 Energy Monitoring
  - Comply with Issue ID Wat 02 Water Monitoring
  - Comply with Issue ID Wat 03 Water Leak Detection
  - Comply with Issue ID Pol 01 Impact of Refrigerants

271.120 ELECTRICAL RECORDING INSTRUMENTS:

- Type
- Application
- Reference Y71.2160A
- Details
  - As shown on drawings/schedules

- Parameter recorded
- Channels
- Chart
  - Scale
  - Speed
- Type

271.130 INDICATOR LIGHTS:

- Type
- Application
- Reference Y71.2170A
- Details
  - As shown on drawings/schedules
  - Lamp wattage
  - Provide neon indicators
- Mounting

271.140 LOW VOLTAGE COILS RATING:

- Reference Y71.2180

271.150 FRAMEWORK:

- Type
- Application
- Reference Y71.2190A

271.160 FUSES:

- Application
- Reference Y71.2200A
- Use motor circuit fuses
- As shown on drawings/schedules

271.170 DISTRIBUTION BOARDS:

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent.
- Reference Y71.2210A
- Provide spare ways
- As shown on drawings/schedules

271.180 CONSUMER UNITS:

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent.

- Reference Y71.2220A
- As shown on drawings/schedules

271.190 MINIATURE CIRCUIT BREAKERS:

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent.
- Reference Y71.2230A
- As shown on drawings/schedules

271.200 RESIDUAL CURRENT DEVICE:

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent.
- RCCD's
  - Reference Y71.2240A
  - As shown on drawings/schedules
- RCBO's - reference Y71.2245

271.210 CABLE TERMINATIONS:

- Reference Y71.2250

271.220 STATIC CAPACITOR:

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent.
- Free standing, wall mounted - reference Y71.2260A
- Free standing, floor mounted - reference Y71.2260B
- Wall mounted within switchboard - reference Y71.2260C
- Floor mounted within switchboard - reference Y71.2260D
- Capacitor rating - Output (VAR)
- As shown on drawings/schedules

271.230 AUTOMATICALLY CONTROLLED CAPACITOR BANKS:

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent.
- Free standing wall mounted - reference Y71.2270A
- Free standing floor mounted - reference Y71.2270B
- Wall mounted within switchboard - reference Y71.2270C
- Floor mounted within switchboard - reference Y71.2270D
- Single cubicle within switchboard - reference Y71.2270E

- Capacitor rating - Output (VAR)
  - As shown on drawings/schedules
- Relay stages
- As shown on drawings/schedules

271.240 HARMONIC FILTER:

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent.
- Reference Y71.2280A
- Rating
- As shown on drawings/schedules

271.250 MEDIUM VOLTAGE IRON CORE FILTER REACTOR:

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent.
- Reference Y71.2290A

271.260 SWITCHGEAR AND CONTROLGEAR ACCESSORIES:

- Type
- Application
- As shown on drawings/schedules

271.270 WORKMANSHIP

- Fixing - reference Y71.3010
- Mounting height - reference Y71.3020
- Access - reference Y71.3030
- Marking and drawing
  - Reference Y71.3040A
- Cable terminations - reference Y71.3050
- Installation and commissioning
  - Reference Y71.3060A

**273.000 LUMINAIRES AND LAMPS**

273.010 GENERAL:

- Comply with work section general clauses reference Y73.1000 and those detailed below.
- Supply luminaires and lamps as schedule reference
  - Location
- Supply luminaires and lamps as schedule reference Y73-Luminaires
  - Location
- BREEAM New Construction 2014 requirement

- Comply with Issue ID Hea 01 Visual Comfort
- BREEAM Refurbishment and Fit-out 2014 requirement
  - Comply with Issue ID Hea 01 Visual Comfort

#### 273.020 LUMINAIRES:

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent.
- Lamp efficacy - reference Y73.2005
- General purposes - reference Y73.2010A
- General purposes, with safety glass - reference Y73.2010B
- Special applications - reference Y73.2010C
  - Emergency lighting
    - Reference Y73.2020A
  - Hazardous areas
- Reference Y73.2040A

#### 273.030 LAMPHOLDERS:

- Type
- Application
- General
  - Reference Y73.2060A
- Tungsten fittings - reference Y73.2070
- Mounting
  - Reference Y73.2080A

#### 273.040 CONTROL GEAR AND COMPONENTS:

- Type
- Application
- Compatibility
  - Reference Y73.2090A
- Circuit losses - reference Y73.2095
- Fluorescent lamp ballasts and starters
  - Reference Y73.2100A
- Discharge lamp ballasts and starters
  - Reference Y73.2110A
- Capacitors
  - Reference Y73.2120A
- Supply terminals - reference Y73.2130
- Fuse - reference Y73.2140
- Remote gear - reference Y73.2160

#### 273.050 LAMPS:

- Type
- Application

- Manufacturer and reference
  - Or approved equivalent.
- Types of high efficiency lamp for non-daylight areas  
Reference Y73.2165
- Tungsten filament lamps
  - Reference Y73.2170A
- Fluorescent lamps to BS EN 62639
  - Reference Y73.2180A
- Tungsten halogen lamps - reference Y73.2185A
- High pressure mercury vapour lamps - reference Y73.2190
- LED lamps - reference Y73.2215A
- LED modules - reference Y73.2215B
- Transformers for LV luminaires - reference Y73.2220A

#### 273.060 SUPPORT SYSTEM:

- Type
- Application
- Conduit
  - Steel - reference Y73.2240A
  - Installation
    - Support from conduit - reference Y73.4120
    - Suspension - reference Y73.4160
    - Connections to luminaires - reference Y73.4220
    - Direct to conduit
      - Terminal box - reference Y73.4230A
      - At luminaire - reference Y73.4230B
    - Conduit suspension - reference Y73.4270
- Rod
  - Cadmium plated steel - reference Y73.2250A
  - Installation
    - Suspension - reference Y73.4160
    - Suspension by rod - reference Y73.4170
    - Connections to luminaires - reference Y73.4220
    - Rod or chain suspension - reference Y73.4280
- Chain
  - Cadmium plated steel - reference Y73.2260A
  - Installation
    - Suspension - reference Y73.4160
    - Suspension by chain - reference Y73.4180
    - Connections to luminaires - reference Y73.4220
    - Rod or chain suspension - reference Y73.4280
- Flexible cord
  - Reference Y73.2270A
  - Size and type as indicated on the drawings/schedules
  - Installation
    - Suspension - reference Y73.4160
- Wall brackets
  - Reference Y73.2280A
  - Installation

- Height
- Ball and socket - reference Y73.2290
  - Installation
    - Suspension - reference Y73.4160
    - Height
- Wire rope - reference Y73.2295
  - Installation
    - Suspension - reference Y73.4160
- Height

#### 273.070 COLUMNS AND BOLLARDS:

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent.
- Steel - reference Y73.2300A
- Finish as shown on drawings/schedules
- Aluminium - reference Y73.2300C
- Columns and bollards installation
  - Reference Y73.4210A

#### 273.080 LUMINAIRES AND LAMPS ACCESSORIES:

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent.
- Track lighting
  - Reference Y73.3010A
  - Class, poles and current rates as indicated on drawings/schedules
- Air handling luminaires
  - Reference Y73.3030A

#### 273.090 LUMINAIRES AND LAMPS WORKMANSHIP - GENERAL:

- Material of supporting surface - reference Y73.4060
- Installation of extra low voltage tungsten halogen lamps - reference Y73.4100
- Support - reference Y73.4110
- Support by direct fixing
  - Reference Y73.4140A
  - Support in suspended ceiling
- Connections to luminaires - reference Y73.4220
  - MICS cable - reference Y73.4290
- Lighting switches on different phases
  - Separate - reference Y73.4300A
  - Phase barrier - reference Y73.4300B

#### 273.100 LUMINAIRES AND LAMPS WORKMANSHIP - RECESSED FITTINGS:

- Installation of recessed fittings

- Installation of semi-recessed fittings
- Connections to luminaires - reference Y73.4220
  - Recessed fittings
    - Plug and socket - reference Y73.4260A

#### 273.110 LUMINAIRES AND LAMPS WORKMANSHIP:

- Support - reference Y73.4110
- Support from trunking - reference Y73.4130
- Connections to luminaires - reference Y73.4220
  - Direct to trunking
  - At luminaire - reference Y73.4240B

### 274.000 ACCESSORIES FOR ELECTRICAL SERVICES

#### 274.010 GENERAL:

- Comply with work section general clauses reference Y74.1000 and those detailed below.
- Supply accessories for electrical services as section
- Supply accessories for electrical services in accordance with schedule reference

#### 274.020 SAMPLES:

- Provide samples of the following items

#### 274.030 ACCESSORIES COMMON REQUIREMENTS:

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent.
- White plastic plates, flush installation - reference Y74.2010A
- Matt finish metal plates, flush installation - reference Y74.2010B
- Metal clad plates, surface steel conduit installation - reference Y74.2010D
- Surface, steel conduit, weatherproof installation - reference Y74.2010E
- Surface, plastic, weatherproof installation - reference Y74.2010F
- Accessories details
  - As shown on drawings/schedules
  - Coverplate architrave
  - Fuses
  - Switch rocker bar colour
- Plastic coverplate colour

#### 274.040 INTERIOR LIGHTING SWITCHES:

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent.
- General purpose moulded plastic - reference Y74.2020A

- Grid moulded plastic - reference Y74.2020B
- Pull cord - reference Y74.2020C
- General purpose secret key - reference Y74.2020D
- Grid secret key - reference Y74.2020F
- Switch details
  - As indicated on drawings/schedules
  - Gangs
- Pole characteristics

#### 274.050 EXTERIOR LIGHTING SWITCHES:

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent.
- Metal clad rotary - reference Y74.2030A
- Sealed rocker bar - reference Y74.2030B
- Switch details
  - As indicated on drawings/schedules
  - Gangs
- Pole characteristics

#### 274.060 TIME SWITCHES:

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent.
- 7 day - reference Y74.2040B

#### 274.070 LUMINAIRE CONNECTORS:

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent.
- General and emergency lighting - reference Y74.2050A
- General lighting - reference Y74.2050B
- Cord grip general and emergency lighting.
  - Reference Y74.2050C
- Luminaire supporting coupler as shown on drawings/schedules

#### 274.080 LAMPHOLDERS:

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent.
- BC type - reference Y74.2060A
- ES type - reference Y74.2060B
- Details

- As indicated on drawings/schedules
- Fixings
- Ancillaries

#### 274.090 ISOLATING SWITCHES:

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent.
- Reference Y74.2070A
- Reference Y74.2070B
- Details
  - As indicated on drawings/schedules
  - Utilisation category
  - Making capacity
  - Rating
- Pole configuration

#### 274.100 FUSE CONNECTION UNITS:

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent.
- Switched - reference Y74.2080A
- Unswitched - reference Y74.2080B
- Details
  - As indicated on drawings/schedules
- Ancillaries

#### 274.110 SOCKET-OUTLETS:

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent.
- Single, switched - reference Y74.2090A
- Single with integral RCD, switched.  
Reference Y74.2090B
- Double, switched - reference Y74.2090C
- Single, unswitched - reference Y74.2090D
- Details
  - As indicated on drawings/schedules
  - Mains trip failure sensitivity
- Fused

#### 274.120 COOKER CONTROL UNIT

- Type
- Application

- Manufacturer and reference
  - Or approved equivalent.
- With integral socket - reference Y74.2100A
- Without socket - reference Y74.2100B

#### 274.130 CORD OUTLETS:

- Type
- Application
- Manufacturer and reference
- Or approved equivalent.

#### 274.140 CABLE AND APPLIANCE COUPLERS:

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent.
- 16A, 230V Single-phase, general purpose - reference Y74.2120A
- Details
  - As indicated on drawings/schedules
- Ancillaries

#### 274.150 TELEPHONE AND DATA OUTLET SOCKETS:

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent.
- General purpose - reference Y74.2130A
- Details
  - As indicated on drawings/schedules
- Circuit configurations

#### 274.160 TELEPHONE CORD OUTLETS:

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent.
- General purpose - reference Y74.2140A
- Details
  - As indicated on drawings/schedules
- Circuit configurations

#### 274.210 SHAVER POINTS:

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent.

- Bath and washroom use - reference Y74.2190A

#### 274.220 INDICATOR LAMPS:

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent.
- General purpose neon - reference Y74.2200A

#### 274.240 WORKMANSHIP:

- Earthing - reference Y74.3010
- Protection - reference Y74.3020
- Fixing - reference Y74.3030
- Measuring mounting heights - reference Y74.3040
- Accessories mounting heights
  - As indicated on Architects drawings.
  - As indicated on the drawings/schedules.
  - Standard - reference Y74.3050
- For the disabled - reference Y74.3070

### **280.000 EARTHING AND BONDING COMPONENTS**

#### 280.010 GENERAL:

- Comply with work section general clauses reference Y80.1000 and those detailed below.
- Supply earthing and bonding components as specified in section
- Where there is copper cabling requirement for voice and/or data, the contractor shall give consideration to the provision of a MESH-BN (Bonded Network) or equipotential bonding of the components within the communication rooms and distributors and state what has been included with the tender. Requirements

and further guidance are set out in

- BS EN 50310
- BS EN 50174
- Supply MESH-BN (Bonded Network)

#### 280.020 CONDUCTORS:

- Type
- Application
- Manufacturer
- Conductors for lightning protection system
  - Horizontal air terminations - reference Y80.2010A
    - Covering colour
  - Self supporting air terminations - reference Y80.2010B
- Conductors for earthing systems
  - Reference Y80.2010C
- Conductor joints
  - Lightning protection - reference Y80.2020A
  - Earthing systems - reference Y80.2020B
- Tape fixing devices
  - Reference Y80.2030A

#### 280.030 EARTH ELECTRODES:

- Type
- Application
- Manufacturer
- Drawing/schedule
  - Earth electrodes for lightning protection systems
- Earth electrodes for system earthing.
  - Rod - reference Y80.2040B
- Building or structural element - reference Y80.2040D
- Earth electrode clamps
  - Reference Y80.2060A
- Earth electrode inspection facilities
  - Reference Y80.2070A
  - Earth electrode tank penetration seal

#### 280.040 EQUIPOTENTIAL BONDING:

- Where there is a copper cabling requirement for voice and/or data, the contractor shall give consideration to the provision of a MESH-BN (Bonded Network) or equipotential bonding of the components within the communication rooms and distributors and state what has been included with the

tender. Requirements and further guidance are set out in BS EN 50174 and BS EN 50310

- Type
- Application
- Main equipotential bonds
  - Reference Y80.2090A
- Supplementary equipotential bonds
  - Reference Y80.2100A

#### 280.050 EARTHING:

- Type
- Application
- Circuit protective conductors
  - Reference Y80.2110A
- Earthing clamps - reference Y80.2120
- Earth busbars
  - Reference Y80.2130A
- Test links - reference Y80.2140
- Lugs/tags - reference Y80.2150
- Protective cable terminations - reference Y80.2160
- Protective conductor warning notices/labels
  - Reference Y80.2170
- Main earth conductor - reference Y80.2180
- Earth bar label - reference Y80.2190

#### 280.060 WORKMANSHIP:

- Low noise earth distribution - reference Y80.3010
- Dissimilar metals - reference Y80.3020
- Tape joints
  - Application
  - Copper - reference Y80.3030A
  - Aluminium - reference Y80.3030B
- Stranded conductor joints - reference Y80.3040
- Protective cable terminations
  - Reference Y80.3050A
- Earth electrodes
  - Application
  - Reference Y80.3060A

### **281.000 TESTING AND COMMISSIONING OF ELECTRICAL SERVICES:**

#### 281.010 GENERAL:

- Comply with work section general clauses reference Y81.1000 and those detailed below.
- Carry out testing and commissioning of electrical services as section

#### 281.020 TESTING AND COMMISSIONING:

- Incorporated equipment characteristics

- Reference Y81.2010A
- Prospective short circuit current ( $I_p$ )
  - Reference Y81.2020A
- Initial verification
  - Reference Y81.2030A
- Test equipment and consumables
  - Reference Y81.2040A
- Testing
  - Reference Y81.2050A
  - Continuity of protective conductors
- Earth fault loop impedance (ZS)
  - Reference Y81.2070A
- Settings and adjustments - reference Y81.2080
- Standby generators
  - Reference Y81.2090A
- HV and LV switchgear
  - Reference Y81.2100A
- HV power transformers
  - Reference Y81.2110A
- Specialist installations
  - Fire detection and alarm systems.
    - Reference Y81.2120A
  - Lightning and surge protection - reference Y81.2120B
  - Emergency lighting installations
    - Reference Y81.2120E
- Calibration - reference Y81.2130
- Certification and reporting
  - Reference Y81.2140A
- Completion certificates
  - Reference Y81.2150A
- Records - reference Y81.2160

#### 281.030 WORKMANSHIP:

- Conductive parts - reference Y81.3010
- High voltage tests
  - Reference Y81.3030A
  - Reference Y81.3030#
- Cables
  - LV buried cables - reference Y81.3040A

### **282.000 IDENTIFICATION - ELECTRICAL**

#### 282.010 GENERAL:

- Comply with work section general clauses reference Y82.1000 and those detailed below.
- Supply identification - electrical as specified in section

#### 282.020 LABELS AND NOTICES:

- Reference Y82.2010A
- Fit labels and notices as shown on
  - Contract drawings.
  - Schedules
  - Drawings

#### 282.030 LABELS AND NOTICES MATERIALS:

- Type
- Application
- Material
  - Reference Y82.2020A
- Fixing
  - Reference Y82.2030A
- Arrangement
  - Reference Y82.2040A
- Lettering and size of labels and notices
  - Reference Y82.2050A

#### 282.040 CONDUCTOR ARRANGEMENT:

- Reference Y82.2060A

#### 282.045 GRAPHICAL SYMBOLS FOR USE ON EQUIPMENT IN ACCORDANCE WITH BS EN 80416:

#### 282.050 EQUIPMENT SIGNS AND LABELS:

- Safety signs
  - Reference Y82.2070A
- Plant and equipment labels
  - Reference Y82.2080A
- Maintenance notices - reference Y82.2090
  - Equipment
- Colour corrected light fittings - reference Y82.2100
- Motors and starters labels
  - Reference Y82.2110A
- Engraved accessory plates
  - Reference Y82.2120A
- Switchgear
  - Reference Y82.2130A
- Distribution boards - reference Y82.2140

#### 282.055 GRAPHICAL SYMBOLS FOR USE ON EQUIPMENT IN ACCORDANCE WITH BS EN 80416:

#### 282.060 SCHEMATIC DIAGRAMS:

- Type
- Application
- Reference Y82.2150A

**282.070 SPECIAL PURPOSE EARTHING:**

- Type
- Application
- Reference Y82.2160A

**282.080 INDICATOR LAMPS AND PUSH BUTTONS FOR POWER SYSTEMS:**

- Type
- Application
- Reference Y82.2170A

**282.090 CONDUIT AND TRUNKING COLOUR CODING:**

- Type
- Application
- Reference Y82.2180A

**282.100 CABLE IDENTIFICATION:**

- Cable identification
  - Reference Y82.2190A
- Terminal marking and conductor identification
  - Reference Y82.2200A
- Underground cable identification
  - Reference Y82.2210A
- Cable conductor colour coding
  - Reference Y82.2220A
- Cable jointing and termination - reference Y82.2230
  - Cable sheath identification - internal
- Cable sheath identification - external

**282.110 ADDITIONAL SAFETY SIGNS:**

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent.
- Reference Y82.2260A

**290.000 FIXING TO BUILDING FABRIC**

**290.010 GENERAL:**

- Comply with work section general clauses reference Y90.1000 and those detailed below.
- Carry out fixing to building fabric as specified in work section

**290.020 FIXINGS:**

- Type
- Application
- Standards - reference Y90.2010
- Plugs - reference Y90.2020
- Screws - reference Y90.2030
- Non-penetrative support systems - reference Y90.2080
  - Manufacturer and reference
  - Or approved equivalent.

290.030 WORKMANSHIP:

- Type
- Application
- Drilling - reference Y90.3010
- Fixing to timber rails - reference Y90.3050
- Fixing to hollow stud/tile/block wall
  - Reference Y90.3060A
- Fixing to concrete, brickwork or blockwork
  - Reference Y90.3070A
- Fixing to metalwork
  - Reference Y90.3080A
- Fixing to structural steelwork and concrete structures
  - Reference Y90.3090A
- Non-penetrative support systems for roof mounted equipment - reference Y90.3100#

**291.000 OFF-SITE PAINTING AND ANTI-CORROSION TREATMENT**

291.010 GENERAL

- Comply with work section general clauses reference Y91.1000 and those detailed below.
- Carry-out off-site painting and anti-corrosion treatment as work section

291.020 PAINT MATERIALS:

- Type
- Application
- Paint materials
  - Reference Y91.2010A
- Paint quality - reference Y91.2020

---

## PART 3 SPECIFICATION CLAUSES SPECIFIC TO V40.

### 300.000 GENERAL

#### 300.010 EMERGENCY LIGHTING SYSTEM:

- Type
- Application
- Standard
  - BS EN 50172 (BS 5266-8).
  - BS 5266-2.
  - BS 5266-4.
  - BS 5266-5.
  - BS 5266-6.
  - BS EN 13032-3
  - BS EN 1838,BS 5266-7
  - BS EN 50171.
  - BS EN 62034.
  - BS 5266-1
  - SLL CIBSE LG12.
  - SLL CIBSE LG2.
- Authorities
- Type of system
  - Escape route lighting.
  - Open area (anti-panic) lighting.
  - High risk task area light.
  - Standby lighting.
    - Grade A.
    - Grade B.
- Category of operation
  - Type
    - X - self contained.
    - Y - central supply.
- Facilities
  - A - including test devices.
  - B - including remote test mode.
  - C - including inhibiting mode.
  - D - high risk task area luminaire.
- Duration
  - 1 - 10 min duration.
  - 30 min - 1 hour duration.
  - 120 - 2 hour duration.
  - 180 - 3 hour duration.
- Power source
  - Generator-powered emergency lighting system.
  - Battery-powered emergency lighting system.
  - Combined generator and back-up battery system.
  - Self contained emergency luminaires.
- Mode of operation
  - 0 - non-maintained

- 1 - maintained.
- 2 - combined non-maintained.
- 3 - combined maintained.
- 4 - compound non-maintained
- 5 - compound maintained.
- 6 - satellite.
- Type of premises
  - Sleeping accommodation.
  - Non-residential used for treatment or care.
  - Non-residential used for recreation.
  - Non-residential used for teaching, training and research offices.
  - Non-residential public.
  - Industrial.
  - Sports stadium.
  - Multiple use

#### 300.020 ILLUMINATION OF SIGNS:

- Type
- Application
  - Illuminate exit, emergency exit and escape route signs so that they are legible at all times, by
    - luminaires external to sign.
    - lamps contained within sign.

#### 310.000 PRODUCTS/MATERIALS

##### 310.010 LAMPS FOR EMERGENCY LIGHTING:

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent
- Duty
  - Type
  - Size
- Lamp
  - Compact fluorescent lamps.
  - Incandescent filament lamps.
  - Tubular fluorescent lamps.
  - LED.

##### 310.020 SELF-CONTAINED EMERGENCY LIGHTING LUMINAIRE SYSTEM AND EQUIPMENT: Type

- Application
- Manufacturer and reference
  - Or approved equivalent
- Standard - BS EN 60598-2-22.
- Categories
  - Non-maintained.
  - Maintained.

- Sustained.
- Combined.
- Batteries for self-contained luminaires
  - Sealed nickel-cadmium cells.
  - Jelly electrolyte sealed lead-acid cells.
  - Absorbed electrolyte gas recombination sealed lead-acid cells.
- Type
  - Self-contained luminaire.
  - Self-contained illuminated sign.
  - Self-contained modification (conversion) units.
  - Self-contained projector units.
  - Self-contained isotope illuminated exit signs.
- Ancillaries
  - Red/Green LED indicator.

310.025 LOW MOUNTED WAY GUIDANCE SYSTEMS FOR EMERGENCY USE:

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent
- Standard
  - BS 5266-2.
  - BS 5266-5.
  - BS 5266-10.
  - BS EN 50172.
  - BS EN 60598-2-22.
- Point source
- Planar source
- Escape route markers
- Exit markers
- Power supply
  - Central
  - Self centred
- Photoluminescent

310.027 OPTICAL FIBRE EMERGENCY LIGHTING SYSTEM:

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent
- Standard
  - BS 5266-4.

310.030 CENTRAL POWER SUPPLY SYSTEMS:

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent

- Standard - BS EN 50171.
- Slave Luminaires
  - Filament lamp slave luminaires.
  - Fluorescent slave luminaires.
  - Slave modification (conversion) units.
- Battery accommodation
  - Within composite charger and battery cubicle.
  - In separate cubicle.
  - On separate battery stands.
- Batteries for use in central systems
  - Portable sealed rechargeable single cells - nickel-cadmium cells to BS EN 61951-1.
  - Sealed nickel-cadmium cells to BS EN 60622.
  - Vented nickel-cadmium cells to BS EN 60623.
  - Lead-acid cells vented to BS EN 60896-11.
  - Lead-acid cells valve regulated to BS EN 60896-22.
- Categories
  - Changeover
    - ac output.
    - dc output.
  - Without interruption
    - ac output.
    - dc output.
  - Changeover with control switching devices
    - ac output.
    - dc output.
    - Control switching device arrangement
  - Non-maintained changeover
    - ac output.
    - dc output.
- Service conditions
  - Normal.
  - Unusual
- Characteristics
  - Voltages
    - Input (V)
    - Output (V)
  - Load profile
  - Division of load
  - Permissible transfer time (s)
  - Duration of load (hr)
  - Battery installation
  - Ambient temperature range
- Ambient relative humidity range

#### 310.040 BATTERY CHARGERS:

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent

- Standard - BS EN 60335-2-29, BS EN 60146, BS EN 50372-2 and ICEL 1009:2000
- Charging Techniques
  - Constant current.
  - Constant voltage.
  - Taper charging.
  - Trickle charging.

#### 310.050 MAINS FREQUENCY CENTRAL INVERTERS:

- Type
- Application
- Manufacturer and reference
  - Or approved equivalent
- Standard - ICEL 1009:2000
- Output voltage performance
  - Unstabilised output voltage, non-sinusoidal waveform.
  - Stabilised output voltage, non-sinusoidal waveform.
  - Unstabilised output voltage, sinusoidal waveform.
  - Stabilised output voltage, sinusoidal waveform.

#### 310.060 ANCILLARIES:

Provide ancillaries in accordance with the appropriate standards and regulatory authority requirements.

- Accessible test switch.
  - For luminaire groups
  - For individual luminaire.

#### 310.070 EMERGENCY LIGHTING EQUIPMENT SCHEDULES:

Supply lighting equipment in accordance with

- Schedule reference
- Luminaire schedule reference V40-Emergency Luminaires.
- Luminaire support schedule reference V40-Emergency Luminaires Supports.
- Location of schedules
  - At end of the Work Section.

#### 320.000 WORKMANSHIP

##### 320.010 INSTALLATION:

- Install, test and commission emergency lighting system in accordance with BS EN 50172.

##### 320.020 SELF-CONTAINED LUMINAIRES:

- Ensure self-contained luminaires are not installed where temperatures are likely to exceed

manufacturers recommended maximum.

- Ensure fluorescent luminaires are not used at temperatures below that specified by manufacturer.

**320.030 EQUIPMENT:**

- Install equipment in accordance with manufacturer's recommendations.

## **BS APPENDIX**

BS 3041-12:1981

Radio-frequency connectors. Part 12 Specification for r.f. coaxial connectors with screw coupling, unmatched (type UHF)

BS 3041-7:1996

Radio-frequency connectors. Part 7 R.F. coaxial connectors with inner diameter of output conductor 9,5 mm (0,374 in) with bayonet lock. Characteristic impedance 50 Ohms (Type C)

BS 5266-1:2011

Emergency lighting. Part 1 Code of practice for the emergency escape lighting of premises

BS 5266-2:1998

Emergency lighting. Part 2 Code of practice for electrical low mounted way guidance systems for emergency use

BS 5266-4:1999

Emergency lighting. Part 4 Code of practice for design, installation, maintenance and use of optical fibre systems

BS 5266-5:1999

Emergency lighting. Part 5 Specification for component parts of optical fibre systems

BS 5266-6:1999

Emergency lighting. Part 6 Code of practice for non-electrical low mounted way guidance systems for emergency use. Photoluminescent systems

BS EN 13032-3:2007

Measurement and presentation of photometric data of lamps and luminaires. Part 3 Presentation of data for emergency lighting of work places

BS EN 1838:2013

Lighting applications. Emergency lighting

BS EN 187103:2003

Harmonized system of quality assessment for electronic components. Family specification. Optical fibre

cables for indoor applications

BS EN 50171:2001  
Central power supply systems

BS EN 50172:2004  
Emergency escape lighting systems

BS EN 50310:2010  
Application of equipotential bonding and earthing in buildings with information technology equipment

BS EN 60169-21:1997  
Radio-frequency connectors. Part 21 Two types of radio-frequency connectors with inner diameter of outer conductor 9,5 mm (0,374 in) with different versions of screw coupling. Characteristic impedance 50 Ohms (types SC-A and SC-B)

BS EN 60169-24:1994  
Radio-frequency connectors. Part 24 Radio-frequency coaxial connectors with screw coupling, typically for use in 75 ohm cable distribution systems (Type F)

BS EN 60335-2-29:2004+A2:2010  
Household and similar electrical appliances. Safety Part 2-29 Particular requirements for battery chargers

BS EN 60598-2-22:2014  
Luminaires. Part 2-22. Particular requirements. Luminaires for emergency lighting

BS EN 60622:2003  
Secondary cells and batteries containing alkaline or other non-acid electrolytes. Sealed nickel-cadmium prismatic rechargeable single cells

BS EN 60623:2001  
Secondary cells and batteries containing alkaline or other non-acid electrolytes. Vented nickel-cadmium prismatic rechargeable single cells

BS EN 60794-2-11:2012  
Optical fibre cables. Part 2-11 Indoor optical cables. Detailed specification for simplex and duplex cables for use in premises cabling

BS EN 60896-11:2003  
Stationary lead-acid batteries. General requirements and methods of test. Part 11 Vented types. General

requirements and methods of tests

BS EN 60896-22:2004

Stationary lead-acid batteries. Part 22 Valve regulated types. Requirements

BS EN 61169-2:2007

Radio-frequency connectors. Sectional specification. Radio frequency coaxial connectors of type 9,52

BS EN 61169-24:2009

Radio-frequency connectors. Sectional specification. Radio frequency coaxial connectors with screw coupling, typically for use in 75 ohm cable networks (type F)

BS EN 61169-8:2007

Radio-frequency connectors. Sectional specification. RF coaxial connectors with inner diameter of outer conductor 6,5 mm (0,256 in) with bayonet lock. Characteristic impedance 50 ohms (type BNC)

BS EN 61951-1:2014

Secondary cells and batteries containing alkaline or other non-acid electrolytes. Portable sealed rechargeable single cells. Part 1 Nickel-cadmium

BS EN 62034:2012

Automatic test systems for battery powered emergency escape lighting

BS EN 62148-17:2014

Fibre optic active components and devices. Package and interface standards. Transmitter and receiver components with dual coaxial RF connectors

BS EN 62639:2012

Fluorescent induction lamps. Performance specification

BS QC 221100:1997

Radio-frequency connectors. RF coaxial connectors with inner diameter of outer conductor 4,13 mm (0,163 in) with screw coupling. Characteristic impedance 50 Ohms (Type SMA)

BS QC 221300:1997

Radio-frequency connectors. RF coaxial connectors with inner diameter of outer conductor 6,5 mm (0,256 in) with screw coupling. Characteristic impedance 50 Ohms. (Type TNC)

BS QC 221400:1997

Radio-frequency connectors. RF coaxial connectors with inner diameter of outer conductor 3 mm (0,12 in)

with screw coupling. Characteristic impedance 50 Ohms (Type SMC)

BS QC 222000:1996

Radio-frequency connectors. RF coaxial connectors with inner diameter of outer conductor 6,5 mm (0,256 in) with screw coupling. Characteristic impedance 50 Ohms. (Type TNC)

---

## Y10 PIPELINES AND PIPEWORK

### 1000 GENERAL

#### 2010A HEAVY BLACK STEEL PIPES TO BS EN 10255:

- Material - Steel
- Standard - BS EN 10255
- Dimensions - Heavy. Random single lengths, 4m to 7m.
- Ends - Screwed to BS 21 and BS EN 10226-1, taper thread or plain.
- Finish - Varnished.

#### 2010B MEDIUM BLACK STEEL PIPES TO BS EN 10255:

- Material - Steel
- Standard - BS EN 10255
- Dimensions - Medium. Random single lengths, 4m to 7m.
- Ends - Screwed to BS 21 and BS EN 10226-1, taper thread or Plain.
- Finish - Varnished.

#### 2010C MEDIUM GALVANISED STEEL PIPES TO BS EN 10255:

- Material - Steel
- Standard - BS EN 10255
- Dimensions - Medium. Random single lengths, 4m to 7m.
- Ends - Screwed to BS 21 and BS EN 10226-1, taper thread.
- Finish - Galvanised.

#### 2010D HEAVY GALVANISED STEEL PIPES TO BS EN 10255:

- Material - Steel
- Standard - BS EN 10255
- Dimensions - Heavy. Random single lengths, 4m to 7m.
- Ends - Screwed to BS 21 and BS EN 10226-1, taper thread.
- Finish - Galvanised.

#### 2010E HEAVY BLACK STEEL PIPES TO BS EN 10255 - GROOVED ENDS:

- Material - Steel
- Standard - BS EN 10255
- Dimensions - Heavy. Random single lengths, 4m to 7m.
- Ends - Grooved for mechanical joints.
- Finish - Unvarnished, varnished, painted.

#### 2010F MEDIUM BLACK STEEL PIPES TO BS EN 10255 - GROOVED ENDS:

- Material - Steel
- Standard - BS EN 10255
- Dimensions - Medium. Random single lengths, 4m to 7m.
- Ends - Grooved for mechanical joints.
- Finish - Unvarnished, varnished, painted.

2010H MEDIUM GALVANISED STEEL PIPES TO BS EN 10255 - GROOVED ENDS:

- Material - Steel
- Standard - BS EN 10255
- Dimensions - Medium. Random single lengths, 4m to 7m.
- Ends - Grooved for mechanical joints.
- Finish - Galvanised.

2012A LIGHT GAUGE CARBON STEEL FOR PUSH-FIT AND PRESS-FIT SYSTEMS:

- Standard - Manufacturer's standard.
- Material - Carbon steel.
- Dimensions - Manufacturer's standard.
- Ends - Plain.
- Finish - Galvanised externally.

2020A STEEL FITTINGS - SCREWED BENDS AND SPRINGS TO BS EN 10255:

- Material - Steel grade, seamless.
- Standard - BS EN 10255.
- Size range - 6mm to 150mm.
- Dimensions - BS EN 10255, medium weight.
- Ends - Screwed to BS 21 and BS EN 10226-1.
- Finish - Galvanised.

2060A HEAVY WEIGHT CARBON STEEL FITTINGS, BUTT WELDED TO BS EN 10253:

- Material
- Carbon steel, grade 430, electric resistance welded.
- Standard - BS EN 10253-1 or BS EN 10253-2.
- Size range - 25mm to 400mm.
- Dimensions - BS EN 10253-1 or BS EN 10253-2 Heavy
- Ends - Bevelled.
- Finish - Varnished.

2060B MEDIUM WEIGHT CARBON STEEL FITTINGS, BUTT WELDED TO BS EN 10253:

- Material
- Carbon steel, grade 430, electric resistance welded.
- Standard - BS EN 10253-1 or BS EN 10253-2.
- Size range - 25mm to 400mm.
- Dimensions - BS EN 10253-1 or BS EN 10253-2 Medium.
- Ends - Bevelled.
- Finish - Varnished.

2070A MALLEABLE CAST IRON FITTINGS, SCREWED:

- Material - Cast iron to BS EN 1562.
- Standard - BS 143 & 1256 or BS EN 10242.
- Size range - 10mm to 164mm.

- Dimensions - BS 143 & 1256 or BS EN 10242.
- Ends - screwed to BS 21 and BS EN 10226-1.
- Finish - Black

2070B GALVANISED MALLEABLE CAST IRON FITTINGS, SCREWED:

- Material - Cast iron to BS EN 1562.
- Standard - BS 143 & 1256 or BS EN 10242.
- Size range - 10mm to 164mm.
- Dimensions - BS 143 & 1256 or BS EN 10242.
- Ends - screwed to BS 21 and BS EN 10226-1.
- Finish - Galvanized.

2080E GALVANISED CAST IRON FITTINGS, GROOVED FOR MECHANICAL JOINTS:

- Material - Steel fittings to ASTM A-536, grade 65-45-12.I
- Standard - Manufacturer's.
- Size range - 20mm to 600mm.
- Ends - Grooved or mechanical joints.
- Finish - Galvanized.

2080F PAINTED STEEL FITTINGS, GROOVED FOR MECHANICAL JOINTS:

- Material - Steel fittings to ASTM A-53.
- Standard - Manufacturer's.
- Size range - 20mm to 600mm.
- Ends - Grooved for mechanical joints.
- Finish - Painted.

2220 LIGHT GAUGE STAINLESS STEEL TO BS EN 10312:

- For use with push and pressfit piping systems.
- Material - Stainless steel, austenitic grade 316 (1.4401).
- Standard - BS EN 10312.
- Dimensions - BS EN 10312 as per tables 1 and 2.
- Ends - Plain.
- Finish - Uncoated.

2250A AUSTENITIC STAINLESS STEEL TO BS EN 10216-5:

- Material - Austenitic stainless steel, seamless.
- Standard - BS EN 10216-5.
- Dimensions - BS EN ISO 1127.
- Ends - Plain.
- Finish - Uncoated.

2250B AUSTENITIC STAINLESS STEEL TO BS EN 10217-1:

- Material - Austenitic stainless steel, welded.
- Standard - BS EN 10217-7.
- Dimensions - BS EN ISO 1127.

- Ends - Plain
- Finish - Uncoated.

**2255A STAINLESS STEEL FITTINGS, GROOVED MECHANICAL JOINTS:**

- Material - stainless steel grades 304, 316, 316L, 316T, schedules 5S, 10S, 20S, 40S.
- Standard - manufacturer's.
- Size range - 20mm to 600mm.
- Dimensions - manufacturer's standard.
- Ends - grooved for mechanical joints. Use special 'RX' type roll sets for stainless steel pipe.
- Finish - natural.

**2270A COPPER HALF HARD:**

- Kitemarked.
- Material - copper.
- Standard - BS EN 1057, R250, (Class X).
- Dimensions - BS EN 1057 table 3.
- Ends - plain, grooved for mechanical joints; copper-tube dimensioned.
- Finish - uncoated.

**2270B CHROMIUM PLATED COPPER, HALF HARD:**

- Kitemarked.
- Material - Copper.
- Standard - BS EN 1057, R250, (Class X).
- Dimensions - BS EN 1057 table 3.
- Ends - Plain
- Finish - Chromium plated.

**2310A CAPILLARY FITTINGS FOR COPPER TUBING, GENERAL POTABLE RANGE:**

- Material - Copper or dezincifiable resistant copper alloy.
- Standard - BS EN 1254-1.
- Size range - 6mm to 67mm.
- Dimensions - BS EN 1254-1 table 2.
- Ends - Integral (lead-free) solder ring.
- Finish - Natural.

**2310B CAPILLARY FITTINGS FOR CHROME PLATED COPPER TUBING, POTABLE RANGE:**

- Material - Copper or dezincifiable resistant copper alloy.
- Standard - BS EN 1254-1.
- Size range - 6mm to 67mm.
- Dimensions - BS EN 1254-1 table 2.
- Ends - Integral (lead-free) solder ring.
- Finish - Chrome plated.

**2320A TYPE A COMPRESSION FITTINGS FOR COPPER TUBING:**

- Kitemarked.

- Material - Dezincifiable resistant copper alloy
- Standard - BS EN 1254-2, type A, non-manipulative.
- Size range - 6mm to 54mm.
- Dimensions - BS EN 1254-2, table 2 and 3.
- Ends - Socket.
- Finish - Natural.

2320B TYPE A COMPRESSION FITTINGS FOR CHROME PLATED COPPER TUBING:

- Kitemarked.
- Material - Dezincifiable resistant copper alloy and brass.
- Standard - BS EN 1254-2, type A, non - manipulative.
- Size range - 6mm to 54mm.
- Dimensions - BS EN 1254-2, table 2 and 3.
- Ends - Socket.
- Finish - Chrome plated.

2350A CAST IRON PIPES AND FITTINGS TO BS 416-1:

- Material - Cast grey or ductile iron.
- Standard - BS 416-1, spun.
- Dimensions - BS 416-1.
- Ends - Socket type A or B.
- Finish - Hot dipped to BS 416-1.

2370A CAST IRON PIPES TO BS 437 FOR FLEXIBLE JOINTS:

- Material - Cast iron.
- Standard - BS 437.
- Dimensions - BS 437.
- Ends - For flexible joint to BS EN 877.
- Finish - Hot dipped to BS 437.

2380A CAST IRON FITTINGS TO BS 437 FOR FLEXIBLE JOINTS:

- Material - Cast iron.
- Standard - BS 437, sand cast.
- Size range - 50mm to 225mm.
- Dimensions - BS 437, figures 1 to 66.
- Ends - For flexible joints to BS EN 877.
- Finish - Hot dipped to BS 437.

2390A RED CAST IRON PIPES AND FITTINGS TO BS EN 877:

- Material - Cast iron.
- Standard - BS EN 877.
- Dimensions - BS EN 877, table 1.
- Ends - Plain.
- Finish - Red epoxy.

2390B GREY CAST IRON PIPES AND FITTINGS TO BS EN 877:

- Material - Cast iron.
- Standard - BS EN 877.
- Dimensions - BS EN 877, table 1.
- Ends - Plain.
- Finish - Grey epoxy.

2410A FLANGED DUCTILE IRON PIPES AND FITTINGS TO BS EN 545:

- Material - Ductile iron.
- Standard - BS EN 545.
- Dimensions - Flanged, class K9.
- Ends - Flanged.
- Finish - External, zinc rich, with polyethylene sleeving, extruded polyethylene, extruded polypropylene or polyurethane.  
Internal, polyurethane to BS EN 15189.

2410B DUCTILE IRON PIPES AND FITTINGS TO BS EN 545:

- Material - Ductile iron.
- Standard - BS EN 545.
- Dimensions - Spigot/socket, tables 18 and 19.
- Ends - Spigot and socket.
- Finish - External, zinc rich, with polyethylene sleeving, extruded polyethylene, extruded polypropylene or polyurethane.  
Internal, polyurethane to BS EN 15189.

2425A FLANGED DUCTILE IRON PIPES AND FITTINGS TO BS ISO 2531:

- Material - Ductile iron.
- Standard - BS ISO 2531.
- Dimensions - Flanged, table 16.
- Ends - Flanged.
- Finish - External, zinc rich, with polyethylene sleeving, extruded polyethylene, extruded polypropylene or polyurethane to BS EN 15189.  
Internal, high alumina cement mortar.

2425B DUCTILE IRON PIPE AND FITTINGS TO BS ISO 2531:

- Material - Ductile iron.
- Standard - BS ISO 2531.
- Dimensions - Spigot/socket, table 17.
  - Permissible deviation on length of fittings, table 6.
- Ends - Spigot or socket.
- Finish - External, zinc rich, with polyethylene sleeving, extruded polyethylene, extruded polypropylene or

polyurethane to BS EN 15189.

- Internal, high alumina cement mortar.

#### 2430 MULTILAYERED PIPING SYSTEM FOR HOT AND COLD WATER TO BS EN ISO 21003:

- Piping system to
  - BS EN ISO 21003-1
  - BS EN ISO 21003-2
  - BS EN ISO 21003-3
  - BS EN ISO 21003-5
- Materials - as scheduled or specified in the particular specification.
  - Appropriate standards.
    - Polypropylene (PP)
      - BS EN ISO 15874-1
      - BS EN ISO 15874-2
      - BS EN ISO 15874-3
      - BS EN ISO 15874-5
    - Crosslinked polyethylene (PE-X)
      - BS EN ISO 15875-1
      - BS EN ISO 15875-2
      - BS EN ISO 15875-3
      - BS EN ISO 15875-5
    - Polybutylene (PB)
      - BS EN ISO 15876-1
      - BS EN ISO 15876-2
      - BS EN ISO 15876-3
      - BS EN ISO 15876-5
    - Chlorinated polyvinyl chloride (PVC-C)
      - BS EN ISO 15877-1
      - BS EN ISO 15877-2
      - BS EN ISO 15877-3
      - BS EN ISO 15877-5
    - Polyethylene of raised temperature resistance (PE-RT)
      - BS EN ISO 22391-1
      - BS EN ISO 22391-2
      - BS EN ISO 22391-3
      - BS EN ISO 22391-5
  - Installation standard - manufacturer's standard.
  - Size range - 16mm to 50mm.
  - Dimension - manufacturer's standard.
  - Ends - compression.
  - Finish - black.

#### 2440 MULTILAYERED PLASTICS PIPE SYSTEMS FOR INDOOR GAS INSTALLATIONS TO BS ISO

17484-1:

- Stress bearing polymeric materials, with or without a metallic layer.
- System standard - BS ISO 17484-1.
- Materials - as scheduled or specified in the particular specification.
  - Appropriate standards
    - Polyethylene (PE)
      - BS ISO 4437-1
      - BS ISO 4437-2
      - BS ISO 4437-3
      - BS ISO 4437-5
    - Crosslinked polyethylene (PE-X)
      - BS ISO 14531-1
      - BS ISO 14531-2
      - BS ISO 14531-3
      - BS ISO 14531-5
      - ISO 10146
    - Polyethylene of raised temperature resistance (PE-RT)
      - BS ISO 4437-1
      - BS ISO 4437-2
      - BS ISO 4437-3
      - BS ISO 4437-5
      - ISO 24003
  - Size range - 16mm to 63mm.
  - Dimension - Manufacturer's standard.
  - Fittings - Mechanical, electrofusion.
  - Finish - Manufacturer's standard.

2442 PLASTIC PIPING SYSTEMS TO BS EN 15014:

- Standard - BS EN 15014.
- Application - Buried and above ground systems for water (not potable) and other fluids under pressure.
- Performance characteristics for pipes, fittings and their joints.
- Performance characteristics - reaction to fire; external pressure strength; internal pressure strength; dimensional tolerance; tightness (air and water); durability; dangerous substances.

2455A PLASTICS PIPING SYSTEMS FOR WATER SUPPLY - PIPES TO BS EN ISO 1452:

- Material - Unplasticised polyvinyl chloride (PVC-U).
- Standard - BS EN ISO 1452-2.
- Dimensions - Length - manufacturer's standard range. BS EN ISO1452-2 tables 1, 2, 3, 4 and 5.
- Ends - Plain; elastomeric ring seal socket and spigot; or socket and spigot for solvent cement.
- Finish - Grey, blue or cream.

2475A PLASTICS PIPING SYSTEMS FOR WATER SUPPLY - FITTINGS TO BS EN ISO 1452:

- Plastic piping system for water under pressure up to 45°C and drainage/sewerage under pressure.
- Material - Unplasticised polyvinyl chloride (PVC-U).
- Standard - BS EN ISO 1452-3.
- Size range - 12mm to 315mm (injection moulding fittings); 63mm to 630mm (bends made from pipe)
- Dimensions - BS EN ISO 1452-3.

- Ends - Plain; elastomeric ring seal socket and spigot; or socket and spigot for solvent cement.
- Finish - Grey or brown.

2490A UNPLASTICIZED PVC FITTINGS, SOLVENT WELDING TO BS 4514:

- Material - Unplasticized PVC.
- Standard - BS 4514, table 2.
- Size range - 82mm, 110mm or 160mm.
- Dimensions - BS 4514 tables 3 and 5.
- Ends - Spigot/plain.
- Finish - Black, grey or white.

2491A ORIENTED UNPLASTICISED PVC TO BS ISO 16422:

- Material - Unplasticised PVC.
- Standard - BS ISO 16422.
- Dimensions - BS ISO 16422.
- Ends - Plain, socket.
- Finish - Blue, grey or cream.

2495A PLASTICS PIPING SYSTEMS TO BS EN 1453:

- Plastics piping system with structured wall pipes for soil and waste discharge (low and high temperature)

within the building structure.

- Material - Unplasticised polyvinyl chloride (PVC-U).
- Standard - BS EN 1453.
- Dimensions - Length - manufacturer's standard range. BS EN 1453 tables 1, 2 and 3.
- Ends - Plain; elastomeric ring seal socket and spigot; or socket and spigot for solvent cement.
- Finish - Grey, black, or white.

#### 2510A COMPRESSION FITTINGS FOR POLYETHYLENE PIPES:

- Material - Copper/copper alloy (dezincifiable resistant).
- Standard - BS EN 1254-3
- Size range - 20mm to 63mm.
- Dimensions - To suit pipes to BS EN 12201.
- Ends - Socket.
- Finish - Cast.

#### 2525A BURIED POLYETHYLENE PIPES FOR GASEOUS FUELS TO BS ISO 4437:

- PE Pipes, including any identification tapes.
- Material - Polyethylene (PE).
- Standard
  - BS ISO 4437-1
  - BS ISO 4437-2
  - BS ISO 4437-3
  - BS ISO 4437-5
- Dimensions
  - BS ISO 4437-1
  - BS ISO 4437-2
  - BS ISO 4437-3
  - BS ISO 4437-5
- Ends - Plain for butt fused joints.
- Finish - Black, yellow.

#### 2525B BURIED POLYETHYLENE PIPES FOR GASEOUS FUELS TO BS ISO 4437:

- PE pipes with co-extruded layers on either or both the outside and/or inside.
- Material - Polyethylene (PE).
- Standard
  - BS ISO 4437-1
  - BS ISO 4437-2
  - BS ISO 4437-3
  - BS ISO 4437-5
- Dimensions
  - BS ISO 4437-1
  - BS ISO 4437-2
  - BS ISO 4437-3
  - BS ISO 4437-5
- Ends - Plain for butt fused joints.
- Finish - Black, yellow.

2525C BURIED POLYETHYLENE PIPES FOR GASEOUS FUELS TO BS ISO 4437:

- PE pipes with additional external thermoplastics layer.
- Material - Polyethylene (PE).
- Standard
  - BS ISO 4437-1
  - BS ISO 4437-2
  - BS ISO 4437-3
  - BS ISO 4437-5
- Dimensions
  - BS ISO 4437-1
  - BS ISO 4437-2
  - BS ISO 4437-3
  - BS ISO 4437-5
- Ends - Plain for butt fused joints.
- Finish - Black, yellow.

2528 POLYETHYLENE PIPES TO BS EN 1555:

- Material - Polyethylene.
- Standard - BS EN 1555-1, BS EN 1555-2 and BS EN 1555-5.
- Dimensions - BS EN 1555-2
  - Lengths - straight pipe 6m or 12m.
  - Lengths - coiled pipe multiples of 50m.
- Marking - BS EN 1555-2
- Ends - Plain.
- Finish
  - Black
  - Yellow
  - Black with yellow identification stripes.

2880 PRE-INSULATED BONDED PIPE SYSTEMS FOR DISTRICT HEATING - STEEL

- Supply pre-insulated bonded pipe systems for underground networks, designed, installed and tested in accordance with BS EN 13941
- For twin pipe systems comply with BS EN 15698-1
- To comprise, straight lengths of prefabricated thermally insulated pipe-in-pipe assemblies comprising mild steel service pipes, polyurethane thermal insulation and high density polyethylene outer casing to BS EN 253.
- Provide fitting and valve assemblies in accordance with BS EN 448, BS EN 488 and BS EN 15698-2 . Joint assemblies to be in accordance with BS EN 489
- Installation to be in accordance with the manufacturer's instructions.

2882 PRE-INSULATED FLEXIBLE PIPE SYSTEMS FOR DISTRICT HEATING - METAL AND PLASTIC SERVICE PIPES:

- Supply pre-insulated flexible pipe systems for underground networks, installed and tested in accordance with relevant parts of BS EN 15632.
- Assembly to comprise prefabricated thermally insulated pipe-in-pipe assemblies comprising service pipes, thermal insulation and high density polyethylene outer casing.
- The detail design and installation of the system shall be in accordance with the manufacturer's

recommendations.

- This shall include all trenching details, wall entry details and all provisions for thermal expansion.
- Manufacturer's proprietary fittings shall be used for tee pieces, elbows, branches, wall entry kits etc.

Whenever possible these should be pre-fabricated/pre-insulated fittings to minimize on-site work.

- Installations to be in accordance with the manufacturer's instructions.

#### 3010A CIRCULAR FLANGES FOR PIPES, PN DESIGNATED - WELDED FLANGE:

- Material - BS EN 1092-1.
- Flange type - Weld neck flange or hubbed slip-on flange for welding.
- Flange facings - Raised face - type B.
- Bolting - In accordance with BS EN 1092-1.

#### 3010B CIRCULAR FLANGES FOR PIPES, PN DESIGNATED - THREADED FLANGE:

- Material to BS EN 1092-1.
- Facings - Raised face type B.
- Bolting - in accordance with BS EN 1092-1.
- Threaded flanges - BS 21 and BS EN 10226-1 parallel thread.

#### 3010C CIRCULAR FLANGES FOR PIPES, PN DESIGNATED - CAST IRON FLANGE:

- Material - BS EN 1092-2 - Ductile cast iron.
- Bolting - In accordance with BS EN 1092-2.

#### 3020A JOINTING RINGS - NON-METALLIC FLAT GASKETS:

- Non-metallic flat gaskets for flanges to BS EN 1092-4.
- Standard - BS EN 1514-1
- Gasket type - Full face for type B.

#### 3020B JOINTING RINGS - METALLIC GASKETS:

- Corrugated, flat or grooved metallic and filled metallic gaskets for flanges to BS EN 1092-4.
- Standard - BS EN 1514-4
- Gasket type - Corrugated metal.
- Gasket design - Self centring for type B.

#### 3020C JOINTING RINGS FOR CAST IRON:

- Non-metallic flat gaskets for flanges to BS EN 1092-2
- Standard - BS EN 1514-1.
- Gasket type - Suitable for flanges to BS EN 545, BS EN 598 and BS EN 969.

#### 3030A SCREWED JOINTS TO BS 21 AND BS EN 10226-1:

- Use PTFE tape to BS 7786 or use hemp and jointing compound to BS 6956-5, or BS EN 751-2.

#### 3030B SCREWED JOINTS TO BS 21 AND BS EN 10226-1 WITH PTFE TAPE:

- Use PTFE tape to BS 7786.

#### 3030C SCREWED JOINTS TO BS 21 AND BS EN 10226-1 WITH CHEMICAL CLEANING:

- Use hemp and jointing compound to BS 6956-5 or BS EN 751-2, prior to chemical treatment and use

PTFE tape to BS 7786 after chemical treatment.

3050A WELDED JOINTS, WELDING RODS FOR STEEL PIPES:

- Gas welding, BS EN 12536; electric arc welding BS 2971.

3070A CAPILLARY JOINTS FOR COPPER:

- Use materials as follows
- Solder - BS EN ISO 9453.
- Flux - Copper pipe - BS EN 29454-1.

3070B CAPILLARY JOINTS FOR POTABLE WATER:

- Use materials as follows
- Solder - Use lead-free fittings in accordance with BS EN 1254-1, on potable water systems.
- Flux - Copper pipe - BS EN 29454-1.

3095B JOINTING MATERIALS FOR PLASTICS PIPES TO BS 7291 - PUSHFIT:

- Plastics fittings to BS 7291.
  - Method of jointing to BS 5955-8
  - Mechanical joints - Pushfit.

3095C JOINTING MATERIALS FOR PLASTICS PIPES TO BS 7291 - SOLVENT CEMENT:

- Plastics fittings to BS 7291.
  - Method of jointing to BS 5955-8 - Solvent cement joints.

3105A STAINLESS STEEL COUPLINGS FOR CAST IRON PIPES TO BS EN 877:

- Material - Stainless steel, with zinc coated bolts and bolt holder.
- Gasket - EPDM.

3105B RED DUCTILE IRON COUPLINGS FOR CAST IRON PIPES TO BS EN 877:

- Material - Ductile iron.
- Finish - Red.
- Gasket - EPDM.

3105C GREY DUCTILE IRON COUPLINGS FOR CAST IRON PIPES TO BS EN 877:

- Material - Ductile iron.
- Finish - Grey.
- Gasket - EPDM.

3105D BLACK DUCTILE IRON COUPLINGS FOR CAST IRON PIPES TO BS EN 877:

- Material - Ductile iron.
- Finish - Black.
- Gasket - EPDM.

**3110A SPIGOT/SOCKET CAULKED JOINTS:**

- Use for spun cast iron pipe.
- Yarn - Tarred hemp or spun yarn; or sterile inorganic yarn.
- Lead - Virgin blue pig lead.

**3170A FLEXIBLE COUPLINGS, SLEEVE TYPE:**

- Joint - Bolted, sleeve type, with wedge type elastomeric gaskets.
- Type - Non-end load capable.
- Dimensions - Manufacturer's standard.
- Material - Ductile cast iron to BS EN 1564, or to BS EN 1563.
- Finish - Manufacturer's standard.
- Gaskets - In accordance with BS EN 681-1, BS EN 681-2 or BS EN 682.

**3180A FLEXIBLE FLANGE ADAPTERS, SLEEVE TYPE:**

- Joint - Bolted, sleeve type, with wedge type elastomeric gaskets, flanged on end.
- Type - Non-end load capable.
- Dimensions - Manufacturer's standard.
- Material - Ductile cast iron to BS EN 1564.
- Flange - To connect to BS EN 1092-2, PN10 flange.
- Finish - Manufacturer's standard.
- Gaskets - In accordance with BS EN 681-1, BS EN 681-2 or BS EN 682.

**3190A WALL, FLOOR AND CEILING CHROMIUM PLATED MASKING PLATES:**

- Material - Copper alloy, chromium plated.
- Type - Heavy, split on the diameter, close fitting to outside of pipe.
- Fixing - Chrome raised head fixing screws.

**3190B WALL, FLOOR AND CEILING PLASTIC MASKING PLATES:**

- Material - Plastic.
- Fixing - Clipped with plastic lug.

**4010 APPEARANCE:**

- Arrange all exposed pipe runs to present neat appearance, parallel with other pipe or service runs and building structure, subject to gradients for draining or venting.
- Ensure all vertical pipes are plumb or follow building line.

**4020 SPACING:**

- Space pipe runs in relation to one another, other services runs and building structure, allow for specified thickness of thermal insulation and ensure adequate space for access to pipe joints, etc.
- The following are recommended as minimum clearances in spacing of pipe runs:-

Between	and	Clearance (mm)
Pipeline insulated or uninsulated	Wall Finish	25
	Ceiling Finish	50
	Soffit Floor Finish	150
Insulated Pipeline	Adjacent service runs	25
Uninsulated pipeline	Adjacent service runs	50
Adjacent pipelines	Both uninsulated	150
	One uninsulated	75
	Both insulated	25

#### 4030 GRADIENTS:

- Install pipework with gradients to allow drainage and/or air release, and to the slopes where indicated.

#### 4040A AIR BOTTLES:

- Provide a means of venting the pipe system at all high points.
- Provide a vertical extension from the pipe approximately 100mm long, at the bore of the pipe, with a copper extension pipe with a manual vent cock located in an easily accessible position.

#### 4040B AUTOMATIC AIR VENTS:

- Provide a means of venting the pipe system at all high points.
- Provide an automatic air vent valve with a copper outlet pipe from the valve to a tundish in an adjacent drain line or to another suitable location.

#### 4050 DRAIN REQUIREMENTS:

- Grade pipework to allow system to be drained. Provide a means of draining the system at all low points.

#### 4060 EXPANSION AND CONTRACTION:

- Arrange supports and fixings to accommodate pipe movement caused by the thermal changes, generally allow the flexure at changes in direction. Allow for movement at branch connections.
- For water systems, using a grooved pipework system, the proprietary flexible couplings may be used to accommodate thermal growth, contraction and for the elimination of expansion loops. The type, quantity required, locations and installation/support details of flexible couplings proposed shall be in accordance with the manufacturer's written recommendations and show on the installation drawings. Where loops are required, use flexible couplings on the loop.

#### 4070A PIPE FITTINGS, BENDS/SWEPT TEES:

- Use eccentric type reductions and enlargements on horizontal pipe runs to allow draining and venting, concentric on vertical pipes, with easy transition and an included angle not exceeding 30 degree. Do not use bushes, except at radiators and at fittings where required size is not of standard manufacture. Where required, use eccentric bushes to allow draining or venting; maximum aspect ratio not to exceed two pipe

sizes; above this ratio use reducing fittings. Use square tees at venting and draining points. Square elbows are not acceptable. Use bends and swept tees where practical.

#### 4070B PIPE FITTINGS, ELBOWS/SQUARE TEES:

- Use eccentric type reductions and enlargements on horizontal pipe runs to allow draining and venting, concentric on vertical pipes, with easy transition and an included angle not exceeding 30 degree. Do not use bushes, except at radiators and at fittings where required size is not of standard manufacture. Where required, use eccentric bushes to allow draining or venting; maximum aspect ratio not to exceed two pipe sizes; above this ratio use reducing fittings. Use square tees at venting and draining points. Square elbows are not acceptable. Use elbows and square tees.

#### 4110 PIPES THROUGH NON FIRE RATED WALLS AND FLOORS:

- Enclose pipes passing through building elements, (walls, floors, partitions, etc.) concentrically within purpose made sleeves. Fit masking plates where visible pipes pass through building elements, including false ceilings of occupied rooms. Unless detailed elsewhere, carry insulation including vapour barrier where necessary through pipesleeves.

#### 4120A PIPE SLEEVES IN NON FIRE RATED WALLS AND FLOORS - INSULATION NOT CARRIED THROUGH:

- Where pipe insulation is not carried through pipe sleeve, cut sleeves from material same as pipe one or two sizes larger than pipe to allow clearance. Do not use sleeves as pipe supports.
- Install sleeves flush with building finish. In areas where floors are washed down install with a 100mm protrusion above floor finish and cap off end of sleeve.

#### 4125 PIPE SLEEVES THROUGH FIRE BARRIERS:

- Where pipes pass through a fire rated wall or floor use one of the following methods
  - Proprietary sleeves
    - Install proprietary fire sleeves, tested to BS 476-20 and the principles of BS 476-22, to meet the fire rating of the partition. In each case the thermal insulation and vapour sealing properties (where required) shall be maintained through the wall, floor or partition. The sleeves shall be
      - Mineral wool insulated fire sleeves comprising a combination of mineral wool and graphite intumescent or
      - A one piece stainless steel sleeve with an intumescent lining the full length and 3 bands of acoustic foam adhered to the bore of the sleeve. Where insulation is carried through the wall or partition and vapour seal is required, oversized mineral wool shall be fitted to the pipework with an oversized proprietary sleeve fitted over the mineral wool.
  - Ablative coated batt
    - All components and sealants / glue used must be tested to BS 476 and be provided from a single manufacturer.
    - For plastic pipes, install a proprietary ablative coated batt in combination with a proprietary fire sleeve where the pipes pass through the batt. Ablative batt minimum density to be 180 kg/m<sup>3</sup> and have a test certificate to match the fire resistance of the wall or partition and should have LPCB third party approval.
    - For metal pipes install proprietary fire rated insulation for 500mm either side of the batt. Standard -

BS 3958-4

- Proprietary systems must be installed strictly in accordance with the manufacturers' recommendations.

4150A TEMPORARY PLUGS, CAPS AND FLANGES:

- Seal all open ends as installation proceeds by plugs, caps or blank flanges, to prevent ingress of foreign matter.
  - Use plugs of metal, plastic or wood to suit pipework material.
- In the event of such precautions not being taken, strip out pipework adjacent to open ends to demonstrate that fouling of bores has not occurred.

4160 FLANGED JOINTS GENERAL:

- Use number and diameters of bolts to standard. Fit bolts of length to give not less than one thread, or more than 3mm protrusion beyond nut when joint is pulled up.
- Fit washers under each nut.

4170 DISSIMILAR METALS:

- Take appropriate means to prevent galvanic action where dissimilar metals are connected together.

4180 PIPE RINGS AND CLIPS:

- Select type according to the application and material compatibility, give particular attention where pipes are subject to axial movement due to expansion or contraction.

4190 ANCHORS:

- Construct to resist axial stress transmitted by flexure of horizontal and vertical pipe runs or loading on vertical pipes assuming that unbalanced forces exist at all anchor points, even when these are situated in intermediate positions between two expansion loops or bellows. Use similar or compatible materials to the attached pipe.
- Provide and fix all associated backing plates, nuts, washers and bolts for attachment to or building into building structure; ensure structure is suitable for transmitted stress. Set out and line up anchors accurately in position. Inspect final grouting into building structure.

4200 SLIDE GUIDES:

- Direct movement of expansion and contraction from pipe anchor points towards loops, bellows or flexible inserts. Ensure that thrust is linear relative to the axis of pipe.
- Apply a friction reducing material between metal faces subjected to movement.

4205 PIPE SUPPORTS:

- Arrange supports and accessories for equipment, appliances or ancillary fittings in pipe runs, so that no

undue strain is imposed upon pipes.

- Ensure that materials used for supports are compatible with pipeline materials.

4210 SUPPORT SYSTEM - WIRE ROPE:

- Provide wire rope support system. Confirm wire rope is suitable for supporting pipelines.

4220 SUPPORT SPACING:

- Space supports as tables.

Pipe Size (mm) Nominal	Maximum Support Spacing (m)					
	Steel Pipe (Insulated)		Copper or Light Gauge Stainless Steel Pipe (Insulated)		Iron Pipe	
	horizontal	vertical	horizontal	vertical	horizontal	vertical
Up to 15	1.8	2.4	1.2	1.8	-	-
20	2.4	3.0	1.2	1.8	-	-
25	2.4	3.0	1.5	2.4	-	-
32	2.4	3.0	1.8	3.0	-	-
40	2.4	3.7	1.8	3.0	-	-
50	2.4	3.7	1.8	3.0	1.8	1.8
65	3.0	4.6	2.4	3.7	-	-
80	3.0	4.6	2.4	3.7	2.7	2.7
100	3.0	4.6	2.4	3.7	2.7	2.7
125	3.7	5.5	3.0	3.7	-	-
150	4.5	5.5	3.7	3.7	3.7	3.7
200	6.0	8.5	-	-	3.7	3.7
250	6.5	9.0	-	-	4.5	5.4
300	7.0	10.0	-	-	8.0	10.0
350	10.0	12.0	-	-	-	-
400	10.5	12.6	-	-	-	-
450	11.0	13.2	-	-	-	-
500	12.0	14.4	-	-	-	-
600	14.0	16.8	-	-	-	-

Pipe OD	Maximum Support Spacing (m)	
	PVC or ABS Pipe Contents up to 20°C	
	Horizontal	Vertical
15	0.8	1.2
20	0.8	1.2
25	0.9	1.3
32	1.0	1.5
40	1.1	1.6
50	1.3	1.9
80	1.6	2.4
100	1.9	2.8
150	2.1	3.0
200	2.4	3.6
250	2.6	3.9
300	2.8	4.2

- For grooved steel and copper pipe, no individual pipe length should be left unsupported.
- Vertical support spacing
  - Check total self-weight and pressure loading against manufacturer's recommendations when using mechanical joints or end load capable flexible couplings. Ensure adequate pipe support when using non-end load capable flexible couplings.
  - Space vertical support intervals for plastics pipe at not greater than twice horizontal intervals tabulated.
  - Space external vertical PE gas pipes in accordance with the current edition of IGEM/UP/2
- Space horizontal and vertical pliable corrugated stainless steel gas pipes in accordance with the current edition of IGEM/UP/2.
- Where multiple pipe runs of differing bores are supported from a common point, use support spacing of pipe requiring closest spacing.
- Spacings given for PVC-U pipe to BS EN ISO 1452

#### 4230A ISOLATION AND REGULATION:

- Provide valves, cocks and stop taps for isolation and/or regulation where indicated, and on:-
  - mains to isolate major sections of distribution;
  - The base of all risers and drops except in cases where one item of apparatus only is served which has its own local valve or stop tap;
  - Points of pipe connection of all items of apparatus and equipment except where the item could conveniently be isolated or regulated by valves provided for other adjacent items;
  - Draw-off fittings except where ranges of fittings are served by a common float, the isolator then being fitted with the float.

#### 4240 MAINTENANCE AND RENEWAL:

- Arrange pipework, valves, drains, air vents, demountable joints, supports, etc., for convenient routine maintenance and renewals. Provide all runs with a regularly spaced pattern of demountable joints in the

form of unions, flanges, etc., and also at items of equipment to facilitate disconnection.

- Locate valves, drains, flanges etc. in groups.

#### 5010A WELDING GENERAL, CLASS 1:

- Use skilled craftsman in possession of a current Certificate of Competence appropriate to type and class of work, issued by an approved authority. Mark each weld to identify operative. Submit specimen welds, representative of joints and conditions of site welding, for each craftsman, test non-destructively, approximately 10% of butt weld joints and 5% of all other joints.
- Weld pipeline joints to BS 2633 as appropriate. Carry out non-destructive testing on 10% or as indicated.

#### 5010B WELDING GENERAL, CLASS 2:

- Use skilled craftsman in possession of a current Certificate of Competence appropriate to type and class of work, issued by an approved authority. Mark each weld to identify operative. Submit specimen welds, representative of joints and conditions of site welding, for each craftsman, test non-destructively, approximately 10% of butt weld joints and 5% of all other joints.
- Weld pipeline joints to BS 2971 and to HVCA Code of Practice TR/5, Welding of Carbon Steel Pipework, as appropriate.

#### 5020 WELDED JOINTS, STEEL PIPES:

- Preparation, Making and Sealing.
  - Arc welding, conforming to BS 2971 appropriate to system temperature and pressure. Use arc welding process on piping greater than 100mm.

#### 5030 PAINTING WELDED JOINTS, STEEL PIPES:

- Unless pipework is being prepared for galvanizing after manufacture, wire brush and paint all welds with red oxide paint when welds are complete.

#### 5040 FLANGED JOINTS, STEEL PIPES:

- Welded Flanges
  - Weld neck and bore of 'slip on' flange.
  - Butt weld neck of welding neck flange.
- Screwed Flanges
  - Apply jointing materials. Screw on flange and expand tube into flange with roller expander where necessary.
- Preparation
  - Ensure that flange mating faces are parallel; flange peripheries are flush with each other; and bolt holes are correctly aligned.
- Making and Sealing
  - Insert jointing between flange mating faces. Pull up joint equally all round.

#### 5050 SCREWED JOINTS, STEEL PIPES:

- Preparation
  - Ensure that plain ends are cut square. Reamer out bore at plain ends.
  - Screw plain ends, taper thread.
- Making and Sealing
  - Coat male pipe threads with jointing compound and hemp, or PTFE tape on small sizes. Immediately

after applying coating, connect with female end of socket or fitting, and tighten ensuring that coating does not intrude into pipe. Leave joint clean.

#### 5060 MECHANICAL JOINTS, GROOVED STEEL AND STAINLESS STEEL PIPES:

- Preparation
  - Ensure installers receive training from manufacturer on correct installation technique, and correct and safe use of pipe grooving tool by a factory trained manufacturer's representative. The grooving tool must be manufactured by the grooved coupling manufacturer. Ensure that cut ends are square, free of bumps, dents and score marks and that pipe outside diameter is within mechanical joint manufacturer's tolerances. Form groove in accordance with manufacturer's recommendations and to manufacturer's groove diameter tolerances. Ensure that the manufacturer supplies a grooved measuring tape to be able to check the groove is in tolerance. Manufacturer must provide certification to anyone grooving onsite or in a fabrication shop to show the correct training has been provided. Assemble joint in accordance with manufacturer's instructions.
- Making and Sealing
  - Ensure gasket material is suitable for service. For standard couplings thoroughly lubricate gasket, externally and internally, using manufacturer's recommended lubricant. Stretch gasket over one pipe end and bring pipe ends together. Slide gasket into central position over both pipe ends. Position joint half housings over gasket and insert bolts and nuts. Joints should not require any torque to show visual bolt pad to pad connection, if alternative joints are to be proposed that require torque this must be notified at the time of tender for approval. Tighten bolts to manufacturer's instructions. Check alignment of joint and pipework.
- Earth continuity
  - Full earth continuity shall be achieved by both rigid and flexible couplings. If the manufacturer's coupling selected cannot achieve this, install proprietary earth continuity clips to ensure compliance with IET regulations at each joint.
- Installation-ready couplings
  - Do not dismantle the coupling. Lubricate inner sealing lips of gasket using manufacturer's recommended lubricant. Assemble the joint by inserting the grooved pipe ends into each opening of the coupling until the ends make contact with the gasket center leg. Tighten bolts to manufacturer's instructions. Check alignment of joint and pipework.

#### 5070A ANCHORS, STEEL PIPES, U-BOLTS:

- Provide anchors constructed using mild steel over-straps or heavy U-bolts. Secure to channel section, adequately attached to or grouted into building structure; weld longitudinal edges of strap to pipe.

#### 5070B ANCHORS, STEEL PIPES, SLIP-ON FLANGES:

- Provide anchors constructed by passing two slip-on flanges over pipe to anchor point. Bolt together through an interposed mild steel channel section attached to or grouted into building structure, and finally weld flanges to pipe.

#### 5090 STEEL PIPEWORK PAINTING:

- Remove scale, rust or temporary protective coating by chipping, wire brushing or use of approved

solvents and paint with one coat of red oxide primer, as work proceeds.

**5100 COMPRESSION JOINTS, STAINLESS STEEL PIPES:**

- Use BS EN 1254-2 Type 'A' fittings.
- Preparation - Ensure that plain ends are cut square. Reamer out bore at plain ends to full bore size. Clean plain ends with fine steel wool.
- Making and Sealing - In accordance with fitting manufacturer's instructions.

**6030 COMPRESSION JOINTS, COPPER PIPES, LIGHT GAUGE:**

- Preparation for fittings to BS EN 1254-2.
  - Type 'A' fitting
    - Ensure that plain ends are cut square. Reamer out bore at plain ends to full bore size. Clean plain ends with fine steel wool or fine sandpaper.
  - Type 'B' fitting
    - Ensure that plain ends are cut square. Reamer out bore at plain ends to full bore size. Clean plain ends with fine steel wool or fine sandpaper. Then comply with manufacturer's instructions.
- Making and Sealing - As manufacturer's instructions.

**6040 CAPILLARY JOINTS, COPPER PIPES, LIGHT GAUGE:**

- Preparation - Ensure that plain ends are cut square. Reamer out bore at plain ends to full bore size. Clean plain ends with fine steel wool.
- Making and sealing - Use specified flux ensuring no excess material used. Make joint in accordance with manufacturer's instructions. Clean off traces of flux when joint is completed.

**6060A ANCHORS, COPPER PIPES, SADDLE CLAMPS:**

- Provide anchors constructed by fitting two flanges to copper female adapters in pipe run at anchor point. Bolt together through an interposed mild steel channel section attached to or grouted into building structure.

**6060B ANCHORS, COPPER PIPES, SADDLE CLAMPS:**

- Anchor pipework using saddle clamps to mild steel channel section attached to or built into building structure.

**7010 FLANGED JOINTS, CAST IRON/DUCTILE IRON PIPES:**

- Preparation - Ensure that flange mating faces are parallel, flange peripheries are flush with each other and bolt holes are correctly aligned.
- Making and Sealing - Coat both sides of joint ring with jointing compound to BS 6956-5 or BS EN 751-2. Insert joint ring between flange mating faces. Pull up joint with bolts, nuts and washers, ensuring that excess compound does not intrude into the pipe. Leave joint clean.

**7020 CAULKED JOINTS, CAST IRON/SPUN CAST IRON PIPES:**

- Preparation - Ensure plain ends are cut square.
- Making and sealing - Caulk socket with yarn, fill socket with molten lead, allow to cool and caulk home.

Ensure bore of pipe is not obstructed.

#### 7030 FLEXIBLE JOINTS, CAST IRON PIPES:

- Preparation - Ensure that cut ends are square. Form groove to manufacturer's detail. Assemble joint in accordance with manufacturer's instructions.
- Making and Sealing - Ensure joint ring is suitable for service. Thoroughly lubricate joint ring. Slip ring over pipe end and bring ends together. Slide ring into central position over both pipe ends. Position metal half housings over joint ring and insert bolts and nuts. Tighten bolts to manufacturer's instructions. Check alignment of joint and pipework.

#### 8005 THERMOPLASTIC PIPING SYSTEMS:

- Comply with recommendations in PD CEN/TR 13801 and general installation practice given in
  - BS EN 12056-1
  - BS EN 12056-2
  - BS EN 12056-3
  - BS EN 12056-4
  - BS EN 12056-5

#### 8010 SOLVENT WELDED JOINTS, PVC PIPES:

- Use solvent welded joints generally, ring seal joints at expansion joints and elsewhere as necessary.
- Preparation - Ensure that plain ends are cut square. Reamer out bore at plain ends. Clean plain ends with solvent cleaner.
- Making and Sealing - In accordance with fitting manufacturer's instructions.

#### 8020 FUSION JOINTS, POLYETHYLENE PIPES:

- Preparation - Square cut plain ends. Form pipe ends for socket type joints.
- Making and Sealing - In accordance with fitting manufacturer's instructions.
- Carry out butt fusion jointing of pipes and fittings in accordance with the procedures given in BS ISO 21307.

#### 8030 MECHANICAL FITTINGS FOR POLYETHYLENE PIPE:

- Preparation - Ensure that cut ends are square. Check wall thickness/pressure rating of fitting.
- Making and sealing - Ensure correct gasket type is used for service (e.g. water or gas). Assemble fitting in accordance with manufacturer's instructions.

#### 8040 ANCHORS - PVC PIPES:

- Clamp pipework to mild steel channel section attached to or grouted into building structure, using PVC coated over-straps, or clamps and with a polypropylene strip between pipe and mild steel section.

#### 8050 JOINTING POLYBUTYLENE PIPES AND FITTINGS:

- Carry out installation of polybutylene pipes and fittings in accordance with manufacturer's instructions.

#### 8070 WORKMANSHIP, PLASTIC PIPES WITH SECONDARY CONTAINMENT AND FITTINGS FOR

#### UNDERGROUND FUEL OIL SYSTEMS:

- Install plastic pipes with secondary containment for underground fuel oil systems in accordance with OFTEC TI/134 and the manufacturer's recommendations.

#### 9020A STEAM AND CONDENSE MAINS:

- Install steam and condense mains to a minimum fall of 1 in 250. Take steam connections to plant and equipment from the top of the steam main. Connect condense discharge from trap sets, into the top of the condense main.
- Do not use trap sets to lift condense on equipment with automatic control valves.
- On steam mains, provide drain trap sets discharging into the condense mains, at all low points in steam mains. Connect drain traps to a large bore pocket below the steam mains.

#### 9020B STEAM AND CONDENSE MAINS:

- Install steam and condense mains to a minimum fall of 1 in 250. Take steam connections to plant and equipment from the top of the steam main. Connect condense discharge from trap sets, into the top of the condense main. Do not use trap sets to lift condense on equipment with automatic control valves. On steam mains, provide drain trap sets discharging into the condense mains, at all low points in steam mains and immediately before all automatic control valves in the steam mains. Connect drain traps to a large bore pocket below the steam mains.

#### 9030 PROTECTION OF UNDERGROUND PIPEWORK:

- Protect where indicated against corrosion by the application of a compatible anti-corrosive, non-cracking, non-hardening waterproof sealing tape.
- Apply, after cleaning pipework, by wrapping contrawise with two layers spirally around the pipe, ensuring a 50% minimum overlap.

#### 9040A PROTECTION OF BURIED PIPES, UNMARKED:

- Provide earth cover as follows
- Water pipework
  - 900 mm minimum; 1200 mm maximum where practicable.
- Fuel oil and gas - 500 mm minimum.
- Under roadways provide minimum cover of 900 mm.

#### 9040B PROTECTION OF BURIED PIPES, MARKED:

- Provide earth cover as follows
- Water pipework
  - 900 mm minimum; 1200 mm maximum where practicable.
- Fuel oil and gas - 500 mm minimum.
- Under roadways provide minimum cover of 900 mm.
- Provide a marker tape to identify buried pipe services as indicated.

#### 9120A STEELWORK GALVANIZED AFTER MANUFACTURE:

- Prepare supports, bearers and other uncovered steelwork as steel pipework.
- Where not exposed, paint with one coat zinc chromate or red oxide primer.

## **Y11 PIPELINE ANCILLARIES**

2015A STOP VALVES TO BS EN 1213 FOR POTABLE WATER SUPPLIES - COMPRESSION ENDS FOR COPPER:

- Pattern - Straight.
- Material - copper alloy.
- Flow rate class - VA (straight and angle pattern stopvalves).
- End connections - Compression to BS EN 1254-2.

2015B STOP VALVES TO BS EN 1213 FOR POTABLE WATER SUPPLIES - COMPRESSION ENDS

FOR PLASTICS:

- Pattern - Straight.
- Material - copper alloy.
- Flow rate class - VA (straight and angle pattern stopvalves).
- End connections - Compression to BS EN 1254-3.

2015C STOP VALVES TO BS EN 1213 FOR POTABLE WATER SUPPLIES - CAPILLARY:

- Pattern - Straight.
- Material - copper alloy.
- Flow rate class VA (straight and angle pattern stopvalves).
- End connections - Capillary to BS EN 1254-1.

2015D STOP VALVES TO BS EN 1213 FOR POTABLE WATER SUPPLIES - THREADED:

- Pattern - Straight.
- Material - copper alloy.
- Flow rate class - VA (straight and angle pattern stopvalves).
- End connections - Threaded to BS 21 and BS EN 10226-1.

2020A THREADED ENDS GATE VALVES TO BS EN 12288:

- Series - B.
- Gate valve type - Solid or split wedge.
- Ends - Threaded to BS EN ISO 228-1 or ISO 7-1.
- Stem - Inside screw non-rising stem.
- Trim material - Manufacturer's standard.
- Operation - Handwheel.

2020B COMPRESSION ENDS GATE VALVES TO BS EN 12288:

- Series - B.
- Gate valve type - Solid or split wedge.
- Ends - Compression to BS EN 1254-2.
- Stem - Inside screw non-rising stem.
- Trim material - Manufacturer's standard.
- Operation - Handwheel.

2020C FLANGED ENDS GATE VALVES TO BS EN 12288:

- Series - B.
- Gate valve type - Solid or split wedge.
- Ends - Flanged to BS EN 1092-3.
- Stem - Inside screw non-rising stem.
- Trim material - Manufacturer's standard.
- Operation - Handwheel.

2020D LOOSE NUT/UNION ENDS GATE VALVES TO BS EN 12288:

- Series B.
- Gate valve type - Solid or split wedge.

- Ends - Loose nut/union end.
- Stem - Inside screw non-rising stem.
- Trim material - Manufacturer's standard.
- Operation - Handwheel.

2030A FLANGED GATE VALVES TO BS EN 1171:

- Valve type - Solid or split wedge.
- Seat - Metal.
- Ends - Flanged to BS EN 1092-2.
- Body and bonnet material - Grey cast iron.
- Trim category - Copper alloy faced.
- Operation - Handwheel.

2040A THREADED END GLOBE VALVES TO BS 5154:

- Series - B.
- Pattern - Straight.
- Ends - Threaded to BS 21 and BS EN 10226-1.
- Stem - Inside screw rising stem.
- Trim material - Manufacturer's standard.
- Operation - Handwheel.
- Options - Non-metallic renewable seat/disk rings.

2040B FLANGED GLOBE VALVES TO BS 5154:

- Series - B.
- Pattern - Straight.
- Ends - Flanged to BS EN 1092-3.
- Stem - Inside screw rising stem.
- Trim material - Manufacturer's standard.
- Operation - Handwheel.
- Options - Non-metallic renewable seat/disk rings.

2040C COMPRESSION GLOBE VALVES TO BS 5154:

- Series - B.
- Pattern - Straight.
- Ends - Compression fitting to BS EN 1254-2.
- Stem - Inside screw rising stem.
- Trim material - Manufacturer's standard.
- Operation - Handwheel.
- Options - Non-metallic renewable seat/disk rings.

2040D COMPRESSION GLOBE VALVES TO BS 5154 FOR PLASTIC PIPE:

- Series - B.
- Pattern - Straight.
- Ends - Compression fitting to BS EN 1254-3.
- Stem - Inside screw rising stem.
- Trim material - Manufacturer's standard.

- Operation - Handwheel.
- Options - Non-metallic renewable seat/disk rings.

2050A FLANGED GLOBE VALVES TO BS EN 13789:

- Pattern - Straight.
- Stem - Rising stem outside screw.
- Ends - Flanged to BS EN 1092-2.
- Material - Manufacturer's standard.

2060A PARALLEL SLIDE VALVES TO BS EN 1171:

- Ends - Flanged BS EN 1092-2.
- Stem - Rising stem.
- Valve faces - Stainless steel disc and seat.

2070A FLANGED STOP VALVES - GATE TYPE TO BS EN 1984:

- Pattern - Full bore or reduced bore.
- Materials - Cast steel body and materials to suit fluid and operating conditions.
- Ends - Flanged.
- Operation - Handwheel.

2070D THREADED STOP VALVES - GATE TYPE TO BS EN 1984:

- Pattern - Full bore or reduced bore.
- Materials - Cast steel body and materials to suit fluid and operating conditions.
- Ends - Threaded to BS 21 and BS EN 10226-1.
- Operation - Handwheel.

2080A THREADED END BALL TYPE VALVES - SCREW DRIVER/KEY OPERATED:

- Materials - Bronze or DZR copper alloy body.
- Ends - Threaded to BS 21 and BS EN 10226-1.
- Chrome or nickel plated DZR sphere with full bore flow aperture. PTFE seats and stem seals. Anti-blowout stem.
- Operation - Screw driver operated or key operated.

2080B COMPRESSION END BALL TYPE VALVES - SCREW DRIVER/KEY OPERATED:

- Materials - Bronze or DZR copper alloy body.
- Ends - Compression fittings to BS EN 1254-2.
- Chrome or nickel plated DZR sphere with full bore flow aperture. PTFE seats and stem seals. Anti-blowout stem.
- Operation - Screw driver operated or key operated.

2080C THREADED END BALL TYPE VALVES - LEVER OPERATED:

- Materials - Bronze or DZR copper alloy body.
- Ends - Threaded to BS 21 and BS EN 10226-1.
- Chrome or nickel plated DZR sphere with full bore flow aperture. PTFE seats and stem seals. Anti-

blowout stem.

- Operation - lever operated.

2080D COMPRESSION END BALL TYPE VALVES - LEVER OPERATED:

- Materials - Bronze or DZR copper alloy body.
- Ends - Compression fittings to BS EN 1254-2.
- Chrome or nickel plated DZR sphere with full bore flow aperture. PTFE seats and stem seals. Anti-blowout stem.
- Operation - lever operated.

2080E THREADED END BALL TYPE VALVES - LOCKSHIELD:

- Materials - Bronze or DZR copper alloy body.
- Ends - Threaded to BS 21 and BS EN 10226-1.
- Chrome or nickel plated DZR sphere with full bore flow aperture. PTFE seats and stem seals. Anti-blowout stem.
- Operation - lockshield.

2080F COMPRESSION BALL TYPE VALVES - LOCKSHIELD:

- Materials - Bronze or DZR copper alloy body.
- Ends - Compression fittings to BS EN 1254-2.
- Chrome or nickel plated DZR sphere with full bore flow aperture. PTFE seats and stem seals. Anti-

blowout stem.

- Operation - lockshield.

2085A SCREWED END SERVICING VALVES - HANDWHEEL OPERATED:

- Materials - copper alloy body.
- Ends - Screwed to BS EN 1254-2.
- Operation - Handwheel operated.

2085B COMPRESSION END SERVICING VALVES - HANDWHEEL OPERATED:

- Materials - Copper alloy body.
- Ends - Compression fittings to BS EN 1254-2.
- Operation - Handwheel operated.

2085C CAPILLARY END SERVICING VALVES - HANDWHEEL OPERATED:

- Materials - Copper alloy body.
- Ends - Capillary ends to BS EN 1254-1.
- Operation - Handwheel operated.

2085D SCREWED END SERVICING VALVES - LEVER OPERATED:

- Materials - Copper alloy body.
- Ends - Screwed to BS EN 1254-2.
- Operation - Lever operated.

2085E COMPRESSION END SERVICING VALVES - LEVER OPERATED:

- Materials - Copper alloy body.
- Ends - Compression fittings to BS 864 and BS EN 1254-2.
- Operation - Lever operated.

2085F CAPILLARY END SERVICING VALVES - LEVER OPERATED:

- Materials - Copper alloy body.
- Ends - Capillary ends to BS EN 1254-1.
- Operation - Lever operated.

2085G SCREWED END SERVICING VALVES - SCREW DRIVER OPERATED:

- Materials - Copper alloy body.
- Ends - Screwed to BS 864 and BS EN 1254-2.
- Operation - Screw driver operated.

2085H COMPRESSION END SERVICING VALVES - SCREW DRIVER OPERATED:

- Materials - copper alloy body.
- Ends - Compression fittings to BS EN 1254-2.
- Operation - Screw driver operated.

2085I CAPILLARY END SERVICING VALVES - SCREW DRIVER OPERATED:

- Materials - Copper alloy body.
- Ends - Capillary ends to BS EN 1254-1.
- Operation - Screw driver operated.

2090A LEVER OPERATED BUTTERFLY VALVES TO BS EN 593 BETWEEN FLANGES:

- Construction - Provide controlled elastomer compression on flange faces; semi-lugged wafer type design, for installation between flanged pipework connections, body to suit BS EN 1092-2.
- Provide lever and gear operated valves with long body neck for lagging clearance.
- Seat - Bonded.
- Materials - Cast iron body; stainless steel shaft; aluminium bronze disc; EPDM seat.
- Operation - Lever and graduated notch plate.

2090B GEAR OPERATED BUTTERFLY VALVES TO BS EN 593 BETWEEN FLANGES:

- Construction - Provide controlled elastomer compression on flange faces; semi-lugged wafer type design, for installation between flanged pipework connections, body to suit BS EN 1092-2.
- Provide lever and gear operated valves with long body neck for lagging clearance.
- Seat - Bonded.
- Materials - Cast iron body; stainless steel shaft; aluminium bronze disc; EPDM seat.
- Operation - gear operated.

2090C LEVER OPERATED BUTTERFLY VALVES BETWEEN MECHANICAL JOINTS:

- Construction - one piece body with grooved ends or wafer type design, for installation between mechanical joints (up to 300mm only).
- Provide lever operated valves with long body neck for lagging clearance.
- Seat - bonded, pressure responsive elastomer..
- Materials - ductile iron body; stainless steel shaft; electroless nickel coated ductile iron offset disc; EPDM seat.
- Operation - lever and graduated notch plate.

2090D GEAR OPERATED BUTTERFLY VALVES BETWEEN MECHANICAL JOINTS:

- Construction - one piece body with grooved ends or wafer type design, for installation between mechanical joints. Grooves for 350mm and larger to be wedge shaped, for example, Victaulic advanced groove system (AGS).
- Provide gear operated valves with long body neck for lagging clearance.
- Seat - bonded, pressure responsive elastomer in sizes up to 300mm, disc mounted seal for 350mm and larger.
- Materials - ductile iron body; stainless steel shaft; electroless nickel coated ductile iron offset disc;

EPDM seat.

- Operation - gear operated.

2110A STOP VALVES - KEY OPERATED SLUICE TYPE A TO BS 5163-1 AND BS 5163-2:

- Valve type - A
- Seat - Resilient or metal seated.
- Stem seal - Stuffing box and gland; injector packing foil; or toroidal sealing rings (O-rings).
- Operation - T key.
- Materials - Manufacturer's standard and WRAS approved.
- Options - Stem cap.

2210A LEVER OPERATED REGULATING BUTTERFLY VALVES TO BS EN 593 BETWEEN FLANGES:

- Construction - Provide controlled elastomer compression on flange faces; semi-lugged wafer type design, for installation between flanged pipework connections, body to suit BS EN 1092-2.
- Provide lever and gear operated valves with long body neck for lagging clearance.
- Seat - Bonded seat.
- Materials - Cast iron body; stainless steel shaft; aluminium bronze disc; EPDM seat.
- Operation - Infinitely variable setting with travel stops and indicator, lever operation.

2210B GEAR OPERATED REGULATING BUTTERFLY VALVES TO BS EN 593 BETWEEN FLANGES:

- Construction - Provide controlled elastomer compression on flange faces; semi-lugged wafer type design, for installation between flanged pipework connections, body to suit BS EN 1092-2.
- Provide lever and gear operated valves with long body neck for lagging clearance.
- Seat - Bonded seat.
- Materials - Cast iron body; stainless steel shaft; aluminium bronze disc; EPDM seat.
- Operation - Infinitely variable setting with travel stops and indicator, gear operation.

2210C LEVER OPERATED REGULATING BUTTERFLY VALVES TO BS EN 593 BETWEEN MECHANICAL JOINTS:

- Construction - installation between mechanical joints with grooved ends (up to 300mm only).
- Provide lever operated valves with long body neck for lagging clearance.
- Seat - bonded seat, pressure responsive elastomer.
- Materials - ductile iron body; stainless steel shaft; rubber coated ductile iron offset disc; EPDM seat.
- Operation - infinitely variable setting with travel stops and indicator, lever operation.

2210D GEAR OPERATED REGULATING BUTTERFLY VALVES TO BS EN 593 BETWEEN MECHANICAL JOINTS:

- Construction - installation between mechanical joints with grooved ends.
- Provide gear operated valves with long body neck for lagging clearance.
- Seat - bonded seat, pressure responsive in sizes up to 300mm, disc mounted seal for 350mm and

larger.

- Materials - ductile iron body; stainless steel shaft; rubber coated ductile iron offset disc; EPDM seat.
- Operation - infinitely variable setting with travel stops and indicator, gear operation.

2220A THREADED END DOUBLE REGULATING VALVES TO BS 7350, COPPER ALLOY:

- BS 7350, section 3.1.
- Ends - Threaded to BS 21 and BS EN 10226-1.
- Material - Bronze or DZR copper alloy to BS 5154.
- Series B; oblique or Y pattern; inside screw non-rising stem; manufacturer's standard trim material.
- Options - Provide drain plug facility; independent means for positive isolation on pressure tapping or adapter; and test and manufacturer's certificates as indicated.

2220B FLANGED DOUBLE REGULATING VALVES TO BS 7350, COPPER ALLOY:

- BS 7350, section 3.1.
- Ends - Flanged to BS EN 1092-2.
- Material - Bronze or DZR copper alloy to BS 5154.
- Series B; oblique or Y pattern; inside screw non-rising stem; manufacturer's standard trim material.
- Options - Provide drain plug facility; independent means for positive isolation on pressure tapping or adapter; and test and manufacturer's certificates as indicated.

2220C FLANGED DOUBLE REGULATING VALVES TO BS 7350, CAST IRON:

- BS 7350, section 3.1.
- Ends - Flanged to BS EN 1092-2.
- Material - Cast iron to BS EN 13789.
- Oblique or Y pattern; copper alloy, nickel alloy or resilient valve face; rising stem outside screw or non-rising stem inside screw; manufacturer's standard materials.
- Options - Provide drain plug facility; independent means for positive isolation on pressure tapping or adapter; and test and manufacturer's certificates as indicated.

2230A THREADED ENDS FLOW MEASUREMENT DEVICES TO BS 7350, COPPER ALLOY:

- BS 7350, section 3.2 - type 3
- A fixed orifice either integral with or as a fixed orifice fitting close coupled to a double regulating globe valve.
- Ends - Threaded to BS 21 and BS EN 10226-1.
- Material - Double regulating globe valve, bronze or DZR copper alloy to BS 7350 table 6.
- Options - Independent means for positive isolation on pressure tapping or adapter.

2230B FLANGED ENDS FLOW MEASUREMENT DEVICES TO BS 7350 TYPE 3, COPPER ALLOY:

- BS 7350, section 3.2 - type 3
- A fixed orifice either integral with or as a fixed orifice fitting close coupled to a double regulating globe

valve.

- Ends - Flanged to BS EN 1092-3.
- Material - Double regulating globe valve, bronze or DZR copper alloy to BS 7350 table 6.
- Options - Independent means for positive isolation on pressure tapping or adapter.

2230C FLANGED FLOW MEASUREMENT DEVICE TO BS 7350 CAST IRON, TYPE 3:

- BS 7350, section 3.2 - type 3
- A fixed orifice either integral with or as a fixed orifice fitting close coupled to a double regulating globe valve.
- Ends - Flanged to BS EN 1092-2.
- Material - Double regulating globe valve to BS EN 13789 and close coupled fixed orifice fitting to BS 7350, table 6.
- Options - Independent means for positive isolation on pressure tapping or adapter.

2230E THREADED ENDS FLOW MEASUREMENT DEVICES TO BS 7350 TYPE 4, COPPER ALLOY:

- BS 7350, section 3.2 - type 4, variable orifice valve.
- Ends - Threaded to BS 21 and BS EN 10226-1.
- Material - Variable orifice, double regulating globe valve, bronze or DZR copper alloy to BS 5154 series B.
- Options - Independent means for positive isolation on pressure tapping or adapter.

2230F FLANGED FLOW MEASUREMENT DEVICES TO BS 7350 TYPE 4, COPPER ALLOY:

- BS 7350, section 3.2 - type 4, variable orifice valve.
- Ends - Flanged to BS EN 1092-3.
- Material - Variable orifice, double regulating globe valve, bronze or DZR copper alloy to BS 5154 series B.
- Options - Independent means for positive isolation on pressure tapping or adapter.

2230G FLOW MEASUREMENT DEVICES TO BS 7350 TYPE 4, CAST IRON:

- BS 7350, section 3.2 - type 4, variable orifice valve.
- Ends - Flanged to BS EN 1092-2.
- Material - Variable orifice, double regulating globe valve, cast iron to BS EN 13789.
- Options - Independent means for positive isolation on pressure tapping or adapter.

2260A RADIATOR VALVES TO BS 2767 (TYPE 4):

- Material - Bronze or brass copper alloy body.
- Pattern - Angle or straight to suit application.
- Straight - Threaded to BS 21 and BS EN 10226-1 or compression to BS EN 1254-2 to suit pipework as indicated.
- Angle - Threaded to BS 21 and BS EN 10226-1 with one end internal and other end external with union nut and tail pipe; or compression joint to BS EN 1254-2 one end and other end externally threaded to BS 21 and BS EN 10226-1 with union nut and tail pipe to suit pipework as indicated.
- Options - Fit wheel valves on flow connections to radiators, and other heat emitters, without thermostatic

radiator valves. Fit lockshield valves on return connections.

2270A THERMOSTATIC RADIATOR VALVES TO BS EN 215 TABLE A.1:

- Material to A.1.
- Pattern - Straight or angle pattern to suit application.
- Dimensions - Table A.1 series D.
- Thermostatic valve type - Integral sensor unless otherwise indicated.

2270B THERMOSTATIC RADIATOR VALVES TO BS EN 215 TABLE A.2:

- Material to Annex A.
- Pattern - Straight or angle pattern to suit application.
- Dimensions - Table A.2 series F.
- Thermostatic valve type - Integral sensor unless otherwise indicated.

2270C THERMOSTATIC RADIATOR VALVES TO BS EN 215 TABLE A.3:

- Material to Annex A.
- Pattern - Straight or angle pattern to suit application.
- Dimensions - Table A.3 series S.
- Thermostatic valve type - Integral sensor unless otherwise indicated.

2270D THERMOSTATIC RADIATOR VALVES TO BS EN 215 TABLE A.4:

- Material to Annex A.
- Pattern - Straight or angle pattern to suit application.
- Dimensions - Table A.4 series GB.
- Thermostatic valve type - Integral sensor unless otherwise indicated.

2270E TAMPER PROOF THERMOSTATIC RADIATOR VALVES TO BS EN 215 TABLE A.1:

- Material to Annex A.
- Pattern - Straight or angle pattern to suit application.
- Provide tamper proof TRV's.
- Dimensions - Table A.1 series D.
- Thermostatic valve type - Integral sensor unless otherwise indicated.

2270F TAMPER PROOF THERMOSTATIC RADIATOR VALVES TO BS EN 215 TABLE A.2:

- Material to Annex A.
- Pattern - Straight or angle pattern to suit application.
- Provide tamper proof TRV's.
- Dimensions - Table A.2 series S.
- Thermostatic valve type - Integral sensor unless otherwise indicated.

2270G TAMPER PROOF THERMOSTATIC RADIATOR VALVES TO BS EN 215 TABLE A.3:

- Material - Annex A.
- Pattern - Straight or angle pattern to suit application.
- Provide tamper proof TRV's.

- Dimensions - Table A.3 series S.
- Thermostatic valve type - Integral sensor unless otherwise indicated.

#### 2270H TAMPER PROOF THERMOSTATIC RADIATOR VALVES TO BS EN 215 TABLE A.4:

- Material -Annex A.
- Pattern - Straight or angle pattern to suit application.
- Provide tamper proof TRV's.
- Dimensions - Table A.4 series GB.
- Thermostatic valve type - Integral sensor unless otherwise indicated.

#### 2280A FLOAT OPERATED VALVES TO BS 1212-1, COPPER FLOAT:

- Piston type float operated valve to BS 1212-1.
- Connection - Side or bottom entry to suit application.
- Float - Copper to BS 1968.

#### 2280B FLOAT OPERATED VALVES TO BS 1212-1, PLASTIC FLOAT:

- Piston type float operated valve to BS 1212-1.
- Connection - Side or bottom entry to suit application.
- Float - Plastic to BS 2456.

#### 2290A THREADED END FLOAT OPERATED VALVES, BALANCED EQUILIBRIUM:

- WRAS approved.
- Bronze or DZR copper alloy body.
- Inlet - Threaded to BS 21 and BS EN 10226-1.
- Spindle and head effectively guided and arranged with stops to engage with valve body and prevent over travel. Linkage fulcrum adjustable relative to vertical plane, securely locked to body tapping when set.
- Screwed plug from access cover.
- Float and lever arm.
- Spun copper float, halves brazed or welded together, with centre sleeve connecting to lever arm. For feed and expansion application use long arm type arranged to close when tank contains 150mm depth.

#### 2315A OPEN/CLOSE CONTROL BALL VALVES:

- Valve - Open/Close valve.
- Rotary Actuator - Open/close.
- Material - Nickel-plated brass; stainless steel ball; PTFE seal; stainless steel spindle; EPDM spindle seal.
- Connections - Threaded to BS 21 and BS EN 10226-1.
- Ancillaries - Lever for manual operation.

#### 2315B TWO WAY CONTROL BALL VALVES:

- Valve - Two way control valve.
- Rotary Actuator - Modulating.
- Material - Nickel-plated brass; stainless steel ball; PTFE seal; stainless steel spindle; EPDM spindle

seal.

- Connections - Threaded to BS 21 and BS EN 10226-1.
- Ancillaries - Lever for manual operation.

**2315C THREE WAY CONTROL BALL VALVES:**

- Valve - Three way control valve.
- Rotary Actuator - Modulating.
- Material - Nickel-plated brass; stainless steel ball; PTFE seal; stainless steel spindle; EPDM spindle

seal.

- Connections - Threaded to BS 21 and BS EN 10226-1.
- Ancillaries - Lever for manual operation.

2320A THREADED ENDS SWING CHECK VALVES TO BS 5154:

- Series B; horizontal pattern.
- Ends - Threaded to BS 21 and BS EN 10226-1.
- Trim material - Manufacturer's standard.

2320B FLANGED SWING CHECK VALVES TO BS 5154:

- Series B; horizontal pattern.
- Ends - Flanged to BS EN 1092-3.
- Trim material - Manufacturer's standard.

2330A FLANGED SWING CHECK VALVES TO BS EN 12334

- Check valve type to BS EN 736-1 - Swing.
- Body type - Flanged.
- Ends - Flanged to BS EN 1092-2.
- Body and cover materials - Grey cast iron or SG cast iron.
- Orientation of pipework - Horizontal or vertical.

2330B WAFER BODY SWING CHECK VALVES TO BS EN 12334:

- Check valve type to BS EN 736-1 - Swing.
- Body type - Wafer.
- Body and cover materials - Grey cast iron or SG cast iron.
- Orientation of pipework - Horizontal or vertical.

2330C FLANGED LIFT CHECK VALVES TO BS EN 12334:

- Check valve type to BS EN 736-1 - Lift.
- Body type - Flanged.
- Ends - Flanged to BS EN 1092-2.
- Body and cover materials - Grey cast iron or SG cast iron.
- Orientation of pipework - Horizontal or vertical.

2330D WAFER BODY LIFT CHECK VALVES TO BS EN 12334:

- Check valve type to BS EN 736-1 - Lift.
- Body type - Wafer.
- Body and cover materials - Grey cast iron or SG cast iron.
- Orientation of pipework - Horizontal or vertical.

2340A FLANGED SWING CHECK VALVES TO BS EN 12334:

- Wafer pattern design suitable for installation between flanged pipework, body to suit BS EN 1092-2.
- Disc - Double disc.
- Type - Light spring type.

- Seat - Bonded.
- Materials - Cast iron body; bronze disc; EPDM seat.

2385A COMBINED CHECK AND ANTI-VACUUM DEVICE TO PREVENT CONTAMINATION OF WATER BY BACKFLOW TO BS EN 14451:

- Standard - BS EN 14451 combined check and anti-vacuum valves.
- WRAS approval.
- Ends - Compression connections to BS EN 1254-2.

2390A COMBINED CHECK AND ANTI-VACUUM TYPE ANTI BACK SYPHONAGE VALVES:

- Bronze or DZR copper alloy body assembly with compression connections to BS EN 1254-2.
- Pattern - In-line pattern.
- Components - Stainless steel domed air inlet. Non-return valve with plastic body, rubber actuator and stainless steel to plastic seal. WRAS approval.

2395A VERIFIABLE BACKFLOW PREVENTER WITH REDUCED PRESSURE ZONE (RPZ) VALVE - GENERAL REQUIREMENTS:

- Provide an application to the local water supplier using the WRAS "RPZ Valve Assembly - Application for Installation" form.
- Obtain Water Supplier agreement that a Type BA device is a suitable means of backflow protection in the water supply system under consideration.
- Test methods and maintenance regimes shall be in accordance with the Water Suppliers requirements and any failure to comply may result in termination of supply or removal of the device. These maintenance requirements must be detailed within the project Operation & Maintenance documentation.
- The fitting must be included in the WRAS "Products and Materials Directory" and satisfy the requirements of the Regulations.
- The installer must obtain formal Water Supplier agreement that a Type BA device is a suitable means of backflow protection in the plumbing system under consideration before installation.
- Confirm that any Type BA device installed provides protection against back pressure and back siphonage at the point of use from fluids up to and including Category 4 as defined in
  - England and Wales - The Water Supply (Water Fittings) Regulations 1999, the Water Act 2014 and the Construction Products Regulations 2013.
  - Scotland - The Water Supply (Water Fittings) Byelaws 2014.
  - Northern Ireland - The Water Supply (Water Fittings) Regulations (Northern Ireland) 2009.
- Comply with the stipulations and requirements set out in WRAS Approved Installation Method Document AIM-08-01.

2395B VERIFIABLE BACKFLOW PREVENTER WITH REDUCED PRESSURE ZONE (RPZ) VALVE -

INSTALLATION:

- The Type BA device shall not be installed in a place or position which is:
  - Liable to flooding
  - Above electrical equipment
  - Liable to mechanical or other damage
  - Exposed to freezing - unless measures are taken to prevent the assembly from freezing
  - Concealed
- The assembly shall be:
  - Installed horizontally with the relief valve discharging downwards
  - Installed with an inline strainer fitted immediately upstream of the device - to prevent fouling of elements of the assembly
  - Installed above ground at a height enabling effective inspection and maintenance
  - Installed not less than 300mm above ground or floor level or the base of any cabinet to the underside of the exit port of the relief valve
  - Installed no more than 1500mm above ground or floor level
  - Installed with an air break between the relief outlet port and the top of the allied tundish
- Following installation the assembly shall be flushed and disinfected in accordance with BS EN 806-4 and complimentary guidance in BS 8558
- Following flushing and prior to commissioning and site test, the assembly shall be checked by the installer to ensure that the relief valve functions correctly - in accordance with the guidelines in WRAS Approved Installation Method Document AIM-08-01.

2395C VERIFIABLE BACKFLOW PREVENTER WITH REDUCED PRESSURE ZONE (RPZ) VALVE - ON-SITE INSPECTION AND TESTING:

- Site testing must only be carried out by an accredited tester approved by the Water Supplier.
- Testing shall be carried out at intervals not exceeding 12 months.
- Test data during the commissioning of the assembly and at subsequent intervals shall be entered on the "RPZ Valve Test Report Form" produced by the WRAS.
- The inspections and testing shall be in accordance with WRAS Approved Installation Method Document AIM-08-01.
- On completion of site tests, a certificate must be completed by the tester in accordance with WRAS Guidance Note and copies submitted to the water supplier and the person responsible for the device. Copies shall be included in the Operation and Maintenance Manuals, including interval periods for subsequent testing.

2395D VERIFIABLE BACKFLOW PREVENTER WITH REDUCED PRESSURE ZONE (RPZ) VALVE - RECORD OF INSTALLATION AND TEST DATA:

- Provide records for each assembly in accordance with WRAS Approved Installation Method Document AIM-08-01.
- In general, the record shall indicate the following:
  - Purpose of the assembly
  - Precise location of the assembly
  - Data pertaining to prescribed tests
  - Details of the person who carried out the test
  - Frequency of tests
  - Defects found and measures taken to remedy these defects
- The installation, commissioning and subsequent test data shall be forwarded to the Water Supplier and

copies retained by the Tester and the Water Supplier's customer for a period of at least five years.

**2430A SAFETY VALVES, COPPER ALLOY, SINGLE SPRING:**

- Material - bronze or DZR copper alloy body.
- Standard - BS EN ISO 4126-1, BS EN ISO 4126-7.
- Ends - threaded to BS 21 and BS EN 10226-1.
- Spring type - single spring loaded, high lift type.

**2430B SAFETY VALVES, COPPER ALLOY, DOUBLE SPRING:**

- Material - bronze or DZR copper alloy body.
- Standard - BS EN ISO 4126-1, BS EN ISO 4126-7.
- Ends - threaded to BS 21 and BS EN 10226-1.
- Spring type - double spring loaded, high lift type.

**2440A DRAIN COCKS, THROUGHWAY GLAND COCK:**

- Bronze body threaded male to BS 21 and BS EN 10226-1.
- Tapered plug with square shank for loose lever; bolted gland; strap and blank cap screwed on hand tight.
- Outlet to accept hose union.

**2450 DRAIN COCKS - SCREWDOWN TO BS 2879, TYPE 1:**

- Bronze body threaded male to BS 21 and BS EN 10226-1.
- Screw down plug with square shank for loose lever.
- Serrated outlet to accept hosepipe, fixed or union pattern. Lockshield to accept key.

**2460 DRAIN COCKS - BALL TYPE:**

- Bronze or DZR copper alloy body; chrome-plated DZR ball; PTFE seats and stem seals; blow-out proof stem; strap and blank cap screwed on hand tight; serrated outlet to accept hose pipe. Lockshield key operated.

**2490 VENT COCKS - THREE WAY GLAND COCK TYPE:**

- Bronze body threaded to BS 21 and BS EN 10226-1; tapered plug with square shank for loose lever;

plug position indicator; port markings to indicate inlet,vent, waste; bolted gland.

- Port configuration, T port.

**2500A THREE WAY PLUG VALVE VENT COCKS - WRENCH OPERATED:**

- Cast iron body, plug and bottom cover. PTFE thrust washer.
- Ends - Flanged to BS EN 1092-2.
- T port configuration. Wrench operation.

**2500B THREE WAY PLUG VALVE VENT COCKS - GEAR OPERATED:**

- Cast iron body, plug and bottom cover. PTFE thrust washer.
- Ends - Flanged to BS EN 1092-2.
- T port configuration. Gear operation.

**2510A AUTOMATIC AIR VENTS, FLOAT TYPE:**

- Construction - Bronze or DZR copper alloy body with threaded inlet to BS 21 and BS EN 10226-1. Solid polypropylene float and air release valve. Ensure valve is self closing.
- Operating Conditions - Maximum temperature 130°C. Maximum pressure 10 bar.
- Options - Provide connection for piping away released air and integral non-return valve where indicated.

**2515A MICROBUBBLE TEMPERATURE DIFFERENTIAL DEAERATORS:**

- Construction - Vertical mild steel housing incorporating internal spiral wound copper mesh system.
- Provide automatic air release mechanism.
- Ends - Line size with flanges to BS EN 1092-1, PN 16.
- Operating conditions - Maximum temperature 110°C, maximum pressure 10 bar.

**2520A LTHW PRESSURE DIFFERENTIAL DEAERATORS:**

- Unit - Provide a self circulating unit connected to the system by two 15mm connections at least 500mm apart.
- Isolation - Provide valves to isolate the vessel from the main system.
- Operating conditions - Maximum temperature 110°C, maximum pressure 10 bar.

**2520B CHILLED WATER PRESSURE DIFFERENTIAL DEAERATORS:**

- Unit - Provide a self circulating unit connected to the system by two 15mm connections at least 500mm apart. Insulate to prevent condensation.
- Isolation - Provide valves to isolate the vessel from the main system.
- Operating conditions - Maximum temperature 110°C, maximum pressure 10 bar.

**2521A CENTRIFUGAL AIR SEPARATORS:**

- Construction - Vertical steel housing with offset inlet and outlet ports to remove bubbles via centrifugal

force. Provide automatic air release mechanism.

- Ends - Line size with flanges to BS EN 1092-1, PN 16.
- Operating conditions - Maximum temperature 110°C, maximum pressure 10 bar.

#### 2522A GRAVITATION DIRT SEPARATORS:

- Construction - Vertical mild steel housing with internal reservoir, sludge pipe, perforation plate and automatic air release mechanism.
- Ends - Line size with flanges to BS EN 1092-1, PN 16.
- Operating conditions - Maximum temperature 110°C, maximum pressure 10 bar.

#### 2524A MICROBUBBLE AIR AND DIRT SEPARATORS:

- Construction - Vertical steel housing with internal large surface area mechanism to remove microbubbles via coalescence effect. Fitted with dirt drain at its lowest point for removing dirt that sinks, and fitted with a dirt drain valve on the side of the housing for removing dirt that floats on the water.
- Provide automatic air release mechanism.
- Ends - Line size with flanges to BS EN 1092-1, PN 16.
- Operating conditions - Maximum temperature 110°C, maximum pressure 10 bar.

#### 2550 STEAM TRAPS - THERMOSTATIC TYPE, BI-METALLIC:

- Steel body and cover with threaded ends to BS 21 and BS EN 10226-1, suitable for horizontal in-line mounting.
- Thermostatic element in corrosion resistant multiple cross disc type bimetal stainless steel.
- Integral stainless steel strainer.

#### 2580 STEAM TRAPS - INVERTED BUCKET TYPE:

- Cast iron body with threaded ends to BS 21 and BS EN 10226-1. Stainless steel bucket and internal components. Integral strainer with access plug and stainless steel element. Bolted cover with gasket.

#### 2610A STEEL EXPANSION LOOPS:

- Provide expansion loop in material and finish of associated pipeline. Size to limit stress set up in material of pipe wall to 69 MPa.
- Forge bend from a single length of pipe or join by welding fittings if expansion loops are too large to manufacture in one piece.
- Where indicated, galvanize after manufacture.
- Where scheduled or detailed in the particular specification provide expansion loops installed with grooved flexible mechanical joints and elbows. The joint manufacturer shall undertake calculations for sizing of the expansion loops. Installation to be strictly in accordance with the manufacturer's instructions.

#### 2620 EXPANSION LOOPS - COPPER:

- Provide expansion loop in material and finish of associated pipeline. Size to limit total stress set up in

material of pipe wall to less than 51.5 MPa.

- Forge bend from a single length of pipe.

#### 2630A THREADED END EXPANSION COMPENSATORS, AXIAL BELLOWS:

- Ends - Threaded to BS 21 and BS EN 10226-1.
- Bellows - Stainless steel, multi ply or single-ply construction fitted with stainless steel inner sleeves.
- Operation - Supply expansion joints capable of not less than 2000 complete reversals of movement at the given working conditions; and of withstanding a pressure test of 1.5 times the design pressure without deformation.

#### 2630B FLANGED EXPANSION COMPENSATORS, AXIAL BELLOWS:

- Ends - Flanged to BS EN 1092-1.
- Bellows - Stainless steel, multi-ply or single-ply construction fitted with stainless steel inner sleeves.
- Operation - Supply expansion joints capable of not less than 2000 complete reversals of movement at the given working conditions; and of withstanding a pressure test of 1.5 times the design pressure without deformation.

#### 2630D THREADED ENDS EXPANSION COMPENSATORS, ARTICULATED BELLOWS:

- Ends - Threaded to BS 21 and BS EN 10226-1.
- Bellows - Stainless steel, multi-ply or single-ply construction fitted with stainless steel inner sleeves.
- Operation - Supply expansion joints capable of not less than 2000 complete reversals of movement at the given working conditions; and of withstanding a pressure test of 1.5 times the design pressure without deformation.

#### 2630E FLANGED EXPANSION COMPENSATORS, ARTICULATED BELLOWS:

- Ends - Flanged to BS EN 1092-1.
- Bellows - Stainless steel, multi-ply or single-ply construction fitted with stainless steel inner sleeves.
- Operation - Supply expansion joints capable of not less than 2000 complete reversals of movement at the given working conditions; and of withstanding a pressure test of 1.5 times the design pressure without deformation.

#### 2630J GROOVED END EXPANSION COMPENSATORS:

- Material - ductile cast iron to ASTM A536, grade 65-45-12.
- Ends - grooved for mechanical joints.
- Operation - supply expansion joints capable of not less than 2000 complete reversals of movement at the given working conditions; and of withstanding a pressure test of 1.5 times the design pressure without deformation.
- Type - slip-type expansion compensation device, gasketed, with grooved coupling ends and

'telescoping' body.

- Size - 50mm to 150mm.
- Maximum axial end movement - 76mm.
- Limiting test pressure - 24bar pressure rated.
- Gasket - grade 'E' EPDM for water services to 110°C.
- Installation to be strictly in accordance with the manufacturer's instructions.

#### 2630K GROOVED END MULTIPLE FLEXIBLE COUPLINGS TYPE COMPENSATORS:

- Coupling material - ductile cast iron to ASTM A536, grade 65-45-12.
- Ends - grooved for mechanical joints.
- Operation - supply expansion joints capable of not less than 2000 complete reversals of movement at the given working conditions; and of withstanding a pressure test of 1.5 times the design pressure without deformation.
- Type - multiple standard flexible grooved couplings joined by grooved end nipples.
- Axial movement - dependent on number of couplings in the compensator, refer to schedule/particular specification.
- Gasket - grade 'E' EPDM for water services to 110°C.

#### 2650A FLANGED EPDM RUBBER FLEXIBLE CONNECTIONS UP TO 10 BAR AND 100°C:

- Material - EPDM rubber with wire reinforced cuffs.
- Steel reinforcement within the body.
- Marking - Mould date of manufacture on bellows.
- Show manufacturer and type.
- Ends - Flanges to BS EN 1092-1 that can swivel and are removable.
- Operation - Ensure flexible connections have a design life of 120 months at 100°C. Provide tie bars with rubber top hat washers where working pressure exceeds 4 bar. Supply threaded tie bars with adjustable length. Ensure flexible connections are tied when the plant is on vibration isolation mountings.

#### 2650B THREADED END EPDM RUBBER FLEXIBLE CONNECTIONS UP TO 10 BAR AND 100°C:

- Material - EPDM rubber with wire reinforced cuffs.
- Steel reinforcement within the body.
- Marking - Mould date of manufacture on bellows.
- Show manufacturer and type.
- Ends - Threaded to BS 21 and BS EN 10226-1 with one union end.
- Operation - Ensure flexible connections have a design life of 120 months at 100°C. Provide tie bars with rubber top hat washers where working pressure exceeds 4 bar. Supply threaded tie bars with adjustable length. Ensure flexible connections are tied when the plant is on vibration isolation mountings.

#### 2650H FLANGED CHLOROBUTYL RUBBER FLEXIBLE CONNECTIONS UP TO 10 BAR AND 60°C:

- Material - Multi-ply reinforced chlorobutyl rubber with wire reinforced cuffs. Synthetic fibre reinforcement within the body.
- Marking - Mould date of manufacture on bellows.
- Show manufacturer and type.
- Ends - Flanges to BS EN 1092-1 that can swivel and are removable.
- Operation - Ensure flexible connections have a design life of 120 months at given conditions. Provide tie

bars with rubber top hat washers where working pressure exceeds 4 bar. Supply threaded tie bars with adjustable length. Ensure flexible connections are tied when the plant is on vibration isolation mountings.

**2670A TEST PLUGS, SELF SEALING:**

- Provide DZR copper alloy self sealing test plugs for measurement of temperature and pressure, complete with captive cap for sealing when not in use. Ensure test plugs are suitable for system operating temperature and pressure.
- Provide one thermometer and pressure gauge for each range of conditions, for use with test plugs.

**2670B TEST PLUGS, VALVE CONTROLLED:**

- Provide DZR copper alloy self valve controlled test plugs for measurement of temperature and pressure, complete with captive cap for sealing when not in use. Ensure test plugs are suitable for system operating temperature and pressure.
- Provide one thermometer and pressure gauge for each range of conditions, for use with test plugs.

**2680A THREADED PIPELINE STRAINERS, BRONZE:**

- Material - Bronze to BS EN 1982.
- Ends - Threaded to BS 21 and BS EN 10226-1.
- Pattern - Y pattern body.
- Screen free area - Not less than 250% of pipe bore.
- Screen perforations
  - 15 to 50mm nominal size, within range 0.7 - 0.9 mm diameter.
  - 65mm and over nominal size, within range 1.5 - 1.8mm diameter.
- Internal to external flow through screen. Provide plugged connections for drain, air vent and differential pressure monitoring, threaded to BS 21 and BS EN 10226-1.

**2680B FLANGED PIPELINE STRAINERS, BRONZE:**

- Material - Bronze to BS EN 1982.
- Ends - Flanged to BS EN 1092-3.
- Pattern - Y pattern body.
- Screen free area - Not less than 250% of pipe bore.
- Screen perforations
  - 15 to 50mm nominal size, within range 0.7 - 0.9 mm diameter.
  - 65mm and over nominal size, within range 1.5 - 1.8mm diameter.
- Internal to external flow through screen. Provide plugged connections for drain, air vent and differential pressure monitoring, threaded to BS 21 and BS EN 10226-1.

**2680C COMPRESSION PIPELINE STRAINERS, BRONZE:**

- Material - Bronze to BS EN 1982.
- Ends - Compression fittings to BS EN 1254-2.
- Pattern - Y pattern body.
- Screen free area - Not less than 250% of pipe bore.
- Screen perforations
  - 15 to 50mm nominal size, within range 0.7 - 0.9 mm diameter.
  - 65mm and over nominal size, within range 1.5 - 1.8mm diameter.
- Internal to external flow through screen. Provide plugged connections for drain, air vent and differential

pressure monitoring, threaded to BS 21 and BS EN 10226-1.

**2680D PIPELINE STRAINERS, CAST IRON:**

- Material - Cast iron.
- Ends - Flanged to BS EN 1092-2.
- Pattern - Y pattern body.
- Screen free area - Not less than 250% of pipe bore.
- Screen perforations
  - 15 to 50mm nominal size, within range 0.7 - 0.9 mm diameter.
  - 65mm and over nominal size, within range 1.5 - 1.8mm diameter.
- Internal to external flow through screen. Provide plugged connections for drain, air vent and differential pressure monitoring, threaded to BS 21 and BS EN 10226-1.

**2680E GROOVED END PIPELINE STRAINERS, DUCTILE IRON:**

- Material - Ductile iron.
- Ends - Grooved for mechanical joint.
- Pattern - Y pattern body.
- Screen free area - Not less than 250% of pipe bore.
- Screen perforations
  - 50 to 80mm nominal size, 1.6mm diameter.
  - 100mm and over nominal size, 3.2mm diameter.
- Internal to external flow through screen. Provide plugged connections for drain, air vent and differential pressure monitoring, threaded to BS 21 and BS EN 10226-1.

**2680F GROOVED END PIPELINE SUCTION DIFFUSER STRAINERS, DUCTILE IRON:**

- Body materials - ductile iron.
- Coupling gaskets - grade 'E' EPDM for water services to 110°C
- Ends - grooved for mechanical joint for jointing to pipework and flanged for jointing to pump.
- Stainless steel frame and perforated steel diffuser to provide optimum flow conditions at pump inlet.
- Unit to be complete with removable stainless steel fine mesh sleeve start-up pre-filter, bosses on either side for pressure measurement and outlet for drain connection.
- Installation to be strictly in accordance with the manufacturer's instructions.

**2680G PIPELINE SUCTION GUIDE/STRAINERS:**

- Body material - cast iron or ductile iron for water services to 110°C
- Ends - flanged to PN16 or PN25 to suit system maximum working pressure.
- Stainless steel strainer and fine mesh (start-up) strainer.
- Unit to be complete with flow stabilising vanes to allow connection direct to pump suction.
- Unit to be complete with removable stainless steel fine mesh sleeve start-up pre-filter.
- Provide plugged connections for drain, air vent and differential pressure monitoring.
- Installation to be strictly in accordance with the manufacturer's instructions.

**2690A TUNDISHES, COPPER:**

- Provide tundishes located adjacent to equipment, as indicated.
- Use 3mm minimum thickness copper sheet. Form sheet into a tapered reducing cone with a minor

diameter to suit drain line.

- Major diameter nominally 50 mm larger than minor diameter, tapering at approximately 30°.

#### 2690B TUNDISHES, MILD STEEL, GALVANIZED:

- Provide tundishes located adjacent to equipment, as indicated.
- Use mild steel sheet; galvanize after manufacture.
- Form sheet into a tapered reducing cone with a minor diameter to suit drain line.
- Major diameter nominally 50 mm larger than minor diameter, tapering at approximately 30°.

#### 2700A GAUGES, GENERAL:

- Use dial type gauges of robust construction, enclosed in dust tight metal cases. Retain dial glass with bezels screwed to case. Finish with chromium plating.
- Use white dial scales indelibly and clearly marked with black lettering to indicate measured values. Select scale ranges which indicate 'Normal' when pointer is vertical or central on scale.

#### 2700B GAUGES, 150MM DIAMETER, FLUSH PANEL:

- Dial case - 150mm diameter, heavy pattern, finished in black stove enamel for flush mounting.
- Mount gauges with dial face in vertical plane flush to panel and conceal casing within a steel metal cubicle.

#### 2700C GAUGES, 150MM DIAMETER, DIRECT MOUNTING:

- Dial case - 150mm diameter, heavy pattern finished in black stove enamel, for direct connection to instrument.
- Mount gauges with dial face in vertical plane and support casing by connection to instrument.

#### 2710A TEMPERATURE GAUGES, GENERAL:

- Mercury in steel type, mounted direct in pocket.
- Use temperature gauges with pocket and provided with gland attachment on thermometer stem.
- Use separable type pockets, threaded 15/19mm BSP and manufactured from stainless steel.
- Screw pockets into tapped bosses or stools set in pipelines or vessels. Fill pockets with oil to BS 7207 to ensure contact with thermometer bulb.
- Provide gauges with dial graduation in °C marked on logarithmic scale. Ensure pointer movement is clockwise for increase in temperature.
- Provide sensing elements for air and gas systems, where indicated, and fix to provide airtight joints.
- Provide with metal shielding around sensing element to prevent effects of local radiation from equipment.

#### 2710B TEMPERATURE GAUGES, MERCURY IN STEEL:

- Provide mercury in steel temperature gauge, mounted direct in pocket.

#### 2710C TEMPERATURE GAUGES, VAPOUR PRESSURE TO BS EN 13032-3 FOR DIRECT MOUNTING:

- Vapour pressure type to BS EN 13190, mounted direct in pocket, with horizontal or vertical stem as

appropriate.

#### 2720 PRESSURE AND ALTITUDE GAUGES:

- Use vapour pressure type gauges to BS EN 837-1. Connect to pipeline systems via matched gauge cocks and cock connectors.
- Ensure dial graduation is from zero to between 1.5 and 3.0 times normal working pressure. Graduate in bar (gauge) on gauges reading head or working pressure, or in Pascals where pressure differences across plant items are to be established. Where fitted on boilers and pressure vessels, clearly mark with operating and maximum permissible working heads in accordance BS 759. Elsewhere provide gauges with normal working pressure. Ensure dial movement is clockwise for an increasing in head.
- Fit syphons on steam systems.
- Provide flexible piping where gauge is subject to noticeable vibration.
- Fit gauge cocks preceding all connections to altitude and pressure gauges. Copper alloy, tapered ground plug, with ebonite lever. Unless flanged joints are required, screw inlet ends female and fit outlet ends with union connections allowing removal of gauges.

#### 2750A GAUGE MOUNTING BOARDS, HARDWOOD:

- Manufacture from 12mm thick, polished hardwood.
- Mount on walls or purpose made steel frames at a height approximately 1.3m above floor level.

#### 3010A LOOSE ITEMS, KEYS FOR SPINDLE SHANK VALVES:

Provide tee handled short shank keys suitable for each size of valve spindle shank.

#### 3010B LOOSE ITEMS, FOR DRAIN COCKS:

- Provide lever pattern keys suitable for each drain cock and loose hose unions for drain cocks.

#### 4010 INSTALLATION:

- Install pipeline ancillaries in accordance with manufacturer's recommendations and BS 6683.

#### 4020 LOCATION:

- Install valves, cocks, traps, strainers, test plugs, tundishes and other ancillary equipment in positions indicated.

#### 4025 LOCATION OF THERMOSTATIC RADIATOR VALVES:

- Install thermostatic radiator valves in an area which reflects the space temperature. Ensure that they are not behind curtains or enclosed in heating or radiator panels.

#### 4030 POSITIONING OF COMPONENTS:

- Locate flow and pressure measurement valves to ensure manufacturer's recommended straight length of pipe upstream and downstream of valve is provided.

#### 4040 POSITIONING OF DOUBLE REGULATING VARIABLE ORIFICE VALVE:

- Install double regulating variable orifice valve to ensure equivalent of 10 diameters of straight pipe

upstream and 5 diameters downstream of double regulating valve.

#### 4050A POSITIONING OF CONTROL COMPONENTS:

- Install pipeline control components in accordance with manufacturer's instructions and in positions indicated.
- Insulation - Where control components are incorporated in insulated pipelines provide details of insulation method proposed, for approval.
- Supports - Arrange supports for control components to ensure no strain is imposed on components.
- Access - Arrange control components to ensure adequate access for operation and maintenance.

#### 4070 VALVE STUFFING BOXES:

- Adjust glands of all stuffing boxes at normal plant operating temperature and pressure in accordance with manufacturer's instructions. Ensure that valve action is not impaired by over tightening.

#### 4080A DISCHARGE CONNECTIONS, SAFETY VALVES:

- Fit pipework connections, where indicated, to provide discharge connection to Safety and Relief valves terminating at a safe discharge point.

#### 4080B DISCHARGE CONNECTIONS, VENT COCKS:

- Fit pipework connections, where indicated, to provide discharge connection to vent cocks terminating 150mm above floor level.

#### 4080C DISCHARGE CONNECTIONS, AIR BOTTLES:

- Fit pipework connections, where indicated, to provide bleed connection from air bottles terminating with air cock or needle valve in a convenient position.

#### 4080D DISCHARGE CONNECTIONS, AUTOMATIC AIR VENTS:

- Fit pipework connections, where indicated, to provide discharge pipe to automatic air vents terminating over a suitable gully or drain line in a visible location.

#### 4090 EXPANSION DEVICES:

- Where expansion and contraction cannot be accommodated by selected route, provide pipework loops, as indicated. Limit total stress set up in material of pipe wall, taking into account components due to internal pressure, tension and bending to less than 69 MPa for steel pipelines and less than 51.5 MPa for copper pipe lines.
- Where location does not permit sufficient flexibility, provide proprietary devices, as indicated.

#### 4100 EXPANSION COMPENSATORS INSTALLATION:

- Provide anchors and guides to contain all movement and resist maximum loads imposed. Install expansion compensators strictly in accordance with manufacturer's instructions.

#### 4110 FLEXIBLE CONNECTIONS INSTALLATION:

- Fit rubber bellows as close to source of vibration as practicable. Ensure the pipe at other end of bellows

is a fixed point. Install flexible connections strictly in accordance with manufacturer's instructions.

- Ensure flexible connections are tied when the plant is on vibration isolation mountings.

## Y20 PUMPS

### 1010 PUMPS:

- Provide pumps manufactured and tested in accordance with appropriate British Standard.
- With regard to safety requirements, comply with BS EN 809 and BS EN 60335-2-51 where applicable.
- Twin headed pumps to be supplied with a matching blanking plate to enable the pump to be operated with a single head fitted during maintenance or replacement of standby head/impeller.
- All pumps for floor mounting to be supplied with proprietary support foot.

### 1020 PUMP SELECTION AND EFFICIENCY:

- Select pump at or near most efficient part of performance curve for duty required.
- Whenever possible select single stage glanded centrifugal pumps to achieve pump efficiency in the 'optimum efficiency' area (after correcting for pump head) of the figures in the European Guide to Pump Efficiency for Single Stage Centrifugal Pumps as published by Europump 2003.
- Do not select pumps on flat part of performance curve in the anticipated range of the system when used in variable volume applications.
- Comply with EC Regulation 547/2012 on ecodesign requirements of glanded centrifugal water pumps. Minimum Efficiency Index (MEI) to be as scheduled. Pump efficiency tests shall be carried out in accordance with EC document C 402/17.
- Comply with EC Regulation 641/2009 and the amendment 622/2012 for glandless circulators. Energy Efficiency Index (EEI) to be as scheduled.

### 1030 SAFETY GUARDS:

- Fit safety guards around revolving parts on close coupled and belt drive pumps.

### 1040 PUMP TESTING:

- Ensure pumps comply with BS EN ISO 5198 and BS EN ISO 9906 as appropriate.

### 2010C CENTRIFUGAL PUMP - CLOSE COUPLED:

- Configuration
  - Pump casing and motor mounted on a bedplate in line (end suction close coupled).
- Standards
  - BS EN ISO 9908
  - BS EN ISO 3661
  - BS EN 12756
  - BS EN 733
- Casing
  - Provide casing with drain connection fitted with plug.
  - Provide threaded connections in accordance with BS 21 and BS EN 10226-1 for drains, vents, water jackets, cooling lines, etc.
  - Provide pump with split casing to allow access to the impeller for service and maintenance.
- Impeller
  - Ensure impellers are accurately machined and finished smooth, free from blowholes and other defects and designed to be in dynamic balance at all speeds.
  - Provide open or semi-open type impellers for removal of sludge or other foreign material to prevent

clogging.

- Fix impellers to shafts to ensure that they remain firm if direction of rotation is reversed.
- Indicate direction of rotation on pump casing.
- Shaft
  - Ensure shaft is of adequate diameter to withstand all imposed loading and has a critical speed when assembled with its impeller at least 10% above normal operating speed.
- Material
  - Casing - Cast iron to BS EN 1561.
  - Impeller - Manufacturer's standard.
  - Shaft - Manufacturer's standard.
  - Seal Housing - Cast iron to BS EN 1561.
- Bearings - Sleeve.
- Glands and seals - Mechanical.

#### 2010D CENTRIFUGAL PUMP - DIRECT DRIVE IN-LINE:

- Configuration
  - Direct driven unit with pump body incorporating inlet and outlet connections in line, to allow pump to be mounted in pipework.
- Standards
  - BS EN ISO 9908
  - BS EN 12756
- Casing
  - Provide casing with drain connection fitted with plug.
  - Provide threaded connections in accordance with BS 21 and BS EN 10226-1 for drains, vents, water jackets, cooling lines, etc.
  - Provide pump with split casing to allow access to the impeller for service and maintenance.
- Impeller
  - Ensure impellers are accurately machined and finished smooth, free from blowholes and other defects and designed to be in dynamic balance at all speeds.
  - Provide open or semi-open type impellers for removal of sludge or other foreign material to prevent clogging.
  - Fix impellers to shafts to ensure that they remain firm if direction of rotation is reversed.
  - Indicate direction of rotation on pump casing.
- Shaft
  - Ensure shaft is of adequate diameter to withstand all imposed loading and has a critical speed when assembled with its impeller at least 10% above normal operating speed.
- Material
  - Casing - Cast iron to BS EN 1561.
  - Impeller - Manufacturer's standard.
  - Shaft - Stainless steel to BS EN 10088.
  - Seal Housing - Cast iron to BS EN 1561.
- Bearings
  - Sealed-for-life or pre-packed type requiring no maintenance (in-line pumps).
- Glands and seals - Mechanical.

#### 2010E GLANDLESS CIRCULATOR:

- Configuration
  - Glandless circulator incorporating inlet and outlet connections in line, to allow pump to be mounted in

- pipework.
- Pump efficiency
  - Comply with BS EN 16297-1 and BS EN 16297-2 for general requirements and procedures for testing and calculation of the Energy Efficiency Index (EEI) for stand-alone circulators.
  - Comply with BS EN 16297-1 and BS EN 16297-3 for general requirements and procedures for testing and calculation of the Energy Efficiency Index (EEI) for circulators integrated into products.
  - Include EEI of pump on name plate together with an indication of which part of BS EN 16297 was applied for the determination of the EEI.
- Motor
  - Provide electronically controlled permanent magnet type or EC motor.
  - Glandless circulators having a rated input of up to 200W to be tested in accordance with BS EN 16644 for structure and fluid borne noise.
- Casing
  - Provide casing with drain connection fitted with plug.
- Impeller
  - Ensure impellers are accurately machined and finished smooth, free from blowholes and other defects and designed to be in dynamic balance at all speeds.
  - Fix impellers to shafts to ensure that they remain firm if direction of rotation is reversed.
  - Indicate direction of rotation on pump casing.
- Shaft
  - Ensure shaft is of adequate diameter to withstand all imposed loading and has a critical speed when assembled with its impeller at least 10% above normal operating speed.
- Material
  - Casing - cast iron to BS EN 1561, or cast gunmetal to BS EN 1982
  - Impeller - manufacturer's standard.
  - Shaft - stainless steel to BS EN 10088
  - Seal Housing - manufacturer's standard.
- Bearings
  - Sealed-for-life or pre-packed type requiring no maintenance (in-line pumps).

#### 2015 VARIABLE FLOW CONTROL:

- Supply centrifugal pump with variable speed drive for variable flow control. Variable speed drive to meet the safety requirements of BS EN 61800-5-1.
- Load characteristic
  - Variable torque centrifugal pumps.
  - Constant torque for positive displacement pumps.

#### 4010 GENERAL:

- Comply with manufacturer's recommendations for installation of pumps. For in-line pumps ensure that motor is positioned in accordance with manufacturer's requirements.

#### 4020 PIPELINE CONNECTIONS:

- Support pumps independently from connecting pipework to ensure no load is transmitted from pipework to pump casing on pump suction and discharge.

#### 4040 ALIGNMENT:

- Align pump to prevent undue restraint and thrust on interconnecting pipework. Align drives to prevent

undue wear and restraint on pump shaft. For belt drives, align pulleys and tension belts to prevent undue wear and out of balance forces.

4050 ACCESS:

- Locate pump within the system with adequate space around it for service and maintenance.

4060 MAINTENANCE REQUIREMENTS FOR SEWAGE PUMPS:

- For ease of service and maintenance, install submersible sewage pumps on guide rails or with lifting cables. Fit pumps with automatic discharge connections, which locate on to permanent pipework at low level in chamber.

---

## Y25 CLEANING AND CHEMICAL TREATMENT

### 1000 GENERAL

#### 2010 CLEANING AND CHEMICAL TREATMENT SPECIALIST:

- Use a specialist for analysis and for design, supply, installation and operation of any system cleaning and chemical treatment process.

#### 2020A MAINS WATER ANALYSIS:

- Obtain an analysis of mains water taken from site supply point. Check with local water authority to ensure analysis results are typical for site area and report variances for instruction; or submit a sample of water to water treatment specialist as appropriate.
- Carry out tests to establish total viable counts and Pseudomonas and sulphate reducing bacteria.
- Minimum water quality - as BSRIA BG 29/2012 Table 8.

#### 2030A PRELIMINARY CHECKS:

- Prior to carrying out cleaning or chemical treatment process, ensure that
  - All foreign matter is removed.
  - Certified pressure tests have been carried out in the parts of the system to be cleaned. Carry out further pressure tests on the isolated sections of the system independently.
  - All water used for pressure testing is inhibited. Leave remaining pipework sections full after testing.
  - Where there is a risk of freezing a suitable inhibited glycol selected by the water treatment specialist is used.
  - Circulation has been demonstrated and approval obtained on all parts of the system. Manipulate and leave fully open all valves other than those used to isolate sections. Carry out balancing and certification after the flushing, cleaning and passivation operations.
  - No damage can occur to any item of plant or equipment due to cleaning and chemical processes.
  - Chemicals used are compatible with system materials.
  - All items of plant and equipment subject to damage or blockage due to cleaning and chemical treatment processes are isolated or removed.
  - Permanent or temporary by-passes are provided as indicated on drawings.
  - Dirt pockets are installed at low points to facilitate solids removal. Supply dirt pockets with drain valves sized to pipework size.
  - All drains provided have been tested and approved and that any pumping equipment associated with the drainage system is fully commissioned.
  - Dead legs, that are more than 3 pipe diameters in length are looped to allow effective cleaning.
  - Strainer baskets and filter media, incorporated within systems, are removed; and where necessary spool or stool pieces are installed.
  - Temporary strainers and filters are installed as required for removal of solids during cleaning and chemical treatment processes.
  - Strainers are clean prior to the start of the cleaning process, throughout the cleaning and on completion.
  - Suitable supply and drainage points are provided with 50mm minimum connections, properly sited and installed, either valved or plugged.
  - All automatic/manual air vents are fully commissioned.
  - Air vents of a minimum size of 25mm are installed at the tops of large flow risers.
  - All requirements of COSHH regulations are complied with during the chemical cleaning and chemical

treatment of the system.

- Where required by local water authority, provide effluent tanks for storage of all waste products of cleaning and chemical treatment processes.
- Following local water authority approval, either neutralize and dispose to drain of all waste products; or ensure authorised disposal at registered sites.
- Comply with Waste Management Duty of Care: A Code of Practice and The Hazardous Waste (England & Wales) Regulations 2005 where appropriate.

#### 2040A PROCEDURAL PRECAUTIONS FOR CLEANING AND CHEMICAL TREATMENT:

- Carry out tests to ensure that cleaning and chemical treatment processes are operating as required.
- Carry out tests to ensure that cleaning and chemical treatment processes are operating as required. and detailed in the Method Statement.
- Submit all test and sample results for certification and approval.

#### 2040B PROCEDURAL PRECAUTIONS FOR CLEANING AND CHEMICAL TREATMENT INCLUDING TAKING SAMPLES:

- Take and test samples of the filling/flushing water and the system water, before, during and following chemical treatment and/or cleaning in accordance with BSRIA BG 29/2012, Section 3 and BS 8552.
- Submit samples to an independent specialist for analysis in accordance with BSRIA BG 29.
- Monitor water quality of systems after pre-commission cleaning up to practical completion in accordance

with BSRIA BG 29/2012 Section 3.2.

- Submit all test and sample results for certification and approval.
- Ensure all contractually required samples are witnessed.

#### 2050# WATER TREATMENT METHODS:

- Pretreatment of fill water
  - Temporary base exchange softening plant for system fill in very hard water areas
  - Blended softened water
  - Reverse osmosis plant (for microbiological control as it provides a barrier to bacteria)
  - Automated chemical dosing
    - Proportional to the metered volume
    - Controlled by redox potential
    - Chemicals
  - Ultraviolet disinfection
  - Automated biocide dosing.
- Corrosion and scale control
  - Chemical
- Control of general fouling
  - Chemical
  - Physical
    - Filtration units.
- Control of microbiological fouling
  - Chemical
    - Biocides.
    - Biodispersants.
    - Biocides and biodispersants.

#### 2050A WATER TREATMENT METHODS FOR HOT WATER HEATING CLOSED CIRCUIT RECIRCULATING SYSTEMS:

- Corrosion and scale control
  - Chemicals as BSRIA Guide BG 50/2013 Table 5.
- Control of microbiological fouling
  - Chemical.
  - Biocides and biodispersants. Chemicals as BSRIA BG 50/2013 Appendix C and European Biocidal Products Regulation (BPR) 528/2012.

#### 2050B WATER TREATMENT METHODS FOR CHILLED AND CONDENSER WATER CLOSED RECIRCULATING WATER SYSTEMS:

- Corrosion control
  - Chemicals as BSRIA Guide BG 50/2013 Table 5.
- Control of microbiological fouling
  - Chemical.
  - Biocides and biodispersants. Chemicals as BSRIA BG 50/2013 Appendix C and European Biocidal Products Regulation (BPR) 528/2012.

#### 2050C WATER TREATMENT METHODS FOR COOLING TOWER OPEN RECIRCULATING WATER

SYSTEMS:

- Scale control
  - Pretreatment - base exchange softening plant.
- Corrosion control
  - Chemicals as BSRIA Application Guide AG 2/93, Appendix A Table A3.
- Control of microbiological fouling
  - Chemical
    - Biocides and biodispersants. Chemicals as BSRIA Application Guide AG 2/93, Appendix A Table A3 and European Biocidal Products Regulation (BPR) 528/2012.
  - Physical - Ultraviolet disinfection units.

2060A CHEMICAL INJECTION AND DOSING METHODS FOR CLOSED SYSTEMS:

- Method of introducing chemicals
  - Dosing pots.

2060B CHEMICAL CLEANING AND DOSING METHODS FOR OPEN RECIRCULATING SYSTEMS:

- Method of introducing chemicals
  - Chemical dosing for scale and corrosion inhibitors
  - Continuous; timer controller; or proportional dosing as appropriate.
  - Bleed-off control.
  - Biocide dosing - automatic dosing control.

2060C PACKAGED CHEMICAL INJECTION AND DOSING PLANT:

- Provide packaged monitoring and treatment plants.

2060D DOSING POTS - CLOSED SYSTEMS:

- Chemical feed
  - Provide feeder (dosing pots) with a tundish for filling; separate air vent with discharge tube; drain and isolating valves. Fabricate from mild steel tube to BS EN 10255, BS EN 10216 or BS EN 10217 to suit maximum working pressure of system.
- Sampling
  - Install in each water system means of taking samples as clause Y25.2070B and as follows:-
    - Chilled water systems - provide a gate valve and discharge.
    - Heating systems - provide a sample cooler with a copper coil and cooling jacket with cooling water valve and drained to waste.

2060E DOSING - OPEN SYSTEMS:

- Chemical dosing
  - Provide an interface between water treatment plant and system pumps to allow the initiation of water circulation in addition to the requirements of the building services.
  - Where control by-passes are used, set valves to allow reduced circulation but not complete isolation of the equipment.
  - Provide control of chemical inhibitors by linking the dosing pump control unit to operate on a signal from a water meter.
  - Provide skid mounted packaged equipment to feed chemical inhibitors including pre-wired controls and dosing pump, high density polyethylene tank, chemical diaphragm pump complete with all

necessary valves and tubing.

- Provide control of total dissolved solids by linking a solenoid purge valve to operate by a signal automatically received from a conductivity sensor.
- Biocide dosing
  - Provide skid mounted packaged equipment to feed two types of biocides on an automatically alternating basis including pre-wired timer controls and twin biocide diaphragm pumps complete with all necessary valves and tubing. Draw biocide chemical direct from the chemical supply drums located on the skid.
- Control
  - Provide low level alarms for all dosing units.
  - Provide BMS connections to monitor dosing and show run and alarm conditions.
- Injection manifold
  - Provide an injection manifold for use with the above water treatment equipment.
  - Connect the manifold across flow and return pipework and mount above the dosing plant modules, unless otherwise indicated.

#### 2065 CHEMICALS - DOSING:

- Provide biocides effective against Legionella Pnueumophilia, algae, fungi, moulds and slime forming bacteria including pseudomonas and sulphate reducing bacteria.
- Supply biocides as recommended by water treatment specialist.
- Incorporate a bio dispersant in the programme to break up and disperse any slime masses, where required.
- Biocides to comply with European Biocidal Products Regulation (BPR) 528/2012.
- The water treatment specialist shall select the appropriate corrosion inhibitors, to minimise corrosion, and biocides to prevent any proliferation to mild steel, copper and copper alloys.
- Provide a specific inhibitor to protect aluminium when it is present in the system.
- The cleaning agent is to be specified by the water treatment specialist.

#### 2070A MONITORING CLOSED SYSTEMS:

- For closed systems monitor system physical, chemical and bacterial levels from initial fill to practical completion in accordance with BSRIA BG 29/2012 and BS 8552.

#### 2070B SAMPLING:

- For closed systems provide sampling points in accordance with BS 8552 and BSRIA BG 29/2012.
- Provide testing equipment to carry out tests for all inhibitors used in treatment programme indicated.
- Undertake sampling of closed systems in accordance with BSRIA BG 29/2012, Section 3 and Appendices A and B.
- Number and locations of samples in compliance with BG 29/2012, Appendix A.

#### 2070C SAMPLING KITS:

- Provide the following test kits as appropriate
  - Boiler water test kit for steam boilers; conductivity test kit; pH test kit; inhibitor test kit; hardness test kit

where a softener is installed; chloride level test kit.

- For open systems - bacteriology monitoring with use of dipslides.
- Log sheets for recording of test results, bacteriological analysis and any actions required or taken.

#### 2080A CHEMICAL PROVISION, STANDARD ARRANGEMENT:

- Provide consumables for a period of 12 months.
- Where indicated, provide for supply of chemicals from containers refilled by drumless delivery system.
- Include for supply of chemicals for all systems using the basis of:
  - Open circuit systems operating at 100% load for 2080 hours per annum.
  - Closed circuit systems make-up 1% system volume/month.

#### 3010A FLUSHING:

- Carry out flushing of water systems in accordance with BSRIA Guide BG 29/2012 Pre-commission cleaning of pipework systems.
  - Section 4 Installation Considerations.
  - Section 5 System Dynamic Flushing.

#### 3010B FLUSHING:

- Ensure all water used for pressure testing, flushing and system filling is of good quality. Clean and chlorinate temporary site mains to fill and flush closed systems in accordance with BS EN 806-4. Leave remaining pipework sections full and treated after pressure testing.
- Install all necessary pipework ancillaries to enable a specialist to carry out flushing, inspection and witnessing of water systems in accordance with BSRIA Guide BG 29/2012. Pre-commission cleaning of pipework systems. Connections between new and existing systems in accordance with BG 29/2012 Section 7.
- Temporary connection from the mains must be in compliance with
  - WRAS advisory topics B09 or B22.
  - England and Wales - The Water Supply (Water Fittings) Regulations 1999, the Water Act 2014 and the Construction Products Regulations 2013.
  - Scotland - The Water Supply (Water Fittings) Byelaws 2014.
  - Northern Ireland - The Water Supply (Water Fittings) Regulations (Northern Ireland) 2009.
  - BSRIA BG 29/2012 Table 3 for pipe sizes when using mains water for flushing or installation of a temporary tank and pump arrangement shall be provided.
- Domestic water systems are to be flushed and disinfected in accordance with the requirements of BS EN 806-4 and complimentary guidance in BS 8558, and to the satisfaction of the local water supply authority. Flush systems using mains water until the water is clear.

#### 3020A TESTING AND PURGING GAS PIPEWORK - INDUSTRIAL AND COMMERCIAL INSTALLATIONS:

- Comply with IGE/UP/1 Strength and tightness testing and direct purging of industrial and commercial gas installations.

#### 3020B TESTING AND PURGING GAS PIPEWORK - SMALL LOW PRESSURE INDUSTRIAL AND COMMERCIAL INSTALLATIONS:

- Comply with IGE/UP/1A Strength and tightness testing and direct purging of small low pressure

industrial and commercial natural gas installations.

**3030A CHEMICAL CLEANING AND SOLIDS REMOVAL - INHIBITED ACID:**

- Carry out chemical cleaning procedure in accordance with BSRIA Guide BG 29/2012 Pre-commission Cleaning of Pipework Systems.

**3030B CHEMICAL CLEANING AND SOLIDS REMOVAL - FORMULATED PRODUCTS:**

- Carry out chemical cleaning procedure in accordance with BSRIA Guide BG 29/2012 Pre-commission Cleaning of Pipework Systems.

**3040 STERILIZATION - GENERAL:**

- After flushing process, carry out sterilization of water services systems in accordance with BS EN 806-4 and complimentary guidance in BS 8558.
- Prior to sterilization ensure each system is flushed, cleaned and drained.
- Provide temporary connections to system terminal points suitable for introduction of sterilization chemicals and fluids and 22mm minimum valved drain connection on incoming main immediately downstream of mains isolating valve.
- Fill system with clean, fresh water.
- If the building is not occupied immediately after sterilisation, put in hand a system for flushing all outlets to ensure system remains suitable for use when required.
- Repeat disinfection of potable water system immediately prior to handover if required.
- Immediately prior to occupation, retake samples and submit for analysis and report.

**3050 STERILIZATION - MAINS WATER SYSTEM:**

- Carry out the following operations in accordance with BS EN 806-4 and complimentary guidance in BS 8558.
  - Flush system and introduce sterilisation chemical.
  - Agree a list of sentinel points (outlets in a water system that poses the highest risk from infection) prior to sterilisation and take samples from these points to ensure correct chlorine concentration.
  - Leave system to stand for period of time indicated by the chemical manufacturer.
  - Repeatedly flush system with clean water until all traces of chlorine have been removed - leave system filled.
  - Submit samples to registered laboratory for microbiological analysis and report.
- Certificate of conformity
  - Immediately prior to handover, retake samples and submit for analysis and report.
- Where necessary repeat sterilisation of potable water system immediately prior to handover.

**3060 STERILIZATION - WATER STORAGE SYSTEMS:**

- Carry out the following operations in accordance with BS EN 806-4, complementary guidance in BS 8558 and HSE L8 Legionnaires' disease - control of legionella bacteria in water systems ACOP and all

parts of HSG 274 (for technical guidance).

- Carry out operations on all water storage tanks and cisterns, cold and hot.
- Carry out procedures as for mains water systems.

#### 3080 SERVICE VISITS:

- Provide monthly service visits for one full year by a fully qualified chemist, to carry out the following:-
  - Review water analysis records, correspondence and reports since previous visit.
  - Test water samples on-site for hardness; all inhibitors; dissolved solids; pH; total alkalinity.
  - Check performance of feeding equipment, softeners, and testing equipment on-site.
  - Submit a written report.
  - Undertake a sampling of closed systems in accordance with BS 8552.
  - Carry out micro-biological analysis using diptslides.
  - Frequency of service visits - monthly.
  - Frequency of service visits
- Special requirements as indicated.
- Special requirements

#### 3090 DOCUMENTATION:

- Provide number of copies as indicated of hard cover binders containing details of
  - Programme outlines.
  - Purpose of chemical treatment.
  - Chemicals used and quantity.
  - On site testing procedures.
  - Control limits of tests.
  - Equipment data and drawings.
  - Product notes and material safety data sheets for all chemicals used.
- Provide a complete training programme for site operatives covering
  - Methods of basic water testing.
  - Explanation of results obtained.
  - Actions to be taken on test results.

## Y41 FANS

### 2010B POTENTIALLY EXPLOSIVE ATMOSPHERES

- Constructional requirements
  - The constructional requirements for fans constructed to Group IIG (of explosion groups IIA, IIB and hydrogen) categories 1, 2 and 3, and Group IID categories 2 and 3, intended for use in explosive atmospheres shall be in accordance with BS EN 14986 and BS EN 13463-1.
    - Ambient atmosphere pressure:
      - Absolute pressure ranging from 0.8bar to 1.1bar.
  - Temperature range
    - Minimum to maximum operating temperatures of -20°C to 60°C inlet gas temperature, -10% to +20% of nominal gas flow.

## Y50 THERMAL INSULATION

### 1035# EUROPEAN CLASSIFICATION FOR REACTION TO FIRE PERFORMANCE:

- Supply insulating materials classified in accordance with BS EN 13501-1. Classes acceptable are
  - A1/A1<sub>L</sub>
  - A2/A2<sub>L</sub>
  - B/B<sub>L</sub>
  - C
- Smoke emission classification
  - s1
  - s2
  - s3<sub>L</sub>
- Production of flaming droplet/particles classification
  - d0
  - d1
  - d2
- Test methods
- BS EN ISO 1182, BS EN ISO 1716, BS EN 11925-2, BS EN 13823

### 1035A EUROPEAN CLASSIFICATION FOR REACTION TO FIRE PERFORMANCE:

- Supply insulating materials classified in accordance with BS EN 13501-1. Classes acceptable are A1/A1<sub>L</sub>, A2/A2<sub>L</sub> or B/B<sub>L</sub> having smoke emission classification of s1 and production of flaming droplets/particles classification of d0.
- Test methods
  - BS EN ISO 1182, BS EN ISO 1716, BS EN 11925-2, BS EN 13823 as appropriate.

### 1050A SPREAD OF FLAME:

- When completed, ensure surface-finish complies with BS 476-7 Class 1 spread of flame.

### 1055 SMOKE EMISSION CHARACTERISTICS:

- Ensure only products classified by BS EN 13501-1 as s1 (materials that give off little or no smoke) are used.

### 1080 ELECTRICAL BONDING TERMINAL:

- Ensure an electrical bonding terminal suitable for connection of 6mm<sup>2</sup> maximum conductor is provided where indicated.

### 1090 INSPECTION AND TESTING:

- Arrange performance test of thermal conductivity on materials selected, carried out at manufacturer's works or at an approved laboratory and in accordance with appropriate British Standard.
- Provide assistance to allow for inspection of all sizes of insulation on all services after installation to determine thickness and compliance with specification. Make good any sections that are cut during

inspection for thickness and compliance with specification.

**2010 THERMAL CONDUCTIVITY:**

- All thermal conductivity figures given in insulation product clauses are typical values at the mean temperature stated, as declared in manufacturer's Declaration of Performance (DoP) certificates in accordance with the CPR.

**2015A THERMAL PERFORMANCE LIFE EXPECTANCY FOR PLANT DESIGN LIFE:**

- Ensure the insulation will maintain it's thermal performance for a minimum of the plant design life.

**2015B THERMAL PERFORMANCE LIFE EXPECTANCY DETAILS:**

- Provide manufacturer's details which define the life expectancy of the insulation material. Where appropriate this shall include both 'as manufactured' and 'aged' thermal conductivity values in accordance with BS EN 14314.

**2020 RESTRICTIONS ON USE OF MATERIALS:**

- Protect insulated stainless steel surfaces from the risk of stress corrosion in accordance with the recommendations in BS 5970.
- For all mineral wool insulation products, test evidence must be available showing that the fibres from which the products are made are not classified as a possible human carcinogen, as detailed by European

Directive 97/69/EC and the Approved Supply List of CHIP98, and that the fibres should be bio-soluble.

**2030A FOIL FACED ROCK MINERAL WOOL PIPE INSULATION:**

- Standard - BS EN 14303.
- Nominal density - 120 kg/m<sup>3</sup>.
- Thickness - 20mm to 100mm.
- Thermal conductivity - Typical value 0.033 - 0.034 W/mK at a mean temperature of 10°C.
- Finish - Reinforced aluminium foil with at least 25mm overlap.

**2030B CANVAS ROCK MINERAL WOOL PIPE INSULATION:**

- Standard - BS EN 14303.
- Nominal density - 120 kg/m<sup>3</sup>.
- Thickness - 20mm to 100mm.
- Thermal conductivity - Typical value of 0.033 - 0.034 W/mK at a mean temperature of 10°C.
- Finish - Canvas covered with at least 25mm overlaps.

**2030C FOIL FACED GLASS MINERAL WOOL PIPE INSULATION:**

- Standard - BS EN 14303.
- Nominal density - 80 kg/m<sup>3</sup>.
- Thickness - 20mm to 100mm.
- Thermal conductivity - Typical value of 0.033 W/mK at a mean temperature of 10°C.

**2040A FOIL FACED ROCK MINERAL WOOL SEMI RIGID DUCT INSULATION:**

- Standard - BS EN 14303.
- Nominal density - 45 kg/m<sup>3</sup>.
- Thickness - 25mm to 100mm.
- Thermal conductivity - Typical value not exceeding 0.034 W/mK at a mean temperature of 10°C.
- Finish - Reinforced aluminium foil.

**2050A FOIL FACED ROCK MINERAL WOOL FLEXIBLE DUCT INSULATION:**

- Standard - BS EN 14303
- Nominal density - 28 kg/m<sup>3</sup> to 45 kg/m<sup>3</sup>.
- Thickness - 25mm to 60mm.
- Thermal conductivity - Typical value of 0.034 W/mK at a mean temperature of 10°C.
- Finish - Reinforced aluminium foil.

**2060A FOIL FACED ROCK MINERAL WOOL LAMELLA DUCT INSULATION:**

- Standard - BS EN 14303
- Nominal density - 24-45 kg/m<sup>3</sup>.
- Thickness - 25mm to 80mm.
- Thermal conductivity - Typical value of 0.04 W/mK at a mean temperature of 10°C.
- Finish - Reinforced aluminium foil.

2060B KRAFT PAPER FACED ROCK MINERAL WOOL LAMELLA DUCT INSULATION:

- Standard - BS EN 14303
- Nominal density - 24-45 kg/m<sup>3</sup>.
- Thickness - 25mm to 80mm.
- Thermal conductivity - Typical value of 0.04 W/mK at a mean temperature of 10°C.
- Finish - Plain Kraft paper.

2065 CRIMPED MAT DUCT INSULATION:

- Standard - BS EN 14303
- Nominal density - 25 to 45 kg/m<sup>3</sup>.
- Compression resistance - Maximum of 13% compression at a static load of 2 kPa.
- Thickness - 25mm to 80mm.
- Thermal conductivity - Typical value of 0.034 W/mK at a mean temperature of 10°C.
- Finish - Reinforced aluminium foil.

2070A GALVANIZED METAL MESH ON MINERAL WOOL MATTRESSES - ONE FACE:

Standard - BS EN 14303

- Application - High temperature ducts, tanks, vessels and other process equipment.
- Nominal density - 66 - 128 kg/m<sup>3</sup>.
- Thickness - 25mm to 100mm.
- Thermal conductivity - Typical value of 0.041 W/mK at a mean temperature of 50°C.
- Mesh - Galvanized. Faced, one side.

2070B GALVANIZED METAL MESH ON MINERAL WOOL MATTRESSES - BOTH FACES:

- Standard - BS EN 14303.
- Application - High temperature ducts, tanks, vessels and other process equipment.
- Nominal density - 66 - 128 kg/m<sup>3</sup>.
- Thickness - 25mm to 100mm.
- Thermal conductivity - Typical value of 0.041 W/mK at a mean temperature of 50°C.
- Mesh - Galvanized. Faced, both sides.

2070C STAINLESS STEEL MESH ON MINERAL WOOL MATTRESSES - ONE FACE:

- Standard - BS EN 14303
- Application - High temperature ducts, tanks, vessels and other process equipment.
- Nominal density - 66 - 128 kg/m<sup>3</sup>.
- Thickness - 25mm to 100mm.
- Thermal conductivity - Typical value of 0.041 W/mK at a mean temperature of 50°C.
- Mesh - Stainless steel. Faced, one side.

2070D STAINLESS STEEL MESH ON MINERAL WOOL MATTRESSES - BOTH FACES:

- Standard - BS EN 14303
- Application - High temperature ducts, tanks, vessels and other process equipment.
- Nominal density - 66 - 128 kg/m<sup>3</sup>.
- Thickness - 25mm to 100mm.
- Thermal conductivity - Typical value of 0.041 W/mK at a mean temperature of 50°C.

- Mesh - Stainless steel. Faced, both sides.

2080A FLAT DUCTWORK FIRE PROTECTION INSULATION - MITRED JOINTS:

- Material - Mineral wool, slab for flat ducts, with 45° mitred joints.
- Nominal density - 165 kg/m<sup>3</sup>.
- Thermal conductivity - Typical value of 0.035 W/mK at a mean temperature of 10°C.
- Facing - Reinforced aluminium foil.

2080B FLAT DUCTWORK FIRE PROTECTION INSULATION - BUTTED JOINTS:

- Material - Mineral wool, slab for flat ducts, with 90° butted joints.
- Nominal density - 165 kg/m<sup>3</sup>.
- Thermal conductivity - Typical value of 0.035 W/mK at a mean temperature of 10°C.
- Facing - Reinforced aluminium foil.

2080C CIRCULAR DUCTWORK FIRE PROTECTION INSULATION - SECTION:

- Material - Mineral wool
  - Section for circular duct, 17 to 610 mm diameter.
- Nominal density - 165 kg/m<sup>3</sup>.
- Thermal conductivity - Typical value of 0.035 W/mK at a mean temperature of 10°C.
- Facing - Reinforced aluminium foil.

2080D CIRCULAR DUCTWORK FIRE PROTECTION INSULATION - PSM:

- Material - Mineral wool
  - PSM for circular duct greater than 406mm diameter.
- Nominal density - 165 kg/m<sup>3</sup>.
- Thermal conductivity - Typical value of 0.035 W/mK at a mean temperature of 10°C.
- Facing - Reinforced aluminium foil.

2080E CIRCULAR DUCTWORK FIRE PROTECTION INSULATION - FLEXIBLE MAT:

- Material - Mineral wool wire faced flexible mattress.
- Nominal density - 66 kg/m<sup>3</sup>.
- Thermal conductivity - Typical value of 0.035 W/mK at a mean temperature of 10°C.
- Facing - Reinforced aluminium foil.

2110A FOIL FACED CLOSED CELL RIGID PHENOLIC FOAM (PF) PREFORMED SECTIONS:

- Standard - BS EN 14314
- Nominal density - Refer to manufacturer's recommendations.
- Temperature range - Refer to manufacturer's recommendations.
- Thickness - Minimum 15mm.
- Thermal conductivity - Typical value of 0.025 W/mK at a mean temperature of 10°C when fully aged in accordance with BS EN 14314.
- Finish - Reinforced aluminium foil.
- Phenolic foam sections to be completely treated, at the insulation manufacturer's works, with a suitable dust suppressant, acid neutralising and passivating bore coating. This can be either an impregnated

permeable liner or a sprayed coating.

**2120A FOIL FACED CLOSED CELL RIGID LAMINATED PHENOLIC FOAM (PF), DUCT INSULATION SLAB:**

- Standard - BS EN 14314.
- Nominal density - refer to manufacturer's recommendations.
- Thickness - minimum 20mm.
- Thermal conductivity - Typical value of 0.022 W/mK at a mean temperature of 10°C when fully aged in accordance with BS EN 14314.
- Finish - Reinforced aluminium foil.

**2120B CLOSED CELL RIGID LAMINATED PHENOLIC FOAM (PF), DUCT INSULATION SLAB:**

- Standard - BS EN 14314
- Nominal density - refer to manufacturer's recommendations.
- Thickness - minimum 20mm.
- Thermal conductivity - Typical value of 0.022 W/mK at a mean temperature of 10°C when fully aged in accordance with BS EN 14314.

**2170 VAPOUR BARRIER PERMEANCE:**

- Comply with requirements of BS 5422 and BS 5970.
- Maximum permitted water vapour permeance in relation to plant temperature at an ambient temperature of +20°C (dry bulb) to be in accordance with BS 5422, Table 1.

**2180A BITUMEN VAPOUR BARRIER COATINGS:**

- Cut-back bitumens with cotton canvas or open mesh glass cloth to reinforce coatings.

**2180B VINYL VAPOUR BARRIER COATINGS:**

- Vinyl emulsions with cotton canvas or open mesh glass cloth to reinforce coatings.

**2180C SOLVENT POLYMER VAPOUR BARRIER COATINGS:**

- Solvent-based polymers with cotton canvas or open mesh glass cloth to reinforce coatings.

**2180D BITUMEN EMULSION VAPOUR BARRIER COATINGS:**

- Bitumen emulsions (with or without elastomer latex) with cotton canvas or open mesh glass cloth to reinforce coatings.

**2190 ADHESIVES:**

- Comply with the recommendations of clause 10.1 of BS 5970, for insulation bonding adhesives, lagging adhesives; and facing and film attachment adhesives.

**2200A SELF ADHESIVE WEATHER RESISTANT ZERO PERM MULTI-LAYER LAMINATE:**

- Apply multi-layer laminate directly over ducts and pipework, ensuring 75mm overlap for a complete

vapour barrier.

- Test in accordance with BS 476-6 and BS 476-7.
- Finish - Class O
- Laminate to be puncture and tear resistant and have supporting test data in accordance with ASTM D-1000 and ASTM D-624.
- Normal use -5ply laminate.
- Heavy duty use (e.g. Pipework /ductwork which could be walked on regularly or low level pipework in plant areas) -13ply laminate.
- Installation to be in accordance with the manufacturer's recommendations and may be either factory pre-applied or applied in-situ.

#### 2200B ROOFING FELT PROTECTION:

- Secure in position with galvanized wire netting, of 1mm x 25mm mesh. Finish with two coats of black bituminous paint.

#### 2200C FLAT ALUMINIUM-ZINC COATED STEEL PROTECTION:

- Mild steel sheet continuously hot dipped with 185gm aluminium-zinc coating to BS EN 10346, applied directly to insulating material.
- 0.4mm thick flat sheet.

#### 2200D RIBBED ALUMINIUM-ZINC COATED STEEL PROTECTION:

- Mild steel sheet continuously hot dipped with 185gm aluminium-zinc coating to BS EN 10346, applied directly to insulating material.
- 0.4mm thick ribbed sheet.

#### 2200E ALUMINIUM SHEETING PROTECTION:

- Apply flat (embossed) or profiled aluminium cladding directly to insulating material. 0.56mm thick on pipework; 0.71mm thick on ductwork.

#### 2200G CANVAS PROTECTION:

- 130g covering for ductwork with two coats of water based co-polymer solution.
- Canvas sections for pipework with two coats of water based co-polymer solution.

#### 2200H CANVAS PROTECTION WITH ALUMINIUM BANDS:

- 130g covering for ductwork with two coats of water based co-polymer solution, with aluminium bands.
- Canvas sections for pipework with two coats of water based co-polymer solution, with aluminium bands.

#### 2230A ALUMINIUM PROTECTION FOR HEAT EXCHANGERS AND OTHER VESSELS:

- Finish with 0.9mm thick aluminium ribbed or embossed sheeting, with lapped, riveted and sealed joints, laps to shed water. Seal all joints at manholes and stools. Fit cut-outs with purpose made over-plates or collars.

#### 2230B ALUMINIUM PROTECTION FOR HEAT EXCHANGERS AND OTHER VESSELS - WITH CHEST

**AND ACCESS COVERS:**

- Finish with 0.9mm thick aluminium ribbed or embossed sheeting, with lapped, riveted and sealed joints, laps to shed water. Seal all joints at manholes and stools. Fit cut outs with purpose made over-plates or collars.
- Enclose chests and access covers in removable covers lined with high density flexible material. Remove manufacturer's name plate and refix on cladding.

**2230E MULTI-LAYER LAMINATE PROTECTION FOR HEAT EXCHANGERS AND OTHER VESSELS - WITH CHEST AND ACCESS COVERS:**

- Finish with self-adhesive weather resistant zero perm multi-layer laminate to encapsulate insulation, using the taped system as a quick and easy access point.

**2240A MINERAL FIBRE INSULATION FOR BOILER FLUES WITH ALUMINIUM CASING:**

- Use bonded mineral fibre preformed sections secured with aluminium bands direct to flue. Use multi-layers and stagger joints for thicknesses in excess of 65mm. Finish with 0.9mm thick aluminium ribbed or embossed sheeting.

**2280 PUMPS AND OTHER IRREGULAR SHAPES:**

- Where access is required to pumps and other irregular shapes submit proposals for materials and methods of applying a demountable finish, for approval.
- Comply with requirements of BS 5970.

**2286 CALCULATION OF INSULATION THICKNESS - BUILDING REGULATIONS :**

- Provide insulation of thickness conforming with the requirements of the Building Regulations (England and Wales) Part L Approved Documents or the Scottish Technical Handbooks, and the calculation methods given in BS EN ISO 12241 using the standardised assumptions within BS 5422 .

**2287 CALCULATION OF INSULATION THICKNESS - ECA ENHANCED:**

- The insulation manufacturer selected for a particular project should calculate the minimum required thicknesses of pipework insulation based on the actual conductivity of the product at the relevant temperature and the criteria on the ECA web site for an eligible installation using the methodology set out in BS EN ISO 12241 and the assumptions set out in Table C1 of BS 5422.

**2289 INSULATION THICKNESS TABLES:**

- Unless stated otherwise the thicknesses given in the tables in this specification are the nearest commercially available material thickness to meet the minimum calculated thickness to BS EN ISO 12241 and the product declared performance data for CE marking. Thicknesses have been calculated by

manufacturers for each product and use thermal conductivity values calculated from the mean insulation temperature based on the fluid and air temperatures listed in the relevant tables.

- Should alternative products be offered that may have different performance data the Contractor shall ensure the manufacturer undertakes calculations and submits appropriate thickness table.
- Unless specified otherwise elsewhere, the thicknesses for pipe of greater diameter, flat surfaces or irregular shaped plant items shall not be less than that for the largest pipe size given in the thickness tables.

**2290 NON-DOMESTIC HOT WATER SERVICE INSTALLATIONS - BUILDING REGULATIONS ROCK MINERAL WOOL:**

- Insulation thickness to achieve the maximum permissible heat loss stated in the Building Regulations Part L Non Domestic Building Services Compliance Guide, Northern Ireland Technical Booklet F2 and Section 6 of the Scottish Non Domestic Technical Handbook.

Outside diameter of steel pipe (mm)	Thickness of rock mineral wool (mm)	
	0.05	0.9
17	25	30
21	25	30
27	30	35
34	30	35
42	30	35
48	35	40
60	40	40
76	35	45
89	35	45
114	40	45
140	40	45
168	40	50
219	40	50
273 and above	45	50

- Basis: Horizontal pipe at 60°C in still air at 15°C, thermal conductivity values calculated from the mean insulation temperature based on the fluid and air temperatures.
  - Use this table for insulation thickness of copper pipework of the nearest equivalent outside diameter.
  - Use this table for insulation thickness of plastic pipework of the nearest equivalent outside diameter.

**2295 NON-DOMESTIC HOT WATER SERVICE INSTALLATIONS, BUILDING REGULATIONS - GLASS MINERAL WOOL:**

- Insulation thickness to achieve the maximum permissible heat loss stated in the Building Regulations Part L Non Domestic Building Services Compliance Guide, Northern Ireland Technical Booklet F2 and

section 6 of the Scottish Non Domestic Technical Handbook.

Outside diameter of steel pipe (mm)	Thickness of glass mineral wool (mm)	
	0.05	0.9
17	25	30
21	25	30
27	30	40
34	30	40
42	30	40
48	40	40
60	40	40
76	40	40
89	40	40
114	40	50
140	40	50
168	40	50
219	40	50
273 and above	40	50

- Basis: Horizontal pipe at 60°C in still air at 15°C, Thermal conductivity calculated from the mean insulation temperature based on the fluid and air temperatures.
  - Use this table for insulation thickness of copper pipework of the nearest equivalent outside diameter.
  - Use this table for insulation thickness of plastic pipework of the nearest equivalent outside diameter.

**2305 NON-DOMESTIC HOT WATER SERVICE INSTALLATIONS, BUILDING REGULATIONS - PHENOLIC FOAM:**

- Insulation thickness to achieve the maximum permissible heat loss stated in the Building Regulations Part L Non Domestic Building Services Compliance Guide, Northern Ireland Technical Booklet F2 and

section 6 of the Scottish Non Domestic Technical Handbook.

Outside diameter of steel pipe (mm)	Thickness of phenolic foam (mm)	
	(0.05)	(0.9)
Surface emissivity		
17	15	15
21	15	20
27	15	20
34	20	20
42	20	20
48	20	25
60	20	25
76	25	25
89	25	25
114	25	30
140	25	30
168	25	30
219	30	30
273 and above	30	30

- Basis: Horizontal pipe at 60°C in still air at 15°C, aged k value. Thermal conductivity calculated from the mean insulation temperature based on the fluid and air temperatures.

Thicknesses of nitrile rubber are minimum calculated thicknesses

- Use this table for insulation thickness of copper pipework of the nearest equivalent outside diameter.
- Use this table for insulation thickness of plastic pipework of the nearest equivalent outside diameter.
- The above thicknesses relate to Class O rated insulated. the thicknesses may vary for other ratings.

#### 2306 NON-DOMESTIC HOT WATER SERVICE INSTALLATIONS, BUILDING REGULATIONS - NITRILE RUBBER:

- Insulation thickness to achieve the maximum permissible heat loss stated in the Building Regulations Part L Non Domestic Building Services Compliance Guide, Northern Ireland Technical Booklet F2 and

section 6 of the Scottish Non Domestic Technical Handbook.

Outside diameter of steel pipe (mm)	Approx. thickness of nitrile rubber (mm)	
	(0.05)	(0.9)
Surface emissivity		
17	26	31
21	28	33
27	30	35
34	32	37
42	33	38
48	35	41
60	36	42
76	38	44
89	38	44
114	39	45
140	40	47
168	41	48
219	41	48
273 and above	42	49

• Basis: Horizontal pipe at 60°C in still air at 15°C. Thermal conductivity calculated from the mean insulation temperature based on the fluid and air temperatures.

Thicknesses of nitrile rubber are minimum calculated thicknesses.

- Use this table for insulation thickness of copper pipework of the nearest equivalent outside diameter.
- Use this table for insulation thickness of plastic pipework of the nearest equivalent outside diameter.
- The above thicknesses relate to Class O rated insulation. The thicknesses may vary for other ratings.

**2307 NON-DOMESTIC HOT WATER SUPPLY SERVICES, ECA ENHANCED:**

• The insulation manufacturer selected for a particular project should calculate the minimum required thicknesses of pipework insulation based on the actual conductivity of the product at the relevant temperature and the criteria on the ECA web site for an eligible installation using the methodology set out in BS EN ISO 12241 and the assumptions set out in Table C1 of BS 5422: 2009. The table below defines

the maximum permissible heat losses to be used in the calculations.

Non-Domestic Hot Water Supply Maximum Permitted Heat Loss (W/m)	
Temperature	60°C
Outside Pipe Diameter (mm)	
17.2	6.04
21.3	6.45
26.9	7.00
33.7	7.71
42.4	8.46
48.3	9.01
60.3	9.94
76.1	11.25
88.9	12.17
114.3	14.29
139.7	16.09
168.3	18.24
219.1	22.06
273 & above	25.95

2308 DOMESTIC HOT WATER STORAGE VESSELS IN NEW AND EXISTING BUILDINGS- ROCK MINERAL WOOL:

- Provide insulation thicknesses to limit heat losses from DHW storage vessels to the maximum

- recommended in Table 27 in the Non-domestic Building Services Compliance Guide (NDBSCG):2013.
- Minimum thickness of insulation for vessels of capacity less than those in the table below to be 80mm.
  - Insulation thickness for vessels with capacity greater than 2m<sup>3</sup> to be 120mm.
  - Install insulation in accordance with the manufacturer's recommendations.
  - Encase insulation in 1.6mm thick galvanised mild steel sheets.

Nominal Capacity (litres)	Typical vessel Diameter (m)	Typical vessel Height or length(m)	Maximum Heat Loss (kWh/24h)	kW	W/m <sup>2</sup>	Rock mineral wool slab thickness mm
700	0.675	1.750	4.1	0.171	38.6	80
800	0.750	1.950	4.3	0.179	32.7	90
900	0.800	2.000	4.5	0.188	31.1	100
1000	0.850	1.950	4.7	0.196	30.9	100
1200	0.900	2.100	4.9	0.204	28.3	100
1500	1.050	1.950	5.1	0.213	26.0	110
2000	1.050	2.500	5.2	0.217	21.7	120

- Basis of table: Part of Table 27 in NDBSCG 2013, rock mineral wool slabs (plain, without foil facing) conforming to BS EN 14303, 45Kg/m<sup>3</sup> and thermal conductivity of 0.042W/mK at 50°C mean temperature.

#### 2310 NON-DOMESTIC HEATING INSTALLATIONS, BUILDING REGULATIONS - ROCK MINERAL WOOL:

- Insulation thickness to achieve the maximum permissible heat loss stated in the Building Regulations Part L Non Domestic Building Services Compliance Guide Northern Ireland Technical Booklet F2, and

section 6 of the Scottish Non Domestic Technical Handbook.

Outside diameter of steel pipe (mm)	Thickness of rock mineral wool insulation (mm)					
	≤95		96-120		121-150	
Temperature of contents °C	0.05	0.9	0.05	0.9	0.05	0.9
Surface emissivity	0.05	0.9	0.05	0.9	0.05	0.9
17	25	30	25	30	25	30
21	30	35	30	35	30	35
27	35	40	40	45	40	45
34	35	40	45	55	55	55
42	35	40	55	60	65	70
48	40	45	55	60	70	75
60	40	45	60	65	75	80
76	45	50	60	65	80	90
89	45	50	65	70	80	90
114	50	55	65	75	90	100
140	50	55	70	75	90	100
168	50	55	70	80	100	100
219	50	60	75	80	100	120
273	50	60	75	90	100	120

- Basis of calculation of thickness: Horizontal pipe at 75°C (LTHW) or 100°C (MTHW) or 125°C (HTHW) in still air at 15°C. Thermal conductivity calculated from the mean insulation temperature based on the fluid and air temperatures.
- Use this table for insulation thickness of copper or plastic pipework of the nearest equivalent outside diameter.

#### 2315 NON-DOMESTIC HEATING INSTALLATIONS, BUILDING REGULATIONS - GLASS MINERAL WOOL:

- Insulation thickness to achieve the maximum permissible heat loss stated in the Building Regulations Part L Non Domestic Building Services Compliance Guide, Northern Ireland Technical Booklet F2 and

section 6 of the Scottish Non Domestic Technical Handbook.

Outside diameter of steel pipe (mm)	Thickness of glass wool insulation (mm)					
	≤95		96-120		121-150	
Temperature of contents °C	0.05	0.9	0.05	0.9	0.05	0.9
Surface emissivity	0.05	0.9	0.05	0.9	0.05	0.9
17	25	30	25	30	25	30
21	30	40	30	40	30	40
27	30	40	40	40	40	40
34	40	40	50	50	50	50
42	40	40	50	50	60	60
48	40	50	50	60	60	80
60	40	50	60	60	80	80
76	50	50	60	60	80	80
89	50	50	60	80	80	80
114	50	50	60	80	80	100
140	50	60	80	80	100	100
168	50	60	80	80	100	100
219	50	60	80	80	100	100
273	50	60	80	80	100	100

- Basis of calculation: Horizontal pipe at 75°C (LTHW), 100°C (MTHW) or 125°C (HTHW) in still air at 15°C. Thermal conductivity calculated from the mean insulation temperature based on the fluid and air temperatures.

- Use this table for insulation thickness of copper or plastic pipework of the nearest equivalent outside diameter.

#### 2325 NON-DOMESTIC HEATING INSTALLATIONS, BUILDING REGULATIONS - PHENOLIC FOAM:

- Insulation thickness to achieve the maximum permissible heat loss stated in the Building Regulations Part L Non Domestic Building Services Compliance Guide, Northern Ireland Technical Booklet F2 and

section 6 of the Scottish Non Domestic Technical Handbook.

Outside diameter of steel pipe (mm)	Low temperature hot water $\leq 95^{\circ}\text{C}$	
	Thickness of phenolic foam insulation (mm)	
Surface emissivity	(0.05)	(0.9)
17	15	15
21	15	20
27	20	20
34	20	20
42	20	25
48	25	25
60	25	25
76	25	30
89	25	30
114	30	30
140	30	35
168	30	35
219	30	35
273 and above	35	35

- Basis of calculation: Horizontal pipe at  $75^{\circ}\text{C}$  (LTHW), in still air at  $15^{\circ}\text{C}$ , aged k value. Thermal conductivity calculated from the mean insulation temperature based on the fluid and air temperatures.
  - Use this table for insulation thickness of copper pipework of the nearest equivalent outside diameter.
  - Use this table for insulation thickness of plastic pipework of the nearest equivalent outside diameter.

2326 NON-DOMESTIC HEATING INSTALLATIONS, BUILDING REGULATIONS - NITRILE RUBBER:

- Insulation thickness to achieve the maximum permissible heat loss stated in the Building Regulations Part L Non Domestic Building Services Compliance Guide, Northern Ireland Technical Booklet F2 and

section 6 of the Scottish Non Domestic Technical Handbook.

Outside diameter of steel pipe (mm)	Thickness of nitrile rubber insulation (mm)					
	≤95		96-120#		121-150#	
Temperature of contents °C	0.05	0.9	0.05	0.9	0.05	0.9
Surface emissivity	0.05	0.9	0.05	0.9	0.05	0.9
17	27	31	26	29	32	35
21	31	36	32	36	38	42
27	34	39	40	45	48	52
34	36	42	47	52	59	65
42	38	44	51	57	74	81
48	40	46	52	58	77	84
60	42	48	56	62	82	89
76	44	50	59	66	87	95
89	45	52	61	67	90	98
114	47	54	65	71	96	103
140	48	55	68	74	100	107
168	49	56	70	77	102	110
219	51	58	72	79	106	115
273	51	58	74	81	109	118

- Thicknesses of nitrile rubber are minimum calculated thicknesses.
- Basis: Horizontal pipe at 75°C (LTHW) or 100°C (MTHW) or 125°C (HTHW) in still air at 15°C. Thermal conductivity calculated from the mean insulation temperature based on the fluid and air temperatures.
  - Use this table for insulation thickness of copper or plastic pipework of the nearest equivalent outside diameter.
  - # for service temperatures above 110°C specialist high temperature Foamed EPDM rubber must be used as recommended by the manufacturer.

#### 2327 NON-DOMESTIC HEATING INSTALLATIONS, ECA ENHANCED:

- The insulation manufacturer selected for a particular project should calculate the minimum required thicknesses of pipework insulation based on the actual conductivity of the product at the relevant temperature and the criteria on the ECA web site for an eligible installation using the methodology set out in BS EN ISO 12241 and the assumptions set out in Table C1 of BS 5422. The table below defines the

maximum permissible heat losses to be used in the calculations.

Non-Domestic Heating Installations Maximum Permitted Heat Loss (W/m)			
Temperature	Low	Medium	High
	< 95°C	96-120°C	121-150°C
Outside Pipe Diameter (mm)			
17.2	7.78	10.57	13.27
21.3	8.42	11.25	14.06
26.9	9.05	12.06	15.02
33.7	9.86	13.04	16.07
42.4	10.83	14.12	17.34
48.3	11.42	14.80	18.09
60.3	12.61	16.22	19.62
76.1	14.12	17.88	21.41
88.9	15.28	19.20	22.87
114.3	17.51	21.66	25.53
139.7	19.72	23.99	27.98
168.3	22.34	26.63	30.69
219.1	26.61	31.15	35.25
273 & above	30.91	35.83	40.05

**2331 DOMESTIC CENTRAL HEATING AND HOT WATER INSTALLATIONS, ECA ENHANCED:**

- The insulation manufacturer selected for a particular project should calculate the minimum required thicknesses of pipework insulation based on the actual conductivity of the product at the relevant temperature and the criteria on the ECA web site for an eligible installation using the methodology set out in BS EN ISO 12241 and the assumptions set out in Table C1 of BS 5422. The table below defines the maximum permissible heat losses to be used in the calculations.

Domestic Heating & Hot Water Maximum Permitted Heat Loss (W/m)	
Temperature	60°C
Outside Pipe Diameter (mm)	
8	5.82
10	6.20
12	6.52
15	7.03
22	8.02
28	8.87
35	9.63
42	10.58
54	11.83

**2336 DOMESTIC CENTRAL HEATING AND HOT WATER SYSTEMS - PHENOLIC FOAM:**

- Insulation thickness to achieve the maximum permissible heat loss stated in the Building Regulations Part L Domestic Building Services Compliance Guide, Northern Ireland Technical Booklet F1 and section

6 of the Scottish Domestic Technical Handbook.

Outside diameter of copper pipe (mm)	Domestic heating and hot water	
	Thickness of phenolic foam insulation (mm)	
Surface emissivity	0.05	0.9
15	15	15
22	15	15
28	15	15
35	15	15
42	15	15
54	15	15

- Basis: Horizontal pipe, water at 60°C in still air at 15°C, aged k value. Thermal conductivity calculated from the mean insulation temperature based on the fluid and air temperatures.

2337 DOMESTIC CENTRAL HEATING AND HOT WATER SYSTEMS, BUILDING REGULATIONS - NITRILE RUBBER:

- Insulation thickness to achieve the maximum permissible heat loss stated in the Building Regulations Part L Domestic Building Services Compliance Guide Northern Ireland Technical Booklet F1, and section 6 of the Scottish Domestic Technical Handbook.

Outside diameter of copper pipe (mm)	Domestic heating and hot water	
	Thickness of nitrile rubber insulation (mm)	
Surface emissivity	0.05	0.9
8	9	9
10	13	13
12	13	19
15	19	19
22	19	25
28	19	25
35	25	25
42	25	25
54	25	32

- Basis: Horizontal pipe, water at 60°C in still air at 15°C. Thermal conductivity calculated from the mean

insulation temperature based on the fluid and air temperatures.

**2340 STEAM AND CONDENSATE SYSTEMS FOR HVAC SYSTEMS - ROCK MINERAL WOOL:**

Outside diameter of steel pipe (mm)	Thickness of rock mineral wool insulation (mm)					
	Condensate ≤100°C #		Steam & Condensate Up to 149°C ## (3.6 barg max)		Steam & Condensate 150°C and above ###	
Surface emissivity	0.05	0.9	0.05	0.9	0.05	0.9
17	25	30	25	30	45	50
21	30	35	30	35	55	70
27	40	45	40	45	75	80
34	45	55	55	55	90	100
42	55	60	65	70	120	120
48	55	60	70	75	120	120
60	60	65	75	80	120	130
76	60	65	80	90	130	140
89	65	70	80	90	130	140
114	65	75	90	100	140	140
140	70	75	90	100	140	150
168	70	80	100	100	140	150
219	75	80	100	120	150	150
273	75	90	100	120	150	160
Flat surfaces	75	90	100	120	150	160

- # Basis of calculation of thicknesses: BS 5442 Table 16 for high emissivity outer surfaces (0.9 - painted and other finishes including black rubber) and Table 15 for low emissivity outer surfaces (0.05 - aluminium foil or bright aluminium) - Horizontal pipe at 100°C in still air at 15°C. Thermal conductivity calculated from the mean insulation temperature based on the fluid and air temperatures.
- ## Basis of calculation of thicknesses: BS 5442 Table 16 for high emissivity outer surfaces (0.9 - painted and other finishes including black rubber) and Table 15 for low emissivity outer surfaces (0.05 - aluminium foil or bright aluminium) - Horizontal pipe at 125°C in still air at 15°C. Thermal conductivity calculated from the mean insulation temperature based on the fluid and air temperatures.
- ### Basis of calculation of thicknesses: BS 5442 Table 16 for high emissivity outer surfaces (0.9-painted and other finishes including black rubber) and Table 15 for low emissivity outer surfaces (0.05 - aluminium foil or bright aluminium) - Horizontal pipe at 150°C (but using heat losses for 125°C ) in still air at 15°C. Thermal conductivity calculated from the mean insulation temperature based on the fluid and air temperatures.
- These thicknesses are greater than those for process pipework with a hot face temperature of 200°C to control heat loss and limit surface temperature. (Tables 21 and 24 in BS 5224).
- Use this table for insulation thickness of copper pipework of the nearest equivalent outside diameter.

**2396 COOLED WATER SUPPLIES, BUILDING REGULATIONS AND CONDENSATION CONTROL ON COOLED AND COLD WATER SUPPLIES - GLASS MINERAL WOOL:**

- Minimum insulation thicknesses to control heat gain to maximum permissible figures stated in the Building Regulations Part L Non Domestic Building Services Compliance Guide and section 6 of the

Scottish Non Domestic Technical Handbook and control condensation in accordance with BS 5442.

Outside diameter of steel pipe (mm)	Thickness of glass mineral wool insulation (mm)					
	>10		4.9 to 10		0 to 4.9	
Temperature of contents °C	0.05	0.9	0.05	0.9	0.05	0.9
Surface emissivity	0.05	0.9	0.05	0.9	0.05	0.9
17	20	20	20	25	25	25
21	20	20	25	25	30	30
27	20	20	25	25	30	30
34	20	20	25	30	40	30
42	20	20	30	30	40	40
48	25	25	30	30	40	40
60	25	25	30	30	50	40
76	25	25	40	40	50	40
89	25	25	40	40	50	40
114	30	30	40	40	50	40
140	30	30	40	40	50	40
168	30	30	40	40	60	50
219	40	30	50	40	60	50
273	40	30	50	40	60	50
324	40	30	50	40	60	50
356	40	30	50	40	60	50
406	40	30	60	40	80	50
456	40	30	60	40	80	50
508	40	30	60	40	80	50
610	40	30	60	40	80	50
Flat	50	30	60	40	80	50

- Basis for condensation: control ambient temperature of 25°C and a relative humidity of 80%. Thermal conductivity calculated from the mean insulation temperature based on the fluid and air temperatures.

**2411 COOLED WATER SUPPLIES, BUILDING REGULATIONS AND CONDENSATION CONTROL ON COOLED AND COLD WATER SUPPLIES - PHENOLIC FOAM:**

- Insulation thicknesses to control heat gain to maximum permissible figures stated in the Building Regulations Part L Non Domestic Building Services Compliance Guide, Northern Ireland Technical Booklet F2 and section 6 of the Scottish Non Domestic Technical Handbook and control condensation in

accordance with BS 5442.

Outside diameter of steel pipe (mm)	Thickness of phenolic foam insulation (mm)					
	>10		4.9 to 10		0 to 4.9	
Temperature of contents °C						
Surface emissivity	0.05	0.9	0.05	0.9	0.05	0.9
17	15	15	20	15	25	20
21	15	15	20	15	25	20
27	15	15	20	20	25	20
34	20	15	25	20	30	20
42	20	15	25	20	30	25
48	20	20	25	20	30	25
60	20	20	25	25	35	25
76	20	20	30	25	35	30
89	20	20	30	25	40	30
114	25	20	35	25	40	30
140	25	20	35	25	45	30
168	25	20	35	25	45	30
219	30	20	40	30	50	35
273	30	25	40	30	50	35
324	30	25	40	30	55	35
356	30	25	45	30	55	35
406	30	25	45	30	55	35
456	35	25	45	30	60	35
508	35	25	45	30	60	35
610	35	25	50	30	65	35

- Basis for condensation control: ambient temperature of 25°C and a relative humidity of 80%. Thermal conductivity calculated from the mean insulation temperature based on the fluid and air temperatures. Aged k value.
  - Use this table for insulation thickness of copper pipework of the nearest equivalent outside diameter.
  - Use this table for insulation of plastic pipework of the nearest equivalent outside diameter.

**2412 COOLED WATER SUPPLIES, BUILDING REGULATIONS AND CONDENSATION CONTROL ON COOLED AND COLD WATER SUPPLIES - NITRILE RUBBER:**

- Insulation thicknesses to control heat gain to maximum permissible figures stated in the Building Regulations Part L Non Domestic Building Services Compliance Guide, Northern Ireland Technical Booklet F2 and section 6 of the Scottish Non Domestic Technical Handbook and control condensation in

accordance with BS 5442.

Outside diameter of steel pipe (mm)	Thickness of nitrile rubber (mm)					
	>10		4.9 to 10		0 to 4.9	
Temperature of contents °C	0.05	0.9	0.05	0.9	0.05	0.9
Surface emissivity	0.05	0.9	0.05	0.9	0.05	0.9
17	15	21	20	26	23	30
21	16	22	21	27	24	31
27	17	23	23	29	2	33
34	18	25	24	31	29	36
42	19	26	25	32	30	38
48	20	27	26	33	31	39
60	20	27	27	35	33	40
76	21	28	28	37	37	45
89	21	29	29	37	37	45
114	22	30	29	37	37	45
140	22	30	30	38	37	45
168	22	30	30	39	38	47
219	22	31	30	39	38	47
273	22	31	30	39	38	47
324	25	35	30	40	40	50
356	25	35	35	40	40	50
406	25	40	35	40	45	50
456	25	40	35	40	45	50
508	25	40	35	40	45	50
610	25	40	35	40	45	50

- Basis for condensation control: ambient temperature of 25°C and a relative humidity of 80%. Thermal conductivity calculated from the mean insulation temperature based on the fluid and air temperatures.
- Thicknesses of nitrile rubber are minimum calculated thicknesses.

2420 PROTECTION AGAINST FREEZING - ROCK MINERAL WOOL:

Outside diameter of pipe (mm)	Indoor condition where freezing might occur	Outdoor condition where freezing might occur
	Thickness of mineral wool insulation (mm)	
<b>Copper</b>		
15	-	-
22	20	50
28	20	25
35	20	20
42	20	20
54	20	20
76	25	25
108	25	25
<b>Steel</b>		
21	40	-
27	20	45
34	20	25
42	20	20
48	20	20
60	20	20
76	25	25
89	25	25

- Basis BS 5422 Table 29: Initial water temperature +2°C, evaluation period 12hrs thermal conductivity calculated from the mean insulation temperature based on the fluid and air temperatures.
- If mineral wool is used on pipes smaller than 20mm NB the required insulation thickness is too large to be applied in practice. To provide the appropriate degree of frost protection a combination of insulation

and trace heating will be required.

- Indoor condition is for ambient air temperature of -6°C, permitted ice formation of 50%.
- Outdoor condition is for ambient air temperature of -10°C, permitted ice formation of 50%.

2421 PROTECTION AGAINST FREEZING - GLASS MINERAL WOOL:

Outside diameter of pipe (mm)	Indoor condition where freezing might occur	Outdoor condition where freezing might occur
	Thickness of glass mineral wool insulation (mm)	
Copper		
15	-	-
22	25	60
28	20	30
35	20	20
42	20	20
54	20	20
20	20	20
108	20	20
Steel		
21	50	-
27	25	40
34	20	20
42	20	20
48	20	20
60	20	20
76	20	20
89	20	20

- Basis BS 5422 Table 29: Initial water temperature +2°C, evaluation period 12hrs thermal conductivity calculated from the mean insulation temperature based on the fluid and air temperatures.
- If mineral wool is used on pipes smaller than 20mm NB the required insulation thickness is too large to be applied in practice. To provide the appropriate degree of frost protection a combination of insulation

and trace heating will be required.

- Indoor condition is for ambient air temperature of -6°C, permitted ice formation of 50%.
- Outdoor condition is for ambient air temperature of -10°C, permitted ice formation of 50%.

2430 PROTECTION AGAINST FREEZING - PHENOLIC FOAM:

Outside diameter of pipe (mm)	Indoor condition where freezing might occur	Outdoor condition where freezing might occur
	Thickness of closed cell phenolic foam (mm)	
<b>Steel</b>		
21	30	75
27	15	30
34	15	20
42	15	15
48	15	15
60	15	15
76	15	15
89	15	15
<b>Copper</b>		
15	35	130
22	15	30
28	15	20
35	15	15
42	15	15
54	15	15
76	15	15
108	15	15

- Basis BS 5422 Table 29: Initial water temperature +2°C, evaluation period 12hrs, thermal conductivity

calculated from the mean insulation temperature based on the fluid and air temperatures.

- Indoor condition is for ambient air temperature of -6°C, permitted ice formation of 50%.
- Outdoor condition is for ambient air temperature of -10°C, permitted ice formation of 50%.
- Use this table for insulation thickness of copper pipework of the nearest equivalent outside diameter.

**2440 PROTECTION AGAINST FREEZING - CLOSED CELL NITRILE RUBBER:**

Outside diameter of pipe (mm)	Indoor condition where freezing might occur	Outdoor condition where freezing might occur
Thickness of closed cell nitrile rubber (mm)		
<b>Steel</b>		
21	54	-
27	21(25)	59
34	13(13)	31(35)
42	7(9)	17(19)
48	4(6)	10(13)
60	2(6)	6(6)
76	(6)	3(6)
89	(6)	2(6)
<b>Copper</b>		
15	84	-
22	18	59
28	10	31
35	6	17
42	6	10
54	6	6
76	6	6
108	6	6

- Basis BS 5422 Table 29: Initial water temperature +2°C, evaluation period 12hrs, thermal conductivity values calculated from the mean insulation temperature based on the fluid and air temperatures.
- If nitrile runner is used on pipes smaller than 20mm NB for the outdoor condition, the required insulation thickness is too large to be applied in practice. To provide the appropriate degree of frost protection a combination of insulation and trace heating will be required.
- Figures (xx) are nearest commercially available material thicknesses. Greater thicknesses to be achieved by layering of insulation.
  - Indoor condition is for ambient air temperature of -6°C, permitted ice formation of 50%.
  - Outdoor condition is for ambient air temperature of -10°C, permitted ice formation of 50%.
  - Use this table for insulation thickness of copper pipework of the nearest equivalent outside diameter.

**2456 INSULATION THICKNESS ON DUCTWORK, BUILDING REGULATIONS:**

- Insulation thickness to limit heat gains and heat losses stated in the Building Regulations Part L Non Domestic Building Services Compliance Guide, Northern Ireland Technical Booklet F2 and section 6 of

the Scottish Non Domestic Technical Handbook.

Material	Thickness of insulation (mm)					
	Warm air ductwork			Chilled air / dual purpose ductwork		
Surface Emissivity	Low (0.05)	Med (0.44)	High (0.9)	Low (0.05)	Med (0.44)	High (0.9)
Rock Mineral wool Ductwrap	40	40	40	50	60	70
Glass mineral wool	40	40	40	50	60	60
Phenolic foam	20	25	25	35	40	40
Nitrile rubber	32	37	40	51	60	62

- Basis:
  - Warm air ductwork - horizontal duct at 35°C, with 600 mm vertical sidewall in still air at 15°C.
  - Chilled air ductwork - horizontal duct at 13°C, with 600 mm vertical sidewall in still air at 25°C.
  - Thermal conductivity values calculated from the mean insulation temperature based on the fluid and air temperatures.
  - Thicknesses of mineral wool and phenolic foam are the nearest commercially available thickness to meet minimum requirements.
  - Thicknesses of nitrile rubber are minimum thicknesses.

**2460 CONDENSATION CONTROL ON CHILLED AIR DUCTWORK - ROCK MINERAL WOOL:**

- Insulation thickness for condensation control on ductwork carrying chilled air in ambient conditions: indoor still air temperature 25°C, relative humidity 80%, dew point temperature 21.3°C.

Minimum air temperature inside duct °C	Thickness of rock mineral wool insulation (mm)		
Surface emissivity	Low (0.05)	Medium (0.44)	High (0.90)
15	30	25	25
10	50	25	25
5	70	40	25
0	90	50	30

- Basis: Table 12 in BS 5422, thermal conductivity values calculated from the mean insulation

temperature based on the fluid and air temperatures.

- All ductwork shall be insulated where were visible (i.e exposed ductwork) when the duct surface temperature is below the dew point of the air within the space served.

**2461 CONDENSATION CONTROL ON CHILLED AIR DUCTWORK - GLASS MINERAL WOOL:**

- Insulation thickness for condensation control on ductwork carrying chilled air in ambient conditions: indoor still air temperature 25°C, relative humidity 80%, dew point temperature 21.3°C.

Minimum air temperature inside duct °C	Thickness of glass mineral wool insulation (mm)			
	Surface emissivity	Low (0.05)	Medium (0.44)	High (0.90)
15		25	25	25
10		40	25	25
5		50	40	25
0		50	50	40

- Basis: Table 12 in BS 5422, thermal conductivity values calculated from the mean insulation temperature based on the fluid and air temperatures.
- All ductwork shall be insulated where were visible (i.e exposed ductwork) when the duct surface temperature is below the dew point of the air within the space served.

**2470 CONDENSATION CONTROL ON CHILLED AIR DUCTWORK - PHENOLIC FOAM:**

- Minimum insulation thickness for condensation control on ductwork carrying chilled air in ambient conditions: indoor still air temperature 25°C, relative humidity 80%, dew point temperature 21.3°C.

Minimum air temperature inside duct °C	Thickness of phenolic foam insulation (mm)			
	Surface emissivity	Low (0.05)	Medium (0.44)	High (0.90)
15		20	20	20
10		30	20	20
5		50	25	20
0		60	30	20

- Basis: Table 12 in BS 5422, thermal conductivity values calculated from the mean insulation temperature based on the fluid and air temperatures.
- All ductwork shall be insulated where were visible (i.e exposed ductwork) when the duct surface temperature is below the dew point of the air within the space served.

**2475 CONDENSATION CONTROL ON CHILLED AIR DUCTWORK - CLOSED CELL FEF NITRILE FOAM:**

- Minimum insulation thickness for condensation control on ductwork carrying chilled air in ambient

conditions: indoor still air temperature 25°C, relative humidity 80%, dew point temperature 21.3°C.

Minimum air temperature inside duct °C	Nominal thickness of FEF Nitrile foam insulation (mm)	
	low (0.05)	high(0.9)
Surface emissivity		
15	12	6
10	21	11
5	31	17
0	40	22

- Basis: Table 12 in BS 5422, thermal conductivity values calculated from the mean insulation temperature based on the fluid and air temperatures.
- All ductwork shall be insulated where were visible (i.e exposed ductwork) when the duct surface temperature is below the dew point of the air within the space served.
- Thicknesses of nitrile rubber are minimum thicknesses.

#### 2490# THICKNESS OF INSULATION TO BS 5422 FOR PROCESS PIPEWORK AND EQUIPMENT:

- Comply with the requirements of sections 4 and 10 and relevant annexes of BS 5422 and supply minimum thickness of insulation for services in accordance with relevant tables in BS 5422 to control heat loss or limit surface temperature.
  - Table 21 - Minimum insulation thickness for process pipework and equipment to control heat loss.
  - Table 22 - Minimum insulation thickness to control the surface temperature of a non-metallic surface with a surface emissivity of 0.90 and design cold face temperature of 59°C.
  - Table 23 - Minimum insulation thickness to control the surface temperature of a metallic surface with a surface emissivity of 0.05 and design cold face temperature of 50°C.
  - Table 24 - Minimum insulation thickness to control the surface temperature of a non-metallic surface with a surface emissivity of 0.90 and design cold face temperature of 50°C.

#### 2495# THICKNESS OF INSULATION TO BS 5422 FOR REFRIGERATION PIPEWORK AND EQUIPMENT:

- To control heat gain and condensation, comply with the requirements of section 6 of BS 5422 and supply minimum thickness of insulation in accordance with relevant tables below and Annexes F and H in BS 5422.
  - Table 1 – Maximum permitted water vapour permeance in relation to plant temperature at an ambient temperature of +20°C (dry bulb).
  - Table 2 – Minimum insulation thickness for refrigeration applications to control condensation and control heat gain on a high emissivity outer surface (0.90) with an ambient temperature of +20°C and a relative humidity of 70%.
  - Table 3 – Minimum insulation thickness for refrigeration applications to control condensation and control heat gain on a low emissivity outer surface (0.05) with an ambient temperature of +20°C and a relative humidity of 70%.
  - Table 4 – Minimum insulation thickness for refrigeration applications to control condensation and control heat gain on a high emissivity outer surface (0.90) with an ambient temperature of +25°C and a relative humidity of 80%.
  - Table 5 – Minimum insulation thickness for refrigeration applications to control condensation and control heat gain on a low emissivity outer surface (0.05) with an ambient temperature of +25°C and a

relative humidity of 80%.

#### 3010 GENERAL:

- Install insulation in accordance with BS 5970.
- Carry out thermal insulation work using one of the scheduled firms employing skilled craftsmen conversant with class of work.
- In locations where insulation cannot be installed adequately after pipeline or ductline installation, pre-insulated sections shall be installed. Insulation to such sections shall be equivalent in thermal and physical properties to that specified for the remainder of the system including vapour barriers.
- Do not apply thermal insulation until installation has been fully tested and all joints proved sound.
- Ensure all materials are kept dry.
- Ensure all pipework surfaces are dry before the installation of thermal insulation.
- Insulate each unit separately. Do not enclose adjacent units together.
- Ensure there is clearance between insulated pipes.
- Application
  - Apply insulants, facings, coatings and protection strictly in accordance with manufacturer's instructions.
- Finish
  - Neatly finish joints, corners, edges and overlaps and, where possible, arrange overlaps to fall on blind side. Ensure overlaps are neat and even and parallel to circumferential and longitudinal joints.

#### 3020 INSTALLATION OF FOIL FACED MINERAL WOOL INSULATION ON PIPEWORK:

- Ensure joints are close butted together. Secure overlaps with adhesive or matching class 'O' tape, a minimum of 50mm wide, on both longitudinal and circumferential butt joints. Insulate fittings to same standard as adjacent pipework and use mitred segments where necessary, taped as above.
- Where a vapour seal or fibre containment is required tape exposed insulation membrane and return to pipe surface.
- Where insulation abuts pipe support inserts that have integral vapour barriers seal using class 'O' foil tape to continue vapour barrier or containment.

#### 3030 INSTALLATION OF FOIL FACED PHENOLIC FOAM INSULATION ON PIPEWORK:

- Ensure joints are close butted together. Secure overlaps with adhesive or matching class 'O' tape, a minimum of 50mm wide, on both longitudinal and circumferential butt joints. Insulate fittings to same standard as adjacent pipework and use mitred segments where necessary, taped as above.
- Before phenolic foam sectional insulation is applied, ensure that all pipework is clean, dry and free of any debris or corrosive substances such as excess soldering flux, building materials.
- Installation shall be by a contractor approved by the manufacturers strictly in accordance with the manufacturer's installation instructions.
- All exposed edges of phenolic foam insulation shall be sealed to the surface being insulated with a suitable vapour sealing mastic.

#### 3050 INSTALLATION OF CLOSED CELL NITRILE RUBBER INSULATION ON PIPEWORK:

- Install closed cell nitrile rubber in accordance with manufacturer's recommendations.
- Check installation procedure when closed cell nitrile rubber is to be installed on stainless steel pipework.

#### 3060 INSTALLATION OF FOIL FACED RIGID OR SLOTTED PHENOLIC INSULATION ON

#### DUCTWORK:

- Secure the insulation with adhesive in accordance with manufacturer's recommendations. Use insulation hangers that are fit for purpose and in accordance with thermal insulation and insulation hanger manufacturers.
- Cut slabs so that the top and bottom pieces overlap the sides. Seal joints and pin penetrations using 100mm wide class 'O' aluminium foil tape.
- Where cut outs for test holes, etc occur tape over insulation membrane and return to the duct surface.
- Where insulation abuts duct support inserts that have integral vapour barriers seal using class 'O' foil tape to continue vapour barrier.

#### 3070 INSTALLATION OF FOIL FACED FLEXIBLE DUCTWORK INSULATION:

- Secure the insulation with adhesive in accordance with manufacturer's recommendations. Use insulation hangers spaced at maximum 300mm centres on the underside of rectangular and flat oval ducts.
- Seal joints and pin penetrations using 100mm wide class 'O' aluminium foil tape. Where cut outs for test holes, etc occur tape over insulation membrane and return to the duct surface.
- Where insulation abuts duct support inserts that have integral vapour barriers seal using class 'O' foil tape to continue vapour barrier.

#### 3080 INSTALLATION OF FOIL FACED LAMELLA ON DUCTWORK:

- Secure the insulation in accordance with manufacturer's recommendations. Use insulation hangers spaced at maximum 300mm centres on the underside of rectangular and flat oval ducts.
- Seal joints and pin penetrations using 100mm wide class 'O' aluminium foil tape. Where cut outs for test holes, etc occur tape over insulation membrane and return to the duct surface.
- Where insulation abuts duct support inserts that have integral vapour barriers seal using class 'O' foil tape to continue vapour barrier.

#### 3090 INSTALLATION OF INSULATION ON TANKS:

- Fit insulation so that two opposite pieces overlap the sides. Bond insulation to the tank with adhesive, applied in accordance with the manufacturer's recommendations. Closely butt together all slabs and seal joints with a matching self-adhesive tape 100mm wide.

#### 3100 INSTALLATION OF MINERAL WOOL INSULATION ON VESSELS:

- Cut Lamella to length to wrap around duct with an additional 75mm to form an overlap. Remove insulation from facing of overlap together with dust, and seal overlap with adhesive in accordance with manufacturer's instructions. Butt joints closely together and seal with matching self-adhesive tape at least 100mm wide.

#### 3110 INSTALLATION OF PHENOLIC FOAM INSULATION ON VESSELS:

- Use pre-formed segments or pre-slotted foil faced insulation to fit the diameter of the vessel, laid with staggered joints. Vapour seal the joint faces. Use jointing compound to fill and seal joints around protrusions.
- Do not use wire to secure insulation.
- Secure insulation segments up to 3500mm outside insulation diameter with filament tape 38mm wide at

300mm centres.

- Secure insulation segments over 3500mm outside insulation diameter with aluminium banding.
- Finish as manufacturer's recommendations.

#### 3120 INSTALLATION OF POLYISOBUTYLENE (PIB) PROTECTION:

- Wrap pipework and fittings, ductwork or tanks and vessels with PIB sheeting lapped at every joint by at least 50mm. Solvent weld joints and support with banding in accordance with manufacturer's
- Arrange joints to shed water and prevent the ingress of water.

#### 3125 INSTALLATION OF MULTI-LAYERED LAMINATE:

- Install laminated foil/film protection, in accordance with manufacturer's instructions.
- Installation may be either factory pre-applied or applied in-situ.
- Ensure all surfaces are dry and clean, free from dust, oil and grease/silicone.
- Arrange joints to give water shed with the lap facing down.

#### 3130A INSTALLATION OF SHEET METAL FINISH ON PIPEWORK:

- Secure insulation with metal bands at each end of section and at maximum centres of 450mm. Form sheet metal to fit tightly over the outer circumference of insulation with a longitudinal overlap of at least 40mm. Secure the outer part of overlap with self tapping screws or rivets at centres of not more than 150mm. Not on pipes with vapour barrier; or metal bands of same material.
- Ensure circumferential overlaps are at least 50mm, secured with self tapping screws or rivets. Make provision to accommodate expansion and contraction at intervals. Ensure all joints are lapped to shed liquids and seal all joints exposed to weather or spillage. Cover all bends and fittings with matching sheet metal, tailored to fit and sealed as appropriate. Fit pre-insulated, purpose-designed boxes to valves, flanges, etc.

#### 3140A INSTALLATION OF SHEET METAL FINISH ON DUCTWORK, TANKS AND VESSELS:

- Form sheet metal to fit tightly over the insulation with a longitudinal overlap of at least 40mm. Secure the outer part of overlap with self tapping screws or rivets at centres of not more than 150mm. Not on vapour sealed ducts; or metal bands of same material.
- Ensure circumferential overlaps are at least 50mm, secured with self tapping screws or rivets. Make provision to accommodate expansion and contraction at intervals. Ensure all joints are lapped to shed liquids and seal all joints exposed to weather or spillage. Cover all bends and fittings with matching sheet metal, tailored to fit and sealed as appropriate.

#### 3150 INSTALLATION OF CANVAS PROTECTION:

Cover the whole with 130g (minimum) canvas with at least 50mm overlaps. Seal joints.  
Give two coats of class 'O' polymer solution. Fit aluminium bands where indicated.

#### 3160 INSTALLATION OF ROOFING FELT PROTECTION:

- Apply directly to insulating material with an overlap of at least 50mm on all joints, made to shed water. Secure in position with galvanized wire netting, of 1mm x 25mm mesh. Finish with two coats of black

bituminous paint.

**3170 INSTALLATION OF ALUMINIUM SHEETING PROTECTION:**

- Secure lapped joints (at least 40mm) by means of pop rivets at a maximum spacing of 150mm. For cold piping use matching aluminium straps at maximum spacing of 225mm. On piping operating below ambient temperature seal all joints against moisture. For external use make joints shed water and use sheets with treated surface.
- Where 'lockform' seams are used submit proposals for dealing with surfaces curved in three dimensions.

**3180 INSTALLATION OF ALUMINIUM-ZINC COATED STEEL PROTECTION:**

- Install aluminium-zinc coated steel protection, in accordance with manufacturer's instructions.

**3190 INSTALLATION OF RIGID PVC PROTECTION:**

- Apply rigid PVC sheet and pre-formed fittings directly to insulation with an overlap of at least 40mm on longitudinal and circumferential joints. Secure longitudinal laps with plastic rivets at 150mm centres.
- Ensure rigid PVC is not installed in contact with heat sources.

**3195 INSTALLATION OF LAMINATED FOIL/FILM PROTECTION:**

- Install laminated foil/film protection, in accordance with manufacturer's instructions.
- Ensure all surfaces are dry and clean, free from dust, oil and grease/silicone.
- Arrange joints to give a water shed with the lap facing down.

**3210 FLANGES AND VALVES:**

- Cut back to allow removal of bolts and nuts, finish with neat bevel or use end caps.
- Where boxes are used fit over insulation on adjacent piping. Ensure operation of valve remains unimpaired with box in place.

**3230A INSTALLATION WHERE INSULATION IS CARRIED THROUGH PIPELINE SUPPORT:**

- For load bearing insulation, carry through insulation and finish.
- For non-load bearing insulation on hot pipework close butt to a section of load bearing finished material minimum 100mm long.
- For non-load bearing insulation on cold pipework, close butt to high density phenolic foam pipe supports. Ensure the vapour barrier is maintained.

**3230B INSTALLATION WHERE CLOSED CELL INSULATION IS CARRIED THROUGH PIPELINE SUPPORT:**

- For load bearing insulation, carry through insulation and finish.
- For non-load bearing insulation on hot pipework up to 120°C, close butt to a high density phenolic or

polyisocyanurate pipe support.

- For non-load bearing insulation on cold pipework, close butt to high density phenolic foam pipe supports.
- Ensure the vapour barrier is maintained.

#### 3250 INSTALLATION WHERE INSULATION IS CARRIED THROUGH DUCTWORK SUPPORT:

- Provide insulation between duct and support using high density phenolic foam strips. Butt insulation to spacer and carry over finish by 40mm and tape joint. Provide a sheet metal protecting sleeve. Load bearing materials must have a suitable compressive strength for the applied load.

#### 3260 LIQUID VAPOUR BARRIERS:

- Apply vapour seal solution evenly by brush in accordance with manufacturer's instructions; use solution which dries to a colour distinctive from insulating material.

#### 3270 INTEGRITY OF VAPOUR BARRIERS:

- Where a vapour barrier is indicated ensure its integrity throughout. Repair immediately any damage to vapour barriers and where such barriers have been applied off site, repair to manufacturer's instructions. Where aluminium sheeting is used for protection, submit proposals for securing sheeting without impairing the integrity of the vapour seal for approval.

## **Y51 TESTING AND COMMISSIONING**

### **2010 PRESSURE TESTING - GENERAL:**

- Comply with procedures given in HVCA TR/6 Guide to Good Practice for Site Pressure Testing of Pipework. Ensure safety precautions detailed in HSE Guidance Note GS4 Safety in Pressure Testing are adopted.
- Provide a blanked connection to accommodate a check gauge in addition to the accurate gauge fitted to section under test.
- Test concealed or buried pipework before any permanent covering is applied.
- Advise appropriate personnel, in advance, of the time pressure tests may be witnessed.

### **2020 PRESSURE TESTING - WATER CIRCULATING AND SUPPLY SYSTEMS AND STEAM AND CONDENSE LINES:**

- Carry out Hydraulic Pressure Testing as described in HVCA TR/6 Guide to Good Practice for Site Pressure Testing of Pipework. Test section by section for one hour, as the work proceeds and prior to application of thermal insulation as follows
  - Operating gauge pressure less than 3.5 bar, test gauge one and a half times operating pressure.
  - Operating gauge pressure 3.5 - 7.0 bar, test gauge pressure twice operating pressure.
  - Operating gauge pressure greater than 7.0 bar, test gauge pressure 14.0 bar or one and a half times operating pressure, whichever is the greater.

### **2040 PRESSURE TESTING - WATER MAINS:**

- Test to Local Authority requirements. Ensure the provisions laid down in HVCA TR/6 Guide to Good Practice for Site Pressure Testing of Pipework for testing underground CWS mains are carried out.

### **2050 PRESSURE TESTING - FIRE RISERS:**

- Test hydraulically to a pressure of 10 bar (gauge) measured at the top outlet to maintain pressure for not less than 15 minutes. Demonstrate to Fire Brigade when tests are satisfactory. Carry out flow tests after satisfactory pressure testing.

### **2055A PRESSURE TESTING - REFRIGERANT PIPEWORK, STRENGTH PRESSURE TEST:**

- Test refrigerant pipework using the strength test procedure as detailed in Clause R6.4 of the CIBSE Commissioning Code R: 2002.

### **2055B PRESSURE TESTING - REFRIGERANT PIPEWORK, LEAK TEST:**

- Test refrigerant pipework using the leak test procedure as detailed in Clause R6.5 of the CIBSE Commissioning Code R: 2002.

### **2055C PRESSURE TESTING - REFRIGERANT PIPEWORK, DEEP VACUUM TEST:**

- Test refrigerant pipework using the deep vacuum test method as detailed in Clause R6.6 of the CIBSE

Commissioning Code R: 2002.

2065 PRESSURE TESTING - OIL PIPEWORK TO BS 5410:

- Test oil pipework in accordance with BS 5410-2

2070 PRESSURE TESTING - PIPED MEDICAL SERVICES:

- Test in accordance with requirements of HTM 02-01.

2080 PRESSURE TESTING - SOIL, WASTE, VENTILATION, ANTI-SYPHON AND RAINWATER PIPEWORK:

- Test section by section as the work proceeds and subsequently on completion with all sanitary fittings fixed and working. Submit systems to two separate tests, Air test and Hydraulic Performance test in accordance with BS EN 12056-2.

2090 PRESSURE TESTING - UNDERSLAB DRAINAGE:

- Test section by section as the work proceeds and subsequently after completion of backfilling and compaction to the satisfaction of the Engineers and the Local Authority.
- Individually test sections which will be permanently embedded in the structure or concealed in ducts or voids.
- Submit sections to two separate tests Water Test and Test for Straightness and Obstruction in accordance with BS EN 752.

2100 VACUUM TESTING:

- Test vacuum mains in accordance with HVCA TR/6 Guide to Good Practice for Site Pressure Testing of Pipework, Table 1.

3020 COMMISSIONING CODES:

- Carry out commissioning of installations in accordance with the procedures, checks and tolerances given in the BSRIA Application Guides for water systems and air systems to achieve the standards set in the CIBSE Commissioning Codes.

3025 SEASONAL COMMISSIONING:

- Provide appropriately qualified personnel and all necessary equipment and materials to execute the seasonal commissioning works. The same organisation / team that carried out the original construction works shall undertake the seasonal commissioning.
- A schedule of suitable working periods and essential services to be maintained during any work will be provided by the building operator.
- A programme for the works shall be provided at least 1 month prior to the start date. This should account for any phased hand overs, cause as little disruption as possible and ensure essential services are maintained.
- The works shall comply with all statutory and client specific Health and Safety requirements.
- Any performance deficiencies found during seasonal commissioning shall be corrected.
- All seasonal commissioning shall be carried out in accordance with the project commissioning specification, an approved method statement, manufacturers' guidelines and the day-to day operational

requirements of the building users.

- Record all seasonal commissioning works and after completion of the works update all building documentation including O&M manuals, Building Manual, Building Log book, Building User Guide and the Building Information Model (BIM). Any changes made to the systems during the works shall be clearly identified.
- BREEAM New Construction 2014 requirements
  - Comply with Issue ID Man 04 Commissioning and Handover.
  - Comply with Issue ID Man 05 Aftercare.
- BREEAM Refurbishment and Fit Out 2014 requirements
  - Comply with Issue ID Man 04 Commissioning and Handover.
  - Comply with Issue ID Man 05 Aftercare

### 3030 COMMISSIONING WATER DISTRIBUTION SYSTEMS:

- Preliminary checks
  - Carry out checks and procedures as detailed in CIBSE Commissioning Code W. Ensure system is statically complete as defined in Section 4 of BSRIA Guide BG 2/2010 - Commissioning Water Systems.
  - Use pre-commissioning checklist from BSRIA Guide BG 2/2010.
- Setting to work and regulation
  - Set to work and regulate water distribution systems in accordance with CIBSE Commissioning Code W and BSRIA Guide BG 2/2010.
- Measurement
  - Use instruments for measurement detailed in BSRIA Guide BG 2/2010.

### 3040 COMMISSIONING AIR DISTRIBUTION SYSTEMS:

- Preliminary checks
  - Carry out checks and procedures as detailed in BSRIA Guide BG 49/2013 Commissioning Air Systems.
  - Use pre-commissioning checklist in BSRIA Guide BG 49.
- Setting to work and regulate
  - Set to work and regulate constant and variable flow air distribution systems in accordance with CIBSE Commissioning Code A and BSRIA Guide BG 49.
- Measurement of air flow
  - Use instruments for measurement and methods of measurement detailed in BSRIA Guide BG 49 and CIBSE Commissioning Code A.

### 3050 COMMISSIONING BOILER PLANT:

- Follow the procedures laid down for carrying out Preliminary Checks and Start Operation in accordance with CIBSE Commissioning Code B and manufacturers instructions.
- Apparatus and Instruments
  - Use Apparatus and Instruments detailed in CIBSE Commissioning Code B, Appendix B3.1. Apply

tolerances defined in Appendix B3.2.

#### 3055 COMMISSIONING OF GAS PLANT AND SYSTEMS:

- Commission gas fired plant on industrial and commercial premises in accordance with IGE/UP/4.
- Commission gas supply systems in accordance with BS EN 12327

#### 3060 COMMISSIONING REFRIGERATING SYSTEMS:

- Follow the procedures given for use and handling of refrigerants, pressure and leak testing, evacuation and dehydration, charging and lubrication of refrigerating systems in CIBSE Commissioning Code R and manufacturer's instructions.
- Pre-commissioning:
  - Carry out the procedures for pre-commissioning detailed in CIBSE Commissioning Code R, Section R5.
- Combined pressure and leak testing:
  - Carry out the procedures for combined pressure and leak testing, including refrigerant charging, detailed in CIBSE Commissioning Code R, Section R6.
- Setting to work and adjusting
  - Carry out the procedures for setting to work and adjusting detailed in CIBSE Commissioning Code R7.
- Absorption Systems.
  - Carry out the procedures for Preliminary Checks, Testing and Charging, and Setting to Work and adjusting detailed in CIBSE Commissioning Code R, Section R10.
- Apparatus and Instruments
  - Use Apparatus and Instruments detailed in CIBSE Commissioning Code R, Section R8. Apply tolerances defined in Section R8.6.

#### 3070 COMMISSIONING AUTOMATIC CONTROL SYSTEMS:

- Carry out commissioning of Automatic Control Systems in accordance with Manual prepared by the controls equipment manufacturer. Carry out the Checking and Setting-Up procedure detailed in the CIBSE Commissioning Code C, Section C1.
- Measurement
  - Carry out measurements in accordance with CIBSE Commissioning Code C, Appendix C2.1.

#### 3090A INSTRUMENTS AND GAUGES:

- Ensure instruments are correctly calibrated. Record details of instruments on record sheets.
- Submit evidence of correct calibration of instruments to be used in connection with commissioning and

testing.

#### 3100A AIR SYSTEMS COMMISSIONING RECORDS TO BSRIA BG 49/2015:

- Keep a systematic record of commissioning results and distribute as indicated.
- For air systems
  - Use record sheets as described in BSRIA Guide BG 49/2015 Commissioning Air Systems.

#### 3100B WATER SYSTEMS COMMISSIONING RECORDS TO BSRIA GUIDE BG 2/2010:

- Keep a systematic record of commissioning results and distribute as indicated.
- For water systems
  - Use record sheets as detailed in BSRIA Guide BG 2/2010 Commissioning Water Systems.

#### 3110 BMS COMMISSIONING - CONTROL SYSTEM SPECIFICATION DETAILS REQUIRED FOR COMMISSIONING:

- Ensure that the following information is supplied to the commissioning engineer:
  - A network schematic providing a record of the overall control system architecture.
  - Schematics of the systems to be controlled indicating the location of sensors and actuators.
  - A written description of the configured control strategies.
  - Control strategy logic diagrams in the form of logic flow charts.
  - Set-points and other control settings such as initial default parameters for control loops relating to the control strategies.
  - Criteria relating to control accuracy and stability.
  - A points list including digital inputs/outputs and analogue inputs/outputs.
  - Control panel drawings.
  - BMS operator workstation graphics and associated point data displaying monitored conditions.
  - Trend logging archiving requirements and alarm routing.
  - The scope of operational and specified functionality of management software, e.g. utility monitoring and targeting software.
  - Functional requirements of any occupant interfaces.
  - Details of any hard-wired interfaces from, or to, other control devices.
  - Functionality and scope of data to be transferred over any gateway for use as part of an integrated system.
  - Functional profiles for any direct interoperability integration.
- Ensure that the following is included in the BMS commissioning specification:-
  - A clear description of the division of responsibility between the various parties.
  - Off-site and on-site pre-commissioning procedures.
  - On-site commissioning procedures.
  - Requirements for assistance to air and water balancing testing (eg opening and closing control valves) and other plant tests where the controls need to be overridden.
  - A requirement for any point-by-point verification of correct operation.
  - Requirements for evaluation of control loop performance/loop tuning.
  - Requirements for the BMS operator workstation for assistance in the commissioning of plant.
  - Arrangement for the management of delays.
  - Phased completion requirements.
  - Requirements for demonstration/witness testing on the basis of a percentage of points or on a point-

by-point basis. Ensure that the witnessing requirement includes the identification of those responsible.

- Requirement for software/configuration data back-up.
- Requirement for, and involvement in, any complete system and sub-system performance testing.
- Requirement for system documentation.
- Requirement for operator training requirements.
- Requirement for post occupancy checks.

### 3120 BMS COMMISSIONING - PRE-COMMISSIONING:

- Ensure that as much pre-commissioning work as possible is performed off-site:
- Ensure that the following is followed:
  - Table 15 Pre-commissioning requirements

Pre-commissioning action	Pre-commissioning off-site
Control application software	Yes (final commissioning on-site)
User interface software	Yes (final commissioning on-site)
Control panels	Yes (final commissioning on-site)
Terminal units (fan coil units, etc)	Yes (final commissioning on-site)
Wiring	No
Communications network	No
Sensors	No
Actuators	No
Integration gateways	Partial

- Ensure that a record of all settings, set-points and offsets are maintained throughout the pre-commissioning period.
- Ensure that all final physical adjustments to the field devices are indelibly marked.
- Ensure that all packaged plant interfaced with the BMS is fully tested and commissioned by the manufacturer or installer.
- Ensure that the BMS is pre-commissioned in accordance with the following requirements of CIBSE Code

C (Commissioning of automatic control systems).

- Table 16 CIBSE Code C automatic control systems pre-commissioning requirements

Pre-commissioning action	CIBSE Code C section reference
Control applications software	C5.2
Control panels	C5.3
Wiring	C5.4
Communications networks	C5.5
Sensors	C5.6
Actuators and valves	C5.7
Digital inputs/outputs	C5.8
Pneumatic actuation with microprocessor control	C5.9
Field control devices	C5.10

3130A BMS COMMISSIONING - PLANT READY FOR CONTROL SYSTEM COMMISSIONING:

- Confirm that the following plant commissioning has been performed before commencing the final BMS commissioning:
  - Water systems
    - The system is cleaned and flushed to remove any debris.
    - All regulating, isolating and control valves in place and operating correctly.
    - That all flow measuring devices are in place and in the correct location for accurate measurement (including pressure tappings).
    - The system is vented.
    - That the proportional balancing is completed to obtain the branch flow rates in the correct ratio to each other (or through the use of and setting of self-balancing valves).
    - That the pump flow rate has been adjusted to provide the specified flow rate.
  - Air systems
    - Debris has been removed from the air distribution system.
    - That dampers are in the correct location and fully functional.
    - That fire/smoke dampers open.
    - Test holes have been drilled and sealed with removable plugs.
    - That in-situ flow measuring devices have been installed.
    - Ductwork air leakage testing has been performed (if specified).
    - Completion of proportional balancing of regulating dampers so that terminals share the air flow in the correct proportions.
    - Regulation of the fan(s) to provide the specified flow rate.
  - Packaged equipment
    - Ensure that plant and controls have been fully commissioned and are functional, ready for integration with other plant/systems.
    - That control equipment inputs/outputs are in the specified format for connection to the main control

system.

- Confirm that the plant is commissioned in accordance with:
  - Air distribution systems, CIBSE Code A
  - Boiler plant, CIBSE Code B
  - Refrigeration systems, CIBSE Code R
  - Water distribution systems, CIBSE Code W
  - BSRIA Guide BG 49/2015 Commissioning Air Systems
  - BSRIA Guide BG 2/2010 Commissioning Water Systems

#### 3140 BMS COMMISSIONING - CONTROL SYSTEM REQUIREMENTS FOR PLANT COMMISSIONING:

- Ensure that the BMS is pre-commissioned to allow the building services plant to operate under "manual" running conditions.
- Ensure that the control valves can be manually set in their fully open position to allow the balancing of pipework flows.
- Ensure that dampers can be manually opened to allow the commissioning of air systems.

#### 3150 BMS COMMISSIONING:

- Ensure that the BMS is commissioned in accordance with the following requirements of CIBSE Code C (Commissioning of automatic control systems).
  - Control strategy checking - C6.2
  - Checking procedures for basic control functions - C6.3
  - Lighting controls - C6.4
  - Operator workstations - C6.5
  - Occupant interfaces - C6.6
  - Communication networks - C6.7
  - Integrated systems - gateways - C6.8
  - Integrated systems - direct interoperability - C6.9
  - Integration with fire detection systems - C6.10
  - Security systems - C6.11
  - Interruption of electrical power supplies - C6.12
  - Valves - C7.1
  - Dampers - C7.2
  - Fans - single speed - C7.3
  - Fans - variable speed - C7.4
  - Pumps - C7.5

#### 4010 SYSTEM PERFORMANCE TESTING:

- Demonstrate the performance of installations including single, standby, multi-duty plants and systems, and of plants specified for future use.

#### 4015 TESTING OF RESIDENTIAL VENTILATION SYSTEMS:

- Demonstrate the performance of residential ventilation systems through performance testing and installation checks in accordance with BS EN 14134.
- Comply with the best practice requirements of BSRIA BG 46/2015 Domestic Ventilation Systems - A

guide to measuring air flow rates, for measurement of air flow rates use the unconditional method.

#### 4020A ENVIRONMENTAL TESTS, ARTIFICIAL LOADS:

- Carry out environmental testing to prove the performance of the systems.
- Apply artificial loads or provide test arrangements to simulate the full range of operating conditions and duties.

#### 4020B ENVIRONMENTAL TESTS, AMBIENT AIR QUALITY

- Carry out environmental testing to prove the performance of the systems.
- Carry out ambient air quality tests in accordance with BS EN 13528-1, BS EN 13528-2 and BS EN 13528-3.

#### 4030 RECORDERS:

- Provide and maintain on free loan portable seven day space temperature and relative humidity recorders, as indicated, together with adequate charts.

## Y54 IDENTIFICATION - MECHANICAL

### 1000 GENERAL

#### 2010 PIPEWORK IDENTIFICATION:

- Standards - Colour code and label to BS 1710.
- Primary Identification
  - Apply colour bands, 300mm wide, to each pipe at least
    - Once in every room or enclosed area.
    - At intervals not exceeding fifteen metres.
    - At every junction.
    - At every valve.
    - At every inspection and access position into service shafts, false ceilings, bulkheads etc.
- Secondary Identification
  - Apply colour bands, 50mm wide, and superimpose a legend identifying circuit, direction of fluid or gas flow, nominal pipe bore and, where appropriate, fluid or gas pressure.
- Legends
  - Apply to colour bands by transfers of an approved type.

#### 2020 DUCTWORK IDENTIFICATION:

- Standards
  - Generally colour code and label to B&ES DW/144.
- Primary Identification
  - Apply colour bands, 300mm wide, to each duct at least
    - Once in every room or enclosed area.
    - At intervals not exceeding fifteen metres.
    - At every junction.
    - At every damper.
    - At every inspection and access position into service shafts, false ceilings, bulkheads etc.
- Secondary Identification
  - For ducts with longest side or diameter up to and including 225mm. Paint colour bands 50mm wide and superimpose legends.
  - For ducts with longest side or diameter over 225mm. Paint or apply transfers to identification triangles, or triangular plates. Superimpose or incorporate legends.
- Triangular Plates
  - Attach to buckle bands or stool pieces and fix to ducting, with apex indicating direction of airflow. Submit details of plates and fixings for approval before painting and marking. Use equilateral triangle of side 150mm minimum.
- Legends
  - Apply transfers of an approved type to colour bands or triangles or triangular plates. Identify floor and space served, associated equipment reference and direction of airflow.

#### 2030B PLANT AND EQUIPMENT IDENTIFICATION, LAMINATED PLATES:

- Standards
  - Identify each item of equipment by name and, where appropriate, by agreed reference characters. Provide colour identification as called for in work sections and, in all cases, colour fire fighting

equipment red.

- Identification Colours
  - Use primary and secondary identification colours of associated system.
- Plates
  - Use rectangular metal or laminated plastic, securely fixed to each item of equipment.
- Lettering
  - Laminated plates, multi-coloured with outer layer removed for lettering.
- Legends
  - Engrave plates with an approved text. Incorporate operating duty of equipment where this is not incorporated in other labelling.

#### 2035 GRAPHICAL SYMBOLS FOR USE ON EQUIPMENT IN ACCORDANCE WITH BS EN 80416:

- Graphical symbols for use on equipment to be created and applied in accordance with BS EN 80416-1, BS EN 80416-2, BS EN 80416-3.

#### 2040 VALVE AND COCK IDENTIFICATION:

- Standards
  - Identify each valve, cock, stop valve, air vent, drain cock etc. with disc engraved with numerical reference. Except where exposed in occupied areas.
- Identification Colours
  - Use primary and secondary identification colours of associated system for painted or self colour discs.
- Discs
  - Securely attach metal or laminated plastic discs, minimum diameter 35mm, to each item.
- Legends
  - Engrave discs with permanent characters, minimum height 6mm.
- Incorporate in operating instructions relating to regulating valves and flow measuring equipment, details of flow rate, pressure differential and setting, as appropriate.

#### 2070 AIR VOLUME REGULATING AND CONTROL DAMPER IDENTIFICATION:

- Standards
  - Identify each regulating and control damper. Except where exposed in occupied areas. On ductwork

dampers, clearly indicate commissioning set point.

- Identification colours
  - Use primary and secondary identification colours of associated system for painted or self colour discs.
- Discs
  - Securely attach metal or laminated plastic discs, minimum diameter 35mm, to each item.
- Legends
  - Engrave discs with permanent characters, minimum height 6mm.

#### 2080 INSTRUMENT IDENTIFICATION:

- Standards
  - Identify each instrument by name and, where appropriate, by agreed reference characters.
- Plates
  - Use rectangular metal or laminated plastic, securely fixed to each instrument.
- Legends
  - Engrave plates with an approved text.

#### 2090 DANGER AND WARNING NOTICES:

- Hazardous Systems
  - Colour code and label hazardous systems and equipment to requirements of Health and Safety Executive Guidance Notes.

#### 2100A SYSTEM IDENTIFICATION INSTALLATION CHARTS, PERSPEX GLAZED FRAME:

- System Schematics
  - Supply and fix a referenced schematic diagram (or diagrams) of all systems as installed, including equipment and ancillary schedules. Show scheduled information on diagram.
  - Identify all items by appropriate reference characters.
- Control Schematics
  - Supply and fix a referenced schematic diagram (or diagrams) of all control systems as installed, including equipment and ancillary schedules. Show scheduled information on diagram.
  - Identify all items by appropriate reference characters.
- Location
  - Fix in each boiler house, calorifier room, plant room or equipment room.
- Finish
  - Perspex sheet glazing with surrounding frame and mounting attachments.

---

## Y60 CONDUIT AND CABLE TRUNKING

### 1000 GENERAL

#### 2010A CONDUIT SYSTEMS METAL RIGID CLASS 2:

- Provide conduit systems to BS EN 61386. Use conduit of each type from one manufacturer.
- Material - Metal, steel.
- Method of connection - Threadable.
- Suitability for bending - Rigid, BS EN 61386-21.
- Electrical characteristics - with electrical continuity.
- Resistance against corrosive or polluting substances
  - Conduits with same protection outside and inside BS EN 61386-1 Table 10 Class 2
  - Medium protection
  - e.g. stoved enamel or air drying paint.

#### 2010B CONDUIT SYSTEMS METAL RIGID CLASS 4:

- Provide conduit systems to BS EN 61386. Use conduit of each type from one manufacturer.
- Material - Metal, steel.
- Method of connection - Threadable.
- Suitability for bending - Rigid, BS EN 61386-21.
- Electrical characteristics - with electrical continuity.
- Resistance against corrosive or polluting substances
  - Conduits with same protection outside and inside
  - High protection - Hot dip zinc coating. BS EN 61386-1 Table 10 Class 4.

#### 2010E CONDUIT SYSTEMS - NON-METALLIC RIGID:

- Provide conduit systems to BS EN 61386. Use conduit of each type from one manufacturer.
- Material - Insulating, PVC or equivalent material.
- Method of connection - Non-threadable.
- Suitability for bending - Rigid, BS EN 61386-21.
- Electrical characteristics
  - Without electrical insulating characteristics.

#### 2010F CONDUIT SYSTEMS - NON METALLIC FLEXIBLE:

- Provide conduit systems to BS EN 61386. Use conduit of each type from one manufacturer.
- Material - Insulating, PVC.
- Method of connection - Threadable or non-threadable.
- Suitability for bending - Flexible, BS EN 61386-23.
- Electrical characteristics
  - Without electrical insulating characteristics.

#### 2020A RIGID CONDUIT SYSTEM - METALLIC CONDUIT

- Use couplers to match conduit grade and finish.
- Use solid couplers to join lengths of conduit unless inspection couplers are shown on the drawings or

schedules.

- Conduit fittings and adaptable boxes
  - Material - Malleable iron adaptable boxes.
  - Do not use factory made bends, inspection bends or inspection couplers unless shown on drawings or schedules.
  - Ensure fittings are same class and finish as associated conduit system.
  - Supply covers for circular or adaptable boxes in the same material and finish as boxes.
  - Use steel dome or cheese headed screws to secure covers for Class 2 finish.
  - Use brass dome or cheese headed screws to secure covers for Class 4 finish.
  - Limit number of entry holes within loop-in boxes to four.
  - Adaptable box, minimum size - 100mm x 100mm x 50mm.
- Connections
  - Use couplers and externally screwed brass bushes to connect conduit to loop-in circular conduit boxes, switchgear, distribution boards, and adaptable boxes. Use flanged couplers with washers and male brass bushings, at both ends of each conduit run/link.
  - Conduit fixing saddles - Spacer bar.
- Plugs - Hexagonal malleable iron.
- Locknuts - Hexagonal steel.

#### 2030A RIGID CONDUIT SYSTEM - INSULATING CONDUIT:

- Connections
  - Do not use slip joints. Use expansion couplings as required. Use solvent solution connections.
- Conduit fittings and adaptable boxes
  - Use boxes and connections to suit size of conduit and method of jointing.
  - Use heavy gauge, high impact rigid PVC conduit fittings.
  - Provide all boxes for supporting luminaires or other heavy devices with metal brackets or insert clips to provide a support independent of the box.
  - Provide boxes for flexible conduit, accessories and luminaire connection with a brass earthing terminal and/or steel circular earthing ring.
  - Conduit fixing saddles - Spacer bar or hospital.
- Plugs - Spout entry plug.

#### 2050A PLIABLE OR FLEXIBLE CONDUIT SYSTEMS - NON-METALLIC:

- Method of connection - Threadable conduit.
- Connections
  - Use plastic adaptors and bushes.
  - Use male adaptors to connect flexible conduit to motors and other equipment having a threaded entry.
  - Use female adaptors and externally screwed bushes to connect flexible conduit to trunking and

equipment not having a threaded entry.

#### 2080A CABLE TRUNKING AND FITTINGS:

- Comply with BS EN 50085. Use trunking of each type from one manufacturer.

#### 2090B METAL SURFACE TRUNKING - ZINC FINISH:

- Material
  - Steel trunking to BS EN 50085. Supply partitions and covers same material as trunking.
- Gauge of metal - BS EN 50085.
- Trunking type
  - Standard cable trunking with compartments.
- Style
  - Use trunking manufactured with inward return edge flanges and fitted with flange couplers which ensure that when the cover is removed a minimum of 80% of the nominal trunking or compartment width is available for access.
- Protection to BS EN 50085
  - Electroplated zinc having a minimum thickness of zinc coating of 0.0012mm inside and outside.
  - Hot dip zinc coated steel to BS EN 10346 or BS EN 10143.
- Finish - Manufacturer's standard, all surfaces.
- Colour - Self Colour or Manufacturer's standard.
- Fixings
  - Use purpose made brackets to fix to structural steel or suspension rods.
  - Provide external fixing lugs where specified protection for the installation is IP44 or greater.
- Fittings
  - Use bends, tees and angles of similar gauge, type and finish as trunking body and supplied by same manufacturer.
- Partitions and Covers
  - Ensure partitions are electrically continuous with the body of the trunking or provide a connector for a circuit protective conductor.
  - Ensure gap between partitions and lids maintains segregation of circuits.
  - Provide individual mounting plates for each accessory mounted on trunking covers.
  - Material - Same material as trunking.
- Joints
  - Use purpose made jointing pieces fixed with screws into captive nuts. Ensure screws do not protrude through the nuts.
  - Ensure rigidity of trunking is maintained across joint.
  - Ensure external dimensions of trunking are maintained and not reduced by more than 4% across joints between trunking lengths and/or fittings.
  - Use purpose made fittings of the same manufacture where trunking connects to switchgear and distribution boards.
  - Provide flanges for connection of flush floor trunking to vertical trunking to maintain the cross sectional area of compartments with 50 mm minimum radius.
  - Maintain electrical continuity at each joint by a copperlink, (tinned copper for galvanized trunking), fixed on outside of trunking, secured by screws, nuts and shakeproof washers. Screws must not project through the nut. Make provision for continuity to be achieved without need to remove paint from ferrous metal where trunking has a painted finish.
- Screws, Nuts, Washers
  - Do not use self tapping screws. Use cheese or round head screws except where provision is made for

the use of counter-sunk heads.

- Material
  - Use steel zinc coated
    - BS 7371-3 or BS 7371-6.
- Cable supports
  - Provide horizontal trunking with removable cable retainers or bridges to retain cables in situ.
  - Provide vertical trunking with pin racks to support cables at 3000 mm maximum spacing.
  - Use insulated pins or insulation sleeved pins on pin racks.

#### 2090D FLUSH FLOOR TRUNKING:

- Trunking bodies
  - Supply trunking bodies complete with flanged connections for service outlet boxes.
  - Screwed levelling device.
  - Secure covers to trunking body using countersunk brass screws with slots, crosshead or hexagon key heads or steel cam locking devices for use with a removable tool.
  - Provide cork gasket or equivalent between cover and flange for sound deadening.
- Trunking lids
  - Provide for trunking body recessed lids to suit applied floor finish.
  - Ensure securing devices on recessed covers are accessible without removing applied floor finish.

#### 2090E STEEL DADO TRUNKING:

- Material steel - BS EN 50085.
- Wall/dado trunking - three compartment.
- Installation - surface.
- Style.
  - Use trunking manufactured within ward return edge flanges and filled with flange couplers, which ensure that when the cover is removed a minimum of 80% of the nominal trunking or compartment width is available for access.
- Colour - manufacturer's standard or BS 4800 shade to be approved.

#### 2100A UNDERFLOOR STEEL TRUNKING:

- Trunking material
  - Sheet steel trunking to BS 4678-2.
- Gauge of Metal - BS EN 50085.
- Degree of Protection - Class 3.
- Connection to vertical trunking
  - Provide flanges for connection of vertical trunking and temporary blanking plates.
  - Maintain cross sectional area of compartments with 50 mm minimum radius for connections to vertical trunking.
- Trunking bodies
  - Supply trunking bodies complete with flanged connections for service outlet boxes.
  - Use screwed levelling devices.

#### 2110A SERVICE OUTLET BOXES:

- Provide service outlet boxes and junction boxes constructed from sheet steel with same finish as

trunking.

- Maintain continuity and segregation of compartments through boxes and fit flyovers where necessary.
- Provide service outlet boxes with separate and segregated access to outlets associated with each wiring compartment. Fit cable guard or grommet to each section.
- Incorporate spigots on boxes for connection to trunking.
- Make frames adjustable on each corner, recess lids.
- Manufacture frame and lids for service outlet boxes and junction boxes of cast metal, and suitable to accept type of floor covering.
- Outlet plates
  - Provide outlet plates for each low voltage compartment equipped with socket outlets.
  - Provide outlet plates for each extra low voltage compartment equipped with items.
  - Provide outlet plates for each information technology compartment that ensures the IT compartment and its outlet plate conform to the requirements of BS EN 50174 and of the IT system installer, equipped with suitable outlets.
  - Provide blank outlet plates for any unused compartments.

#### 2120A POWER POLES:

- Provide service poles complete with associated conduit or trunking fittings. Maintain continuity and segregation of circuits throughout. Provide outlet boxes with separate access to wiring compartments.
- Standard - BS EN 50085-2-4.
- Material - Extruded Aluminium.
- Finish - Manufacturer's standard.
- Fixings - Free standing or complete with fixing brackets at top.

#### 2130A PVC SERVICE TRUNKING - GENERAL PURPOSE:

- Trunking to BS 4678-4
  - Mechanical properties, trunking for medium mechanical stress.
  - Temperature tolerances - BS 4678-4, Table 1.
- Electrical characteristics
  - Without electrical insulating characteristics.
- Resistance against ingress of solid objects
  - Protected against solid objects greater than 1.0mm (IP4X).
- Resistance to ingress of water
  - Protected against dripping water (IPX2).
- Resistance against corrosive or polluting substances
  - Medium protection.
- Fittings
  - Use fittings from same manufacturer as trunking. Use 'snap-on' covers. Use trunking fittings and accessories suitable for jointing by solvent welding.
  - Use proprietary cable retaining clips at 500 mm maximum intervals on trunking that exceeds 1.8 m in

length. Where junctions occur ensure first clip is not more than 300 mm from junctions.

#### 2130B PVC SURFACE TRUNKING - SKIRTING TRUNKING:

- Trunking to BS 4678-4
  - Mechanical properties, trunking for medium mechanical stress.
  - Temperature tolerances - BS 4678-4, Table 1.
- Electrical characteristics
  - Without electrical insulating characteristics.
- Resistance against ingress of solid objects
  - Protected against solid objects greater than 1.0mm (IP4X).
- Resistance to ingress of water
  - Protected against dripping water (IPX2).
- Resistance against corrosive or polluting substances
  - Low protection.
- Fittings
  - Use fittings from same manufacturer as trunking. Use 'snap-on' covers. Use trunking fittings and accessories suitable for jointing by solvent welding.
  - Use proprietary cable retaining clips at 500 mm maximum intervals on trunking that exceeds 1.8 m in length. Where junctions occur ensure first clip is not more than 300 mm from junctions.

#### 2130C PVC DADO TRUNKING - GENERAL PURPOSE:

- Trunking to BS 4678-4
  - Mechanical properties, trunking for medium mechanical stress.
  - Temperature tolerances - BS 4678-4, Table 1.
- Electrical characteristics
  - Without electrical insulating characteristics.
- Resistance against ingress of solid objects
  - Protected against solid objects greater than 1.0mm (IP4X).
- Resistance to ingress of water
  - Protected against dripping water (IPX2).
- Resistance against corrosive or polluting substances
  - Medium protection.
- Fittings
  - Use fittings from same manufacturer as trunking. Use 'snap-on' covers. Use trunking fittings and accessories suitable for jointing by solvent welding.
  - Use proprietary cable retaining clips at 500mm maximum intervals on trunking that exceeds 1.8m in length. Where junctions occur ensure first clip is not more than 300mm from junctions.

#### 2140A PVC UNDERFLOOR TRUNKING:

- Material
  - Heavy gauge PVC trunking to BS 4678-4.

#### 2150A SEPARATE OR MULTI-COMPARTMENT TRUNKING:

- Use separate trunking or multi-compartment trunking for segregation of services. Ensure steel partitions

have a provision for connecting a circuit protective conductor.

- Provide separation of wiring for circuits as required by BS 7671.

#### 2170 SUPPORTS AND FIXINGS:

- Provide proprietary suspension systems comprising channel sections with return lips and compatible fixing accessories made of material to BS EN 10162, BS EN 10210 and/or slotted angles to BS 4345.
- Ensure support components for Class 4 conduit have the same finishing method as the conduit carried out after manufacture. Ensure components in direct contact with conduit match profile of conduit.
- Ensure all steel components such as studding, bolts and steel screws, bolts, nuts and washers are either cadmium plated and passivated or zinc electroplated to BS 7371 after manufacture. Do not use metal fixing components likely to deteriorate and/or cause damage through electrolytic action.

#### 3010A GENERAL:

- Ensure entire system is electrically and/or mechanically continuous, to BS 7671.
- Fire barriers
  - Comply with the requirements of BS 7671 wherever the conduit or trunking passes through the perimeter of a fire compartment (wall, floor or ceiling).
- Appearance
  - Arrange conduit, trunking and ducting to present neat appearance, parallel with other service runs and lines of building construction, except where in screed or in-situ concrete. Ensure plumb vertical runs.
- Cable installation
  - Install cable in conduit, trunking or equipment enclosures only when completely erected throughout its length.
  - Do not use framework of partitions or similar unless indicated.
- Building expansion and settlement
  - Make provision in conduit and trunking at expansion and settlement joints to allow for movement of building structure. Provide circular through or adaptable boxes no more than 300 mm either side of expansion or settlement joints for conduit crossing.
  - Join boxes with flexible steel conduit type C or conduits arranged to form a telescopic joint and cover overall with PVC sleeve to provide minimum degree of protection of IP44 or purpose made telescopic joint protected by a PVC sleeve to at least IP44.
- Quality
  - Cut conduit clean and square with axis. Remove any burrs prior to erection.
  - Site form 90° in conduit wherever practical or use circular or adaptable boxes.
  - Construct bends and sets cold with a bending machine. Do not apply heat when forming sets or bends.
  - Use bending tools complying with British Standards appropriate to conduit material.
  - Ensure no indentation or reduction in cross sectional area occurs during installation.
  - Use correct tools to assemble conduit. Ensure no toolmarks or damage to components occurs.

#### 3020 LAYOUT:

- Ensure the maximum circuit lengths and groupings of cables indicated are not exceeded.
- Conduit sizing
  - Where dimensions are not indicated select trunking and conduit sizes in accordance with Appendix A

---

of Guidance Note I Selection and Erection published by the IET.

#### 3030 SPACING:

- Install conduit, trunking and equipment clear of other services. Measure distance from external surface of any thermal insulation. Notify instances where minimum clearance cannot be achieved and bond items concerned. Minimum general spacings between conduits, trunking, equipment and insulated steam services - 300 mm, other services excluding steam - 150 mm, above central heating radiators - 1000 mm, ensure separation is in accordance with Appendix K of Guidance Note I Selection and Erection published by the IET and BS EN 50174.

#### 3040 CONDENSATION PREVENTION:

- Install conduit and trunking systems to ensure internal condensation does not affect operation of associated circuits. Provide drainage points in accordance with BS 7671.
- Where conduit passes through external wall between two areas of different ambient temperatures or in other locations likely to cause condensation, install a conduit or adaptable box. After wiring fill box with inert, permanently plastic compound with high insulation value.

#### 3050A PROTECTION AND REPAIR OF STEEL COMPONENTS:

- Paint joints of conduit and minor damages to finish of conduit and trunking immediately after erection or after damage occurs.
- Use paint compatible with finish as follows
  - Galvanized finish, use two coats zinc rich paint.
  - Black enamelled finish, use two coats of good quality, air drying, black enamel paint.
- Remove grease, oil, dirt and rust before applying protective paint.
- Notify serious damage and repair or replace as instructed.

#### 3060 EQUIPMENT CONNECTIONS:

- Where surface mounted equipment is installed in conjunction with concealed conduit work, terminate concealed conduit at flush mounted conduit or adaptable box. Drill back of equipment, bush for back entry and mount equipment to conceal back box.
- Connect to fixed equipment via conduit box located adjacent to termination point, using either solid or flexible conduit as indicated for final connection to equipment terminations.
- Use conduit box as cable change point to facilitate changed wiring locally to adjacent equipment.
- Connect trunking to equipment by specially fabricated connectors or by couplers and externally screwed brass bushes.

#### 3070 CLEANING BEFORE WIRING:

- Clean inside of conduits and trunking with swabs immediately before wiring.
- Inspect all components and remove any foreign matter, fit temporary plugs to open ends of conduit and trunking to prevent ingress of water and solid material.

#### 3080A WIRING:

- Comply with BS 7671 when wiring installations.
- Segregate circuits as indicated.
- Ensure draw wires are left within empty conduits for use of specialist installers. Use draw wires

comprising nylon tapes with fitted eyelets.

- For concealed conduit ensure system is installed to enable re-wiring to be carried out from boxes for fittings or accessories only. Draw-in boxes will only be permitted with prior permission in writing.
- Do not use tallow or any other substances to facilitate drawing-in of cables.

#### 3090 BUILDERSWORK:

- Ensure conduit is not concealed until work has been inspected and approved.
- Obtain permission before horizontally chasing walls.
- Ensure that conduit and fittings buried in concrete or behind plaster are protected against corrosion or electrolytic action prior to rendering.
- Ensure conduit concealed in wall chases is covered by plaster and/or rendering to minimum depth of 12 mm.

#### 4010 DRAW-IN BOXES:

- Provide draw-in boxes in conduit at maximum intervals of 10 metres or after bends and/or sets totalling 180°.

#### 4020 INSTALLATION OF CAST IN OR BURIED CONDUIT:

- Ensure cast-in conduits are firmly secured to reinforcing steelwork and that accessory and/or conduit boxes are secured so they do not move during subsequent building operations.
- Ensure there is no blockage immediately shuttering is removed.
- Check there is no mechanical damage to conduit in floor screed prior to screeding. Fix securely before screed is poured. Provide temporary protection to conduits until screeds are laid.
- Ensure minimum amount of cross-overs occur dependent upon screed depth. Do not install draw boxes in floors.
- Do not install conduits in screeds in areas indicated within site blinding, in main structural slabs unless prior permission in writing is obtained.

#### 4030 CONDUIT BOXES:

- Ensure that wherever conduit boxes are cast in the face of the box is flush with the face of the concrete or plaster. Fit circular conduit boxes with extension rings to ensure a flush face with plaster or concrete or where terminal blocks are to be accommodated.
- Ensure fixing holes are countersunk where material thickness allows or use round head screws to prevent damage to cables and remove burrs before cables are drawn in.
- Use a minimum of two screw fixing for standard circular conduit boxes and four screws for large conduit boxes and adaptable boxes up to 150 mm x 100 mm.
- Use back outlet boxes where surface conduits pass through walls, to outside accessories or lighting points.
- Secure switch boxes and socket boxes using countersunk steel screws where provision is made for them or if not use round head screws. Use plug inserts and finally grout in position prior to plastering or screeding.

#### 4040 FIXING CONDUIT:

- Support conduit in accordance with Appendix I of Guidance Note I Selection and Erection published by the IET.
- Ensure conduit is not under mechanical stress. Fix conduit boxes independently of conduit. Make

allowance for any additional mechanical loading supported by conduit boxes.

- Where protection is specified as IP44 or greater ensure fixings of conduit boxes are suitable to maintain degree of protection.
- Use following methods of fixing conduit:

Location	Type of fixing
Floor screeds	Saddles or crampets
Buried in plaster or render	Crampets or saddles
Above false ceilings	Saddles
Surface	Saddles

•

#### 4050 FLEXIBLE AND PLIABLE CONDUIT:

- Use flexible conduit for final connections to motors, other equipment subject to vibration or adjustment and to thermostats, motorised valves and similar items mounted in pipelines or ducts.
- Use sufficient length between equipment and circular through box at end of conduit run (minimum 450 mm) to allow necessary full range of withdrawal, adjustment or movement.
- Use solid type adapters to terminate flexible conduit.
- Use PVC covered flexible conduit where installed externally, exposed to weather or in any position where ingress of moisture or condensation may occur.

#### 4060 SCREWED STEEL CONDUIT:

- Use materials clean and free from defects, rust, scale and oil. Obtain prior permission in writing for use of materials subject to remedial work before erection. Repair any damage caused by threading, bending or erection by painting with zinc rich paint before any rust occurs.
- Ensure length of thread on conduit matches that in conduit couplers, fittings or equipment with no thread exposed after erection except at running couplers.
- Ensure conduits butt inside couplers.
- Use lubricant when cutting threads.
- Use minimum number of running couplings
  - For running couplings in Class 2 conduit, use coupler and locknut. Paint exposed thread with zinc rich paint.
  - For running couplings in Class 4 conduit, use three piece conduit unions.

#### 4080 UNDERGROUND INSTALLATION:

- Where buried below ground, use Class 4 conduit. Do not use any buried conduit boxes unless prior permission in writing has been obtained. Wrap conduit with PVC self-adhesive tape, half lapped. Extend taping 150 mm beyond point where conduit leaves ground. Install circular through conduit boxes at the end of the tape. Fill conduit boxes after cable installation with inert, permanently plastic compound with high insulation value, and wrap in PVC self adhesive tape.

#### 5020 ACCESS:

- Arrange trunking to allow access to wiring. Locate covers on top or sides of trunking if practicable. Arrange access so covers are on a continuous face and cables can be laid in throughout the length of the

trunking. Notify where either condition cannot be achieved.

#### 5030A FIXING TRUNKING:

- Ensure trunking is independently fixed and supported from building fabric. Obtain approval for proposed fixings/supports.
- Support trunking in accordance with the manufacturers requirements and/or Guidance Note 1 Selection and Erection published by the IET.
  - Use two fixings minimum per standard length.

#### 5040A STEEL TRUNKING:

- Install steel trunking in accordance with the manufacturers requirements and those of BS 7671.
- Use trunking to avoid multiple parallel conduit runs, subject to approval.
- Cut trunking clean and square with axis, prepare ends and remove burrs and sharp edges. Ensure inside of trunking is free from anything liable to damage cables either during installation or after covers are fitted.
- When trunking is held in a vice, ensure surfaces remain undamaged and components are not warped.
- Avoid tool marking or damage to trunking system components.
  - Do not site fabricate trunking tees, bends, flanges and other accessories. Use only factory made accessories.
- Form circular holes over 6 mm diameter in trunking body using correctly sized punch sets. Use twist drill for holes up to 6 mm maximum diameter.
- Use only factory formed openings for accessories.
- Line unprotected apertures in trunking with PVC or nylon edging strip.
- Fit ends of runs with removable blanking plates.
- Ensure connections are not made to covers unless indicated or approval obtained.
- Provide fixed section of cover projecting 25 mm either side of fabric where trunking passes through wall, floors or ceiling.
- Fit cable retaining straps at 500 mm intervals except where cover is on top.

#### 5050 UNDERFLOOR AND FLUSH FLOOR TRUNKING INSTALLATION:

- Lay underfloor and flush floor trunking straight and level. Adjust height of services outlets, junction boxes and flush floor trunking to suit top of screed level. Ensure that spaces below trunking are free from voids and correctly packed. Prevent ingress of screed by masking where necessary.
- Ensure trunking levelling and alignment is carried out in co-operation with person(s) responsible for confirming location and finish of floor levels.
- Immediately following installation of trunking fit temporary covers to service outlets, junction boxes and flush floor trunking. Fit temporary blanking plates over open connections to vertical trunking.
- Retain temporary covers until permanent covers are installed.
- Ensure underfloor trunking systems are fully rewirable to final circuit outlets.
- Connect conduits only at inspection or other easy access points.

---

## Y61 CABLES AND WIRING

### 1010 CABLE MANUFACTURER:

- Use new cables, delivered to site with seals intact, manufactured not more than one year prior to delivery, labelled with manufacturer's name, size, description, BS number, classification, length, grade and date of manufacture.

### 1020 CABLE CERTIFICATION MARKING:

- Mark all types of cables with CENELEC cable certification marking or if included in British Approvals Service for Cables (BASEC) in accordance with BASEC Regulations.

### 1030 MEDIUM VOLTAGE CABLE RECORDS:

- Keep records of MV cable drum numbers and supporting information, mark information on record drawings, indicating precise location of each length of cable, and submit copies of manufacturer's cable test certificate.

### 2005 LSOH SHEATHING:

- Supply cables with Low Smoke zero Halogen (LSOH) sheathing, tested in accordance with BS EN 50267 or BS EN 60754 and BS EN 60332.

### 2010D STANDARD ORDINARY FLEXIBLE CORDS - MULTI COPPER CORES:

- Standard - BS EN 50525-2-21, Clauses 4.1, 4.2, 4.3 and 6.3

### 2020A STANDARD POWER SUPPLY CABLES, COPPER CONDUCTORS, THERMOSETTING INSULATION, SHEATHED:

- Standard - BS 5467, Tables 4, 6, 8, and 10.
- Mechanical protection - unarmoured.

### 2020B STANDARD POWER SUPPLY CABLES, COPPER CONDUCTORS, THERMOSETTING INSULATION, SHEATHED AND ARMoured:

- Standard - BS 5467, Tables 4, 6, 8, and 12.
- Mechanical protection - armour.

### 2020C STANDARD POWER SUPPLY CABLES, COPPER CONDUCTORS, PVC INSULATION, SHEATHED:

- Standard - BS 6004, Tables 7 and 8.
- Mechanical protection - unarmoured.

### 2020E STANDARD POWER SUPPLY CABLES, COPPER CONDUCTORS, LSF SHEATHED AND

**ARMOURED:**

- Standard - BS 6724, Tables 4, 6, 8, and 10.
- Mechanical protection - armour.

**2020G STANDARD CABLES FOR CONDUIT AND TRUNKING, COPPER CONDUCTORS, LSF INSULATED:**

- Standard - BS EN 50525-3-41, Clauses 4.1 and 4.3
- Mechanical protection - conduit and trunking.

**2020J STANDARD FLAT CABLES, 2-CORE OR 3-CORE, COPPER CONDUCTORS WITH OR WITHOUT CPC, LSF INSULATED SHEATHED:**

- Standard - BS 7211, Table 5.

**2020K STANDARD POWER SUPPLY CABLES, COPPER CONDUCTORS LSF INSULATION, SHEATHED:**

- Standard - BS 7211, Tables 3 and 4.
- Mechanical protection - unarmoured.

**2020M STANDARD CABLES WITH DEFINITE FIRE PERFORMANCE:**

- Standard - BS 7629-1 type as shown on drawings / schedules.
- Fire performance BS 5839-1 - standard.
- Sheath colour - red.
- Mechanical protection, as shown on drawings / schedules.

**2020N STANDARD CABLES FOR WALLS, PARTITIONS AND BUILDING VOIDS WHERE**

**PENETRATION BY SHARP OBJECTS IS A HIGH RISK:**

- Standard - BS 8436

**2030# STANDARD HV POWER CABLES:**

- Standard
  - BS 5467 (copper conductors)
    - Table 14.
    - Table 16.
  - BS 5467 (aluminium conductors)
    - Table 15.
    - Table 17.
  - BS 6622
  - BS 6708 (copper conductors)
  - BS 6724 (copper conductors)
    - Table 14.
    - Table 16.
  - BS 6724 (aluminium conductors)
    - Table 15.
    - Table 17.
  - BS 7835
    - Copper conductors.
    - Aluminium conductors.
  - BS 7870
    - BS 7870-4.10
    - BS 7870-4.20
    - Copper conductors.
    - Aluminium conductors.
- Mechanical protection
  - Armour.
  - Unarmoured.

**2030A STANDARD 3.3 KV, COPPER CONDUCTORS, ARMOURED AND LSF SHEATHED CABLES:**

- Standard - BS 6622, Tables 2 and 3.
- Mechanical protection - armour.

**2030B STANDARD 3.3 KV, COPPER CONDUCTORS, ARMOURED AND LSF SHEATHED CABLES:**

- Standard - BS 6724, Tables 14 and 16.
- Mechanical protection - armour.

**2030C STANDARD 11 KV, COPPER CONDUCTORS, ARMOURED AND SHEATHED CABLES:**

- Standard - BS 6622, Tables 4 and 5.
- Mechanical protection - armour.

**2040B LIGHT DUTY MINERAL INSULATED CABLES, LSF OUTER COVERING:**

- Standard - 500V light duty to BS EN 60702-1, Section 14.
- Outer covering

- Halogen free material to BS EN 60702-1, Section 8.3

2050B PAIRED, SCREENED CONTROL CABLES WITH OR WITHOUT METALLIC PROTECTION:

- Standard - BS EN 50288-7
- Paired, screened control cables, with or without metallic protection.

2050G MULTI-CORE UNARMoured LSF, SHEATHED AUXILIARY CABLES:

- Standard - BS 7211, Table 4.
- Mechanical protection - unarmoured.

2070B STANDARD COMMUNICATIONS CABLES FOR INDOOR USE:

- Standard - BT CW1308; BT CW1370; BT CW1700; and BT CW1750.

2080A STANDARD COAXIAL CABLES, FOR BROADCAST RECEIVING:

- Standard - BS EN 50117. CAI Benchmark status, cable types CT100, CT125, CT165.

2090# OPTICAL FIBRE CABLES:

- Standard
  - BS EN 60794-2-10
  - BS EN 60794-2-11.
  - BS EN 60794-2-20
  - BS EN 60794-2-30
  - BS EN 60794-3
  - BS EN 60794-3-10
  - BS EN 60794-3-11
  - BS EN 60794-3-20
  - BS EN 60794-3-30
  - BS EN 60794-4
  - BS EN 187103
- Optical fibre cable type
  - Direct burial.
  - Installation in ducts or tunnels.
  - Overhead.
  - Underwater.
  - Indoor.
  - Portable.
  - Equipment.
  - Special purpose
  - Submarine.
  - Telecommunications.
- Cable make up
  - Single mode fibres
  - Multi mode fibres
  - Single elements
  - Helical or SZ configurations.
  - Hybrid

- Electrical conductors
  - Single conductors
  - Twisted pairs
- Lay up
  - Circular.
  - Flat.
- Fibre type
  - Standard
    - BS EN 60793-2-50
    - BS EN 60793
  - Indoor.
  - Outdoor.
  - Temperature range
    - Storage
    - Installation
  - Use
- Fibre optic interconnecting devices and components to BS EN 61300, BS EN 62148, BS EN 62664-1-1

and PD IEC/TR 62627-03-03

- Cable construction
  - Fibre protection
    - Loose buffer.
    - Tight buffer.
    - Slotted core.
    - Ribbon
    - Loose tube
    - Ruggedised fibre.
  - Colour coding
  - Metallic conductors
  - Inner sheath
  - Outer protection/armouring
    - Metallic construction
    - Non-metallic construction
  - Waterproof construction.
- Category of fibre to BS EN 60793
  - Multimode
    - A1.
    - A2.1
    - A2.2
    - A3.
    - A4.
  - Single mode
    - B1.1
    - B1.2
    - B2.
    - B3.
- Dimensional requirements
  - Core diameter
  - Cladding diameter
  - Core non-circularity
  - Cladding non-circularity
  - Core / cladding concentricity error
  - Coating diameter
  - Buffer diameter
  - Coating non-circularity.
  - Diameter of electrical conductor
  - Thickness of insulation
  - Thickness sheath
  - Overall cable dimensions
- Mechanical requirements
  - Tensile strength
  - Crush resistance
  - Impact resistance
  - Isostatic pressure
  - Repeated bending
  - Torsion
  - Flexing
  - Snatch

- Kink
- Bend
- Transmission and optical requirements
  - Attenuation
  - Back scattering
  - Baseband response
  - Band width
  - Numerical aperture.
  - Total dispersion
  - Mode field diameter
  - Concentricity of mode field diameter
  - Chromatic dispersion
  - Cut-off wavelength
- Electrical requirements
  - Conductor resistance
  - Dielectric strength of insulation
  - Insulation resistance
- Environmental requirements
  - Temperature cycling
  - Performance under fire conditions
  - Sheath integrity
  - Water penetration
  - Cold bend
  - Freezing
  - Nuclear radiation
- Materials and cable dimensions
  - Fibre cladding
  - Coating
  - Loose tube
  - Buffer
  - Fibre armour
    - Kevlar.
  - Fibre sheath
  - Cable core filling
  - Strain member
  - Strain member sheath
  - Moisture barrier
  - Additional or outer strain member
    - Integral overhead suspension wire
- Cable installation characteristics
  - Minimum bending radius, during installation
  - Minimum bending radius, fixed in position
  - Maximum installation tension
  - Nominal cable weight per km

2090A OPTICAL FIBRE CABLES:

- Standard - BS EN 60794-2-11 and BS EN 187103. Category of fibre to BS EN 60793-2-10 A1a or A1b.
- Fibre optic interconnecting devices and components to BS EN 61300, BS EN 62148, BS EN 62664-1-1

and PD IEC/TR 62627-03-03

**2100A INFORMATION TECHNOLOGY CABLES - STRUCTURED WIRING: CATEGORY 5:**

- Provide IT cables in accordance with the IT system suppliers specification.
- Type of system - structured cabling - relevant parts of BS EN 50173
- Standard - for Category 5 and Category 5e, BS EN 50288-3-1 and BS EN 50288-3-2
- Termination reference - EIA/TIA TSB-40.
- Cable construction - multi pair, unshielded (UTP).

**2100C INFORMATION TECHNOLOGY CABLES - HBES CLASS 1:**

- Provide IT cables in accordance with the IT systems suppliers specification.
- Type of system - HBES Class 1.
- Standard - BS EN 50090-9-1.
- Cable construction - 2 twisted pairs unshielded.

**2100D INFORMATION TECHNOLOGY CABLES - INDOOR MULTI-PAIR/QUAD RISER CABLES:**

- Provide IT cables in accordance with IT system suppliers specification.
- Application - Multiple Dwelling Units (MDU) shaft supporting universal services, xDSL and applications up to 100 Mbits over IP.
- Standard - BS EN 50407-3
- Type of system -
- Cable construction -

**2120# CONDUCTORS FOR OPTICAL FIBRE, INFORMATION TECHNOLOGY AND NON-STANDARD**

CABLES:

- Standard
  - BS 5467.
    - Class 1.
    - Class 2.
  - BS 6231 Table 1.
  - BS EN 60228
    - Class 1.
    - Class 2.
    - Class 5.
    - Class 6.
  - BS 6724
    - Class 1.
    - Class 2.
  - BS EN 50214
- Type
  - Super flexible.
  - Flexible.
  - Stranded.
  - Solid.
  - Shaped.
  - Compacted.
  - Sectoral.
  - Milliken.
  - Circular.
- Material
  - Copper.
  - Aluminium.
    - BS 6622
  - Aluminium alloy.
  - Plain.
  - Tinned.
  - Nickel plated.
  - Silver plated.
  - Tinsel.
- Conductor screen
  - BS 6622
- Conductor taping
- Relevant parts of BS EN 50525
  - Crepe paper.
  - Glass fibre braid.
- Outer conductor of co-axial cables.
  - Copper
  - Solid
  - Braided
  - Laminated foil
  - Foil / braid combination
- Over-screen
  - Unscreened.
  - Foil screened.

- Braid screened.
- Foil and braid screened.

2130# CONDUCTOR INSULATION FOR OPTICAL FIBRE, INFORMATION TECHNOLOGY AND NON-

STANDARD CABLES:

- Standard
  - Relevant parts of BS 6469
  - BS 6622
    - XLPE.
    - EPR.
  - BS 7655.
    - 2.
    - CL 1.
    - CL 2.
    - FR 1.
    - FR 2.
    - GP 4.
    - GP 5.
    - GP 6.
    - GP 7.
    - GP 8.
    - OR 1.
    - 2.
  - BS EN 50290-2-21
    - TI 51.
    - TI 52.
    - TI 53.
    - TI 54.
    - TI 55.
  - BS EN 50290-2-23
  - BS EN 50290-2-25
  - BS EN 50290-2-26
  - BS EN 50290-2-29
  - BS EN 50290-2-30
  - BS EN 50363
    - EI 2.
    - EI 3.
    - EI 4.
    - EI 5.
    - EI 6.
    - EI 7.
    - EI 8.
    - TI 1.
    - TI 2.
    - TI 3.
    - TI 4.
    - TI 5.
    - TI 6.
    - TI 7.
    - XI 1.
  - BS EN 60811
  - Glass fibre
  - BS EN 50525
- Materials

- Varnished
- Silicone varnish.
- EPR.
- HOFR.
- Silicone rubber.
- EPR/CSP.
- PCP.
- PTFE.
- ETFE.
- Polyolefin.
- Polypropylene.
- Mineral.
- Elastomer
- Mica/glass tape.
- Form
  - Cellular.
  - Foamskin.
  - Solid.
  - Filled
    - BS EN 50290-2-28 .
- Insulation screen
  - BS 6622
    - Taped.
    - Extruded.
  - Metallic
- Marking of cores to BS EN 50334

2140# SHEATHS AND COVERINGS FOR OPTICAL FIBRE, INFORMATION TECHNOLOGY AND NON-

STANDARD CABLES:

- Usage
  - Bedding.
  - Sheath.
  - Inner Sheath.
  - Extruded inner covering.
  - Outer sheath.
  - Oversheath
- Standard
  - BS 5467
    - 1900/3300V.
    - Single core.
    - Multi core.
    - Extruded.
    - Taped.
  - BS 6004
  - BS 6004 para. 7.2
  - Relevant parts of BS 6469
  - BS 6622
    - Taped.
    - Extruded.
    - Semi-conductor.
  - BS 6724
  - BS 7655
    - LTS 1.
    - LTS 2.
    - LTS 3.
    - LTS 4.
    - RS 2.
    - RS 3.
    - RS 4.
    - RS 5.
    - RS 6.
    - SW 1.
    - SW 2.
    - SW 3.
    - SW 4.
    - TS 2.
    - 2.
    - 5.
    - 6.
    - 9.
    - 10.
  - BS EN 50290-2-22
    - TI 51.
    - TI 52.
    - TI 53.
    - TI 54.
    - TI 55.
  - BS EN 50290-2-24

- BS EN 50290-2-27
- BS EN 50290-2-30
- BS EN 50363
  - EM 2.
  - EM 3.
  - EM 4.
  - EM 5.
  - EM 6.
  - EM 7.
  - EM 8.
  - EM 9.
  - EM 10.
  - TM 1.
  - TM 2.
  - TM 3.
  - TM 4.
  - TM 5.
  - TPU.
  - XM 1.
- Materials
  - Elastomer
  - EPR.
  - CSP.
  - PTFE.
  - ETFE.
  - Reduced flame propagating compound.
  - Reduced HCl gas emission compound.
  - LSOH HCl emission level less than 0.5% to BS EN 50267 or BS EN 60754
  - LSOH
  - Colour
    - Natural.
    - Black.
    - Red.
- Metal sheath
  - Lead alloy to BS EN 12548
  - Aluminium
  - Copper

2150# ARMOUR FOR PAPER INSULATED, OPTICAL FIBRE, INFORMATION TECHNOLOGY AND

NON-STANDARD CABLES:

- Standard
  - BS 5467
  - BS 6622
  - BS 6708
  - BS 6724
  - BS EN 10257-1
- Materials
  - Galvanized steel wire.
  - Galvanized steel tape.
  - Interlocked steel tape.
  - Strip
  - Braid
  - Aluminium
  - Proportion of tinned copper wires
  - Single.
  - Double.
  - Armour coverings (%)
  - Cable diameter over armour

2160# BRAIDING, SCREENS, TAPING AND MOISTURE BARRIERS FOR OPTICAL FIBRE,

---

INFORMATION TECHNOLOGY AND NON-STANDARD CABLES:

- Type
  - Braiding.
  - Screens.
  - Taping.
  - Moisture barriers.
- Materials
  - Glass fibre
  - Mica/glass tape.
  - Varnished
  - Silicone varnished.
  - Lacquered
  - Aluminium/PETP tape.
  - Tinned copper drain wire.
  - Plain copper.
  - Tinned copper.
  - Nickel plated copper.
  - Silver plated copper.
  - Galvanized steel.
  - Stainless steel.
  - Laminated
- Screens.
  - Core.
  - Individual pair.
  - Collective
    - Unscreened.
    - Foil screened.
    - Braid screened.
  - Foil and braid screened.
- Moisture barrier

3010A CABLES GLANDS - UNARMoured CABLES, INDOORS:

- Cable type
  - Flexible; wiring and power; control and auxiliary; and communications.
- Standard - BS EN 62680-1 non-metallic, cable retention, IP54; Type A1 as BS 6121-5 Annex A..
- Environment - indoor.

3010B CABLES GLANDS - UNARMoured CABLES, OUTDOORS:

- Cable type
  - Flexible; wiring and power; control and auxiliary; and communications.
- Standard - BS EN 62680-1 non-metallic, cable retention, IP54; Type A2 as BS 6121-5 Annex A.
- Environment - outdoor.

3010C CABLES GLANDS - ARMoured CABLES, DRY INDOORS:

- Cable type
  - Wiring and power; and control and auxiliary.
- Standard - BS EN 62680-1 metallic, cable retention Class A, protective connection to earth, IP54. Type

B as BS 6121-5 Annex A.

- Environment - dry indoors.

3010D CABLE GLANDS - ARMOURED CABLES, INDOORS:

- Cable type
  - Wiring and power; and control and auxiliary.
- Standard - BS EN 62680-1 metallic, cable retention Class A, protective connection to earth, IP54. Type B as BS 6121-5 Annex A.
- Environment - indoor.

3010E CABLE GLANDS - ARMOURED CABLES, OUTDOORS:

- Cable type
  - Wiring and power; and control and auxiliary.
- Standard - BS EN 62680-1 metallic, cable retention Class A, protective connection to earth, IP54 with shroud. Type C as BS 6121-5 Annex A.
- Environment - outdoor.

3020B CABLE SEALS - HEAVY AND LIGHT DUTY MINERAL INSULATED CABLES - PROTECTED 'E'  
FOR HAZARDOUS AREAS:

- Use seals for mineral insulated cables in accordance with BS EN 60702-2, recommended or supplied by

cable manufacturer.

- Seal type
  - Plain; or earth tail and self-threading pot; or polymeric one piece.
- Pot closure - plastic disc.
- Pot sealant - epoxy putty.
- Conductor insulation sleeving - headed PTFE.
- Seal maximum temperature rating - 100°C or 85°C.
- Other seal characteristics
  - Certified to BS EN 60079-14 for hazardous areas, 'e'.

#### 3090# OPTICAL FIBRE TERMINATIONS:

- Style
  - Single-fibre.
  - Multi-fibre
  - Bifurcation
- Standard
  - BS EN 50377
  - BS EN 60874 series.
  - BS EN 61754 series.
  - BS EN 186110
  - BS EN 186130
  - BS EN 186150
  - BS EN 186160
  - BS EN 186180
  - BS EN 186220
  - BS EN 186230
  - BS EN 186260
  - BS EN 186270
  - BS IEC 60874 series.
- Terminated fibre
  - Cladding diameter 0.125mm.
  - Cladding diameter 0.140mm.
  - Cladding diameter 0.38mm.
  - Cladding diameter
  - Diameter
  - Loose tube.
  - Tight buffered.
  - Number of fibres in tube
- Termination type
  - Mechanical
  - Fusion
- Installation characteristics
  - Termination loss
  - Factory fitted.
  - Site made.
  - Inner sheath sealing
  - Armour termination
  - Strain or reinforcing member termination
  - Outer sheath sealing

- Nominal size
- Nominal weight
- Installation temperature range
- Operating temperature range

#### 3100# OPTICAL FIBRE CABLE JOINTS:

- Standard
  - BS EN 61073-1
- Style
  - Flexibility point
  - Bifurcation point
  - Termination box
  - Straight through.
  - Underground.
  - Internal.
  - External weatherproof
- Joint type
  - Mechanical
  - Fusion
- Installation characteristics
  - Joint loss
  - Factory fitted.
  - Site made.
  - Splice holder
  - Access method
  - Cable glands
  - Laser danger warning notice
  - Enclosure
  - Outer enclosure
  - Inner sheath sealing
  - Armour jointing
  - Strain member jointing
  - Moisture barrier carried across joint
  - Outer sheath sealing
  - Joint box
  - Nominal size
  - Nominal weight
  - Installation temperature range
  - Operating temperature range

#### 3110A CABLE DUCTS:

- Standard
  - BS 4660 provided by Electricity Distribution Company.

#### 3120A CABLE SLEEVES:

- Supply and hand to others for installation non-ferrous cable sleeves for incorporation into the structure where cables pass through fire compartment floors and walls. Sleeving to be in accordance with BS EN

60684

- Packing material
  - Weak mix mortar; intumescent, plaster or mastic; solid intumescent material; or intumescent granule filled bags.

3130A CABLE COVERS AND MARKERS:

- Material - recovered plastic, integral tape.
  - Marking - electricity or telephone.
- Plastic marker tape
  - Yellow, marked electricity or telephone.

4010 CABLE INSTALLATION - GENERAL:

- Use and install cables only as directed in the appropriate standard or as directed by the manufacturer in writing. Lay cables in one length unless otherwise indicated. Obtain permission from supervising officer for all through joints, and where overall length requirement exceeds practical drum size.
- Handle, install and dispose of cables on wooden drums in accordance with BS 8512
- Install cables when ambient temperature is 5°C or greater, using cables stored at or above this temperature for not less than 24 hours.
- Use drum stands, drum axles, fair leads, rollers, cable stockings and other equipment as recommended by the cable manufacturer and as appropriate to the method of installation.

4020 CABLE INSTALLATION IN LOW TEMPERATURES:

- Install cables at lower installation temperatures when authorised by manufacturer in a written statement.

4030 INSTALLATION OF LSF CABLE:

- Install LSF cables in accordance with manufacturer's instructions. Ensure ambient temperature is above 5°C. Ensure oversheaths are not damaged by abrasion or scuffing.

4030A INSTALLATION OF LSZH / LSOH CABLES:

- Install LSZH/LSOH cables in accordance with the manufacturer's instructions, ensuring the ambient temperatures are above the minimum specified by the manufacturer.
- Install LSZH/LSOH cables so that they are not exposed to concrete or other substances containing products similar to lime.
- Where LSZH/LSOH cables are installed outside containment, directly on concrete floors (e.g. under raised floors in offices, control rooms or data centres) ensure suitable cable mat products with appropriate fire performance are used.

4040 INSTALLATION OF UNARMoured CABLES:

- Install and use unarmoured cable to BS EN 50565-1, BS EN 50565-2, BS 7540-3 or the manufacturer's written instructions.

4060 CABLE INSTALLATION IN TRENCHES:

- Lay cables on newly prepared bedding. Ensure multiple layers of cable are separated vertically by a

50mm layer of hard rammed bedding material.

- When using a power winch ensure tension on the cable is taken by element of the cable designed for that purpose, that is armour or conductor cores as appropriate and not plastic sheath, metal sheath or core insulation.
- When hand pulling cable ensure no kinks are formed and that flaking, when used, is done in the correct direction.
- Do not allow cable to twist during installation. Use swivels to connect pulling bond to cable stocking or equivalent fitting.
- Check drum is suitable for jacking before commencing installation. If drum or reel is unsuitable for jacking, flake cable in correct direction in maximum size turns from drum or reel before commencing installation. Use skilled labour to supervise all unreeling, flaking or running of cable from a drum.
- Lay cables in the formation shown, ensure spacing is not reduced below that indicated.
- Bind trefoil groups at 1m intervals. Bind any associated earth or protective conductor to its cable or trefoil group at 1m intervals.
- Space multiple cables in trenches in accordance with BS 7671.
- Ensure installation radii and permanent bending radii are not less than those recommended by the manufacturer.
- Do not lay cables to BS 7211 or BS EN 50525 direct in the ground.

#### 4090A CABLE INSTALLATION IN CONDUIT AND TRUNKING:

- Install cables so that they are orderly and capable of being withdrawn.
- Arrange single core wiring generally using the loop-in method.
- Trunking
  - In vertical trunking provide pin racks at 3m intervals. Use ties at 2m intervals for all wires of the same circuit reference. Mark ties with circuit reference number at 10m intervals.
- Conduit
  - Provide cable clamps in conduit boxes at 10m intervals in vertical conduit.
  - Allow for full range of movement at building construction movement joints. Make all joints to wiring at terminal blocks in conduit boxes.

#### 4110A CABLE SURFACE INSTALLATION:

- Dress cables flat, free from twists, kinks and strain; and align parallel to building elements. When glands and clamps are not required, take sheathing of cables into accessory boxes and equipment and protect against abrasion using grommets or similar sharp edge protection.

#### 4120A CABLE EMBEDDED INSTALLATION:

- Dress cables flat, free from twists, kinks and strain; and align parallel to building elements. When glands and clamps are not required, take sheathing of cables into accessory boxes and equipment and protect against abrasion using grommets or similar sharp edge protection.
- Ensure plaster or screed over cable is a minimum of 12mm. Protect embedded cables with metal capping or PVC oval conduit.

#### 4130A CABLE INSTALLATION - MINERAL INSULATED CABLES:

- Straighten and dress cables using methods and tools recommended by cable manufacturer.
- Use thermoplastic or LSF sheathed cables in location indicated, and where cables may come into direct contact with any material that may be corrosive to copper.
- Do not allow extra length on installed cables to allow for cutting back of moisture affected ends. Store

mineral insulated cables in the form as supplied by manufacturer.

#### 4140 CABLE INSTALLATION - FLEXIBLE CORDS:

- Grip cords securely at connections. Where they do not form an integral part of the connected accessory or equipment, provide separate proprietary cord grips.

#### 4150A CABLE JOINTING AND TERMINATING GENERALLY:

- Ensure all joints and terminations are made by appropriately qualified cable jointers, using jointing materials, components and workmanship recommended by the cable manufacturer and the jointing accessory manufacturer. Install cable glands in accordance with BS 6121-5
  - Cold pour resin and heat shrink joints.
  - Cut all cable ends immediately prior to jointing or terminating. Seal cables left unconnected for more than 24 hours to prevent the ingress of moisture. Seal plastic sheathed cables using proprietary shrink on end caps. Seal lead sheathed cables by a plumbed dressed lead cap with an airspace to allow conductor movement.
- Strip cables to bring out the cores and expose conductors, for the minimum length required for connection, to leave no exposed length of conductor after termination. Ensure that strands are not damaged when stripping cable cores. Twist strands together. Do not reduce number of strands. Secure all strands at terminations.
- Clean armour thoroughly prior to jointing or terminating.
- At connections to equipment and switchgear without integral cable clamping terminals, use compression or solder type lugs for bolted terminal connections, of correct bore.
- Form all compression connections to components using tools that cannot be released unless the correct degree of compression has been achieved.
  - Install and inspect compression and mechanical connectors on conductors in accordance with BS EN 60228 and BS 7609
- Bolt core terminations with lugs to equipment using washers or proprietary shakeproof devices.
- Do not bunch more than three cores at clamping terminals or bolted connections.
- Mark cable conductor phasing or other core identification at each end of all cables; and at all joints maintaining consistency of marking with any existing system.
- Connect all cores, including multicore cable spare cores, at all joints and terminations. Bond any unused cores or multicore cables to earth at both ends, unless otherwise indicated.

#### 4180A TERMINATING - MINERAL INSULATED CABLES:

- Use terminations in accordance with BS EN 60702-2 and components and materials recommended or supplied by cable manufacturer.
- Use seals with maximum temperature rating indicated stub caps to the largest size available; and drilled caps and headed sleeves for larger sizes.
- Use glands of type indicated. At terminations to accessory boxes within a plaster or render finish, cable clamps fixed to accessory box and firmly gripping cable sheath may be used. Use earth tail seals with sheath grip type accessory boxes.
- At equipment not provided with threaded entries secure glands using lock washers and locknuts or brass conduit bush. Use gland shrouds when plastic covered MI cables are used.
- Using PVC, PIB or LSF material tape to BS EN 60454 to match sheath, tape overall gland any bare copper sheath and form seal to cable sheath under all shrouds.
- Mark core sleeving with appropriate identification.
- Install voltage surge suppressors in accordance with manufacturer's recommendations and surge

suppressors to BS 7671, Section 331-01-01.

**4190A CABLE JOINTS - MINERAL INSULATED CABLES:**

- Joint mineral insulated cables using methods and materials recommended by cable manufacturer. Terminate cables in externally threaded glands using seals with temperature rating indicated. Join conductors using crimped connectors.
- Insulate connectors using PVC tape to BS EN 60454, ensuring good seal to conductor sleeving. Make off glands into either end of internally threaded brass sleeve of correct size. Protect brass sleeve using heat shrink sleeve.

**4200A COMMUNICATIONS COAXIAL, OPTICAL FIBRE AND IT CABLE INSTALLATION, JOINTING AND TERMINATING:**

- Use methods approved by cable and accessory manufacturers.
- Use methods of fixing and restraint which do not deform the cross-section of cables, which might otherwise affect the data / signal performance of cables.
- Ensure cable protection mats are used in basket in which unarmoured copper cables are installed, where cable deformation may affect signal / data performance (e.g. Category 6 and Category 6a applications).
- Employ labour certified by acceptable body as qualified to install and make joints and terminations in the referenced cable. Obtain in writing approval of cable manufacturer for accessories not supplied by them.
- Identify cables using structured numbering scheme.
- Install communication, coaxial, optical fibre and IT cables in accordance with BS EN 50174-2 and BS EN 50174-3.

## Y62 BUSBAR TRUNKING

### 1000 GENERAL

#### 2010A GENERAL PURPOSE BUSBAR :

- System characteristics
  - Electrical Supply - Voltage between phases 400 volts; frequency 50 Hz.
  - Rate system to withstand a short circuit fault current of 21 kA.
  - Short time rating - 0.2 seconds.
- Busbar
  - Use high conductivity busbars and connections.
  - Material - Copper.
  - Number of Poles - 3-phase and full size neutral.

#### 2020A GENERAL PURPOSE STEEL BUSBAR TRUNKING:

- Busbar trunking type
  - Surface; flush; bench or underfloor.
- Busbar
  - Y62.2010A
- Steel enclosure
  - Comply with relevant sections of BS 4678.
  - Apply high standard of finish to busbar trunking. For a painted finish apply a minimum of one coat rust inhibiting primer, one undercoat and two semi-gloss finish coats.
  - Remove rust and degrease metal prior to application of selected finish. Zinc coated steel is acceptable as anti-rust treatment.
  - Use rust-proofed (e.g. cadmium plated) screws, bolts, nuts and washers.
  - Finish - Paint or stoved enamel.
  - Colour- Manufacturer's standard colour.
- Fittings
  - Use trunking fittings of the same type and manufacture as the busbar trunking. Use screw fixed covers. Use manufacturer's purpose made units at changes of direction.
- Supply termination
  - Provide facilities for the correct termination of supply cable.
- Fixings
  - Provide external fixing brackets at not greater than 2m intervals. In accordance with manufacturer's instructions and recommendations.
- Marking
  - Provide clear marking of busbars and tap-off outlet sockets with phase colours to enable sequence identification throughout system.

#### 2040A INTERNAL PROTECTIVE CONDUCTORS:

- Standard BS EN 61534-1.
- Provide protective conductor throughout busbar system length to manufacturer's standard.
  - Busbar pole with tap-off at each socket for wall/dado type with integral socket outlets.
- Install protective conductor internally to busbar enclosure.
- Bond protective conductor to trunking enclosure using a method in accordance with BS 7430 at 1.2m

maximum intervals.

- Use high tensile brass bolts and locking nuts.
- Complete trunking system before installing the protective conductor.
- Ensure the continuity of protective circuits.

**3010 GENERAL:**

- Install busbar trunking in accordance with manufacturer's instructions and the relevant standards.
- Check total length of busbar system required on-site prior to manufacture commencing.
- Fit covers at end of each run or provide proprietary end boxes.

**3020 BONDING:**

- Bond between adjacent lengths of busbar trunking with approved mechanical means to maintain conductivity, where two or more parallel runs of busbar trunking occur. Tighten bolted connections between adjacent lengths of busbars to correct torque setting. Avoid damage to conductors.

**3030 EXPANSION:**

- Anchor busbars rigidly in a minimum of one position and provide means of absorbing maximum expansion and contraction likely to occur in busbars under normal operating conditions.
- Provide expansion joints in each length of run

**3050 FIRE BARRIERS:**

- Provide barriers of fire-resisting materials within the busbar trunking where vertical runs pass through floors and horizontal runs pass through fire break walls to prevent spread of fire. (BS 7671 Section 527).

## Y63 SUPPORT COMPONENTS - CABLES

### 1000 GENERAL

#### 2010A CABLE SUPPORTS AND FINISHES:

- Cable supports
  - Support all cables throughout their length using conduit; or trunking and enclosures; or cable tray; or cable racking; or special support systems; or cleat or clip fixing direct to building fabric as indicated on the drawings/schedules.
  - Ensure tray, racking and special support systems are continuous and firmly fixed to building fabric. Allow space for additional cables as indicated on the drawings/schedules.
  - Ensure cable support system allows for spacing in accordance with BS 7671 for the design current of the cable.
- Fixings finishes
  - Ensure finish for all support components, fixings, hangers and accessories is as cable support system or manufacturer's standard.

#### 2020A CABLE SUPPORT SYSTEM - PERFORATED TRAY:

- Type - Flanged or return flanged.
- Perforations
  - Admiralty pattern for light or medium duty; GDGD pattern standard 23; or manufacturer's standard pattern.
- Thickness - Manufacturer's standard thickness for type.
- Fittings
  - Use factory made fittings throughout of same material, type, pattern, finish and thickness as cable tray.
  - Use reducers, inside angles and outside angles as manufacturer's standard.
  - Use flat bends, equal tees, unequal tees and crosses with corners gusseted.
  - Join lengths of tray and fittings using manufacturer's standard shouldered ends, fish plates, or couplers, with galvanized or zinc plated slotted domed head 'roofing' bolts, nuts, washers and shakeproof washers.
- Material
  - Hot rolled steel galvanized after manufacture to BS EN 10346 or BS EN 10143.
- Finish - Self colour galvanized.

#### 2020B CABLE SUPPORT SYSTEM - CABLE RACK:

- Proprietary system of channel sections with return lip and compatible jointing and fixing accessories
- Fittings
  - Use factory made fittings throughout of same material finish and section as rack, for risers, bends, reducers, tees, crosses and drop outs.
- Material
  - Hot rolled steel galvanized after manufacture to BS EN 10346 or BS EN 10143.
- Finish - Self colour galvanized.

#### 2025A CABLE SUPPORT SYSTEM - PROPRIETARY CABLE TIES:

- Two piece cable tray pattern, on cable tray only. Wrap round self locking non releasable pattern on

everything except cable trays.

#### 2025C CABLE SUPPORT SYSTEM - TWO WAY SADDLES:

- Bright copper for unsheathed mineral insulated cables. PVC covered bright copper for sheathed mineral insulated cables.

#### 2025D CABLE SUPPORT SYSTEM - CABLE BASKET:

- Proprietary system of wire basket with compatible jointing and fixing accessories.
- Fittings
  - Use factory made fittings throughout of same material finish as basket, for risers, bends, reducers, tees, crosses and drop outs.

#### 3010 CABLE TRAY INSTALLATION:

- Support from building fabric with minimum clearance behind of 20mm. Install fixings at regular intervals to prevent visible sagging when loaded, with maximum spacing 1.2m and 230mm from fittings.
- Keep cutting of cable tray to a minimum. Cut along a line of unperforated metal. Make good finish with zinc rich paint, primer and top coat, or two pack epoxy paste, as appropriate to tray material and finish.
- Fit holes cut in tray for passage of cables with grommets, bushes or other lining.
- Install all bolts, fixings and hangers with threaded portion away from cables. Cable routes to cross at right angles or spacing to BS EN 50374.

#### 3020A CABLE CLEATS, TIES, SADDLES AND CLIPS INSTALLATION:

- For cables on horizontal tray use ties for each circuit. Use tie manufacturer's special tensioning tool where available. Crop off tie ends.
- For cables on vertical tray use cleats bolted to tray for paper, plastic or elastomeric insulated cables and saddles or clips for mineral insulated cables. Use cleats sized to grip cables firmly without undue pressure or strain on cable, but preventing slipping.
- For cables on vertical or horizontal rack use proprietary fixings to rack for paper, plastic or elastomeric insulated cables and saddles or clips for mineral insulated cables. On continuous flat surfaces of wood, plaster, brick etc.
  - Use polypropylene surface fixing clips with prefixed hardened steel pin for PVC insulated and sheathed cables and sheathed or bright mineral insulated cables. Use round or flat or flat twin pattern as appropriate, manufactured specifically for cable being fixed.
  - Use one hole 'P' clips or two way saddles of bright copper for unsheathed mineral insulated cable. Use PVC covered for sheathed mineral insulated cables.
- Space cleats, ties, saddles and clips
  - As Appendix G of Guidance Notes 'Selection & Erection' published by the IET.

## Y71 LV SWITCHGEAR AND DISTRIBUTION BOARDS

### 1000 GENERAL

#### 1010# CO-ORDINATION STUDY:

- Carry out a complete protection grading and setting calculation of the complete electrical distribution system, including all connected equipment. Engage an independent Chartered Electrical Engineer to:
  - Authenticate the calculation.
  - Undertake the calculation.
- Provide fault (short circuit) calculations for the distribution system as indicated on the drawings and a protective device co-ordination study to ensure that all protective devices are co-ordinated. Base the study on the actual devices and cable lengths installed.
- Prepare the fault calculations and protective device study with a network analyser, digital computer or by written calculations, include complete fault calculations for each proposed source and combinations thereof including motor and generator contributions.
- Present the fault calculations including the following:
  - General description of calculations methods, assumptions and base per unit quantities selected.
  - One line diagrams, source impedance data including X/R ratio and source system characteristics.
  - Impedance diagrams, typical calculations, tabulations of calculation quantities and results, conclusions and recommendations.
- Calculation of 3-phase symmetrical fault currents at each switchboard, Motor Control Centre (MCC) and distribution board.
- Calculation of earth fault currents including the associated zero sequence impedance diagram.
  - Tabulations which include fault impedance, X/R ratios, asymmetry factors, motor contributions, short circuit MVA and symmetrical and asymmetrical fault currents.
- Carry out the protective device co-ordination study including the following:
  - Time-current co-ordination curves graphically indicating the proposed co-ordination for the system on log-log graph transparencies. Include on each sheet, a complete title and one line diagram identifying the specific portion of the system covered.
  - A detailed description of each protective device identifying its type, function, manufacturer and time current characteristics and tabulation of recommended settings.
- Include on the curve sheets, system HV equipment relay characteristics, pertinent transformer, motor and generator characteristics including up to the largest outgoing LV circuit breaker/fuse for each distribution board. Indicate manufacturing tolerances clearly showing the final grading margin.
- Submit the calculation:
  - As a bound report for approval by the CA
  - Upon approval by the CA, submit copies of the approved report
  - Carry out adjustments of the protection settings to conform with the requirements of the report.
  - Ensure that discrimination is achieved throughout the network and select protective devices and settings accordingly.

#### 1020# ELECTRICITY SUPPLY:

- Ensure all electrical equipment supplied and installed is suitable for power supply indicated to BS EN

60038 and relevant parts of BS EN 61558

**2010A CUBICLE SWITCHBOARD - LV SWITCHGEAR AND CONTROLGEAR ASSEMBLY:**

- Standard - BS EN 61439-1.
- External design - Cubicle type assembly.
- Usage - Switchboard.
- Conditions of installation - Indoors.
- Electrical characteristics
  - Rated operational voltage 400V +10% -6%
- Service conditions
  - Ambient air temperature and altitude to relevant parts of BS EN 61439.

**2010B CUBICLE CONTROL PANEL - LV SWITCHGEAR AND CONTROLGEAR ASSEMBLY:**

- Standard - BS EN 61439-1.
- External design - Cubicle type assembly.
- Usage - Control panel.
- Conditions of installation - Indoors.
- Electrical characteristics
  - Rated operational voltage 400V +10% -6%
- Service conditions
  - Ambient air temperature and altitude to relevant parts of BS EN 61439.

**2010C MULTI-BOX SWITCHBOARD - LV SWITCHGEAR AND CONTROLGEAR ASSEMBLY:**

- Standard - BS EN 61439-1.
- External design - Multi-box type assembly.
- Usage - Switchboard.
- Conditions of installation - Indoors.
- Electrical characteristics
  - Rated operational voltage 400V +10% -6%
- Service conditions
  - Ambient air temperature and altitude to relevant parts of BS EN 61439.

**2010D MULTI-BOX CONTROL PANEL - LV SWITCHGEAR AND CONTROLGEAR ASSEMBLY:**

- Standard - BS EN 61439-1.
- External design - Multi-box type assembly.
- Usage - Control panel.
- Conditions of installation - Indoors.
- Electrical characteristics
  - Rated operational voltage 400V +10% -6%
- Service conditions
  - Ambient air temperature and altitude to relevant parts of BS EN 61439.

**2020A FLOOR STANDING ASSEMBLY CONSTRUCTION:**

- Enclosure standard - BS EN 62208.
- Material of enclosure - Manufacturer's standard.
- Terminals for external conductors, main power circuits

- Accommodate cross-sectional area of copper cables in accordance with BS EN 61439-1.
- Terminals for external conductor, control and auxiliary circuits
  - Terminal block. Mounting as manufacturer's standard.
- Size of neutrals on 3-phase supplies - Full sized.
- Degree of protection to BS EN 60529, IP31 for assembly.
- Protection against direct and indirect contact
  - Manufacturer's standard.
- Accessibility for inspection
  - Arrange for following operations to be performed when assembly is in service and under voltage
    - Visual inspection of switching devices and other apparatus; settings and indicators of relays and releases; conductor connections and markings.
    - Adjusting and re-setting of relays, releases and electronic devices.
    - Replacement of fuselinks and indicating lamps.
    - Fault location by voltage and current measuring.
- Accessibility for maintenance
  - Provide space between functional unit or group and adjacent functional units or groups. Provide retainable fastening means for parts likely to be removed for maintenance.
- Removable parts and withdrawable parts as manufacturer's standard.
- Internal separation - Form 4.
- Input voltage variations for electronic equipment supply - BS EN 60439.
- Supply frequency deviation - BS EN 60439.
- Mounting - Floor standing.

#### 2020B WALL MOUNTED ASSEMBLY CONSTRUCTION:

- Enclosure standard - BS EN 62208.
- Material of enclosure - Manufacturer's standard.
- Terminals for external conductors, main power circuits
  - Accommodate cross-sectional area of copper cables in accordance with BS EN 61439-1.
- Terminals for external conductor, control and auxiliary circuits
  - Terminal block. Mounting as manufacturer's standard.
- Size of neutrals on 3-phase supplies - Full sized.
- Degree of protection to BS EN 60529, IP31 for assembly.
- Protection against direct and indirect contact
  - Manufacturer's standard.
- Accessibility for inspection
  - Arrange for following operations to be performed when assembly is in service and under voltage
    - Visual inspection of switching devices and other apparatus; settings and indicators of relays and releases; conductor connections and markings.
    - Adjusting and re-setting of relays, releases and electronic devices.
    - Replacement of fuselinks and indicating lamps.
    - Fault location by voltage and current measuring.
- Accessibility for maintenance
  - Provide space between functional unit or group and adjacent functional units or groups. Provide retainable fastening means for parts likely to be removed for maintenance.
- Removable parts and withdrawable parts as manufacturer's standard.
- Internal separation - Form 4.
- Input voltage variations for electronic equipment supply - relevant parts of BS EN 61439 and BS EN

60439.

- Supply frequency deviation - relevant parts of BS EN 61439 and BS EN 60439.
- Mounting - Wall mounted.

2030A ENCLOSURE FINISH:

- Apply high standard finish to enclosure and supporting metalwork. Degrease metal and remove rust prior to applying finish.
- Comply with paint manufacturer's recommendations regarding preparation, stoving times, temperatures, mixing of finishes, application and coat thickness.
- Finish - Manufacturer's standard.
- Colour - Manufacturer's standard colour.

2060 SITE BUILT ASSEMBLIES:

- Ensure that components of site assemblies are part of a proprietary system and type tested as appropriate.
- Install assemblies in accordance with manufacturer's drawings and instructions.

2070 SITE MODIFICATION:

- Do not make site alterations unless authorised. Where site modifications to assemblies are authorised make in accordance with manufacturer's certified drawings and instructions. Ensure that modifications made comply with type test certificate obtained for arrangement of components.

2080A WALL MOUNTED, TOP ENTRY BATTERY CHARGER AND BATTERY UNIT:

- Supply a unit for tripping.
- Input Supply - 230 V single-phase 50 Hz.
- DC Output
  - Voltage - 50 Volt -20% +10%
  - Operating temperature range - -10°C - 45°C.
  - Charger type - Thyristor or transistor.
  - Battery type
    - Lead acid (sealed) or Nickel Cadmium (maintenance free).
  - Cubicle (sheet steel) - Wall mounted.
  - Cable entry - Top.
  - Finish - Manufacturer's standard.
  - Colour - Manufacturer's standard.
  - Ventilation - Natural.
  - Facilities - MCB input protection; float charge.
  - Battery over-discharge protection
    - Fuses for battery protection; MCB's for outgoing circuits; automatic selection of boost charge.
  - Meters
    - Battery voltage; charging current (dual scale for float and boost); output current.
  - Lamp indications
    - Supply on; supply fail (monitor input terminals); floatcharge; boost charge; no charge (when supply is on); battery voltage low; battery voltage high.
  - Alarms (connected to operate a relay with shrouded 230V3A a.c. or 0.5A d.c. N/C volt free contacts,

closed on any alarm, for remote indication circuit)

- Supply failed; no charge (when supply is on); battery voltage low; battery voltage high.

#### 2080B WALL MOUNTED, BOTTOM ENTRY, BATTERY CHARGER AND BATTERY UNIT:

- Supply a unit for tripping.
- Input Supply - 230 V single-phase 50 Hz.
- DC Output
  - Voltage - 50 Volt -20% +10%
  - Operating temperature range - -10°C - 45°C.
  - Charger type - Thyristor or transistor.
  - Battery type
    - Lead acid (sealed) or Nickel Cadmium (maintenance free).
  - Cubicle (sheet steel) - Wall mounted.
  - Cable entry - bottom.
  - Finish - Manufacturer's standard.
  - Colour - Manufacturer's standard.
  - Ventilation - Natural.
  - Facilities - MCB input protection; float charge.
  - Battery over-discharge protection
    - Fuses for battery protection; MCB's for outgoing circuits; automatic selection of boost charge.
  - Meters
    - Battery voltage; charging current (dual scale for float and boost); output current.
  - Lamp indications
    - Supply on; supply fail (monitor input terminals); floatcharge; boost charge; no charge (when supply is on); battery voltage low; battery voltage high.
  - Alarms (connected to operate a relay with shrouded 230V 3A a.c. or 0.5A d.c. N/C volt free contacts, closed on any alarm, for remote indication circuit)
    - Supply failed; no charge (when supply is on); battery voltage low; battery voltage high.

#### 2080C FLOOR STANDING, TOP ENTRY, BATTERY CHARGER AND BATTERY UNIT:

- Supply a unit for tripping.
- Input Supply - 230 V single-phase 50 Hz.
- DC Output
  - Voltage - 50 Volt -20% +10%
  - Operating temperature range - -10°C - 45°C.
  - Charger type - Thyristor or transistor.
  - Battery type - Lead acid (sealed) or Nickel Cadmium (maintenance free).
  - Cubicle (sheet steel) - Floor standing.
  - Cable entry - Top.
  - Finish - Manufacturer's standard.
  - Colour - Manufacturer's standard.
  - Ventilation - Natural.
  - Facilities - MCB input protection; float charge.
  - Battery over-discharge protection
    - Fuses for battery protection; MCB's for outgoing circuits; automatic selection of boost charge.
  - Meters
    - Battery voltage; charging current (dual scale for float and boost); output current.
  - Lamp indications
    - Supply on; supply fail (monitor input terminals); float charge; boost charge; no charge (when supply

is on); battery voltage low; battery voltage high.

- Alarms (connected to operate a relay with shrouded 230V 3A a.c.or 0.5A d.c. N/C volt free contacts, closed on any alarm, for remote indication circuit)
  - Supply failed; no charge (when supply is on); battery voltage low; battery voltage high.

#### 2080D FLOOR STANDING, BOTTOM ENTRY, BATTERY CHARGER AND BATTERY UNIT:

- Supply a unit for tripping.
- Input Supply - 230 V single-phase 50 Hz.
- DC Output
  - Voltage - 50 Volt -20% +10%
  - Operating temperature range - -10°C - 45°C.
  - Charger type - Thyristor or transistor.
  - Battery type - Lead acid (sealed) or Nickel Cadmium (maintenance free).
  - Cubicle (sheet steel) - Floor standing.
  - Cable entry - bottom.
  - Finish - Manufacturer's standard.
  - Colour - Manufacturer's standard.
  - Ventilation - Natural.
  - Facilities - MCB input protection; float charge.
  - Battery over-discharge protection
    - Fuses for battery protection; MCB's for outgoing circuits; automatic selection of boost charge.
  - Meters
    - Battery voltage; charging current (dual scale for float and boost); output current.
  - Lamp indications
    - Supply on; supply fail (monitor input terminals); float charge; boost charge; no charge (when supply is on); battery voltage low; battery voltage high.
  - Alarms (connected to operate a relay with shrouded 230V 3A a.c.or 0.5A d.c. N/C volt free contacts, closed on any alarm, for remote indication circuit).
    - Supply failed; no charge (when supply is on); battery voltage low; battery voltage high.

#### 2090A UTILISATION A, WITHDRAWABLE AIR BREAK CIRCUIT BREAKERS:

- Provide circuit breakers in accordance with BS EN 60947. Ensure that uninterrupted current rating indicated applies when unit is enclosed and in operating environment at rated operational voltage.
- Standard
  - BS EN 60947-2
  - BS EN 62626-1
- Details of equipment - circuit breaker
  - Characteristics of circuit breakers
    - a.c. Interrupting medium - air.
- Rated and limiting values for the main circuit
  - Rated voltage - operational, 400V.
  - Rated frequency 50 Hertz.
  - Circuit breaker utilisation category - A (without intentional time delay and a short time withstand current rating).
  - Enclosure degree of protection IP 31.
- Circuit breakers and switches
  - Provide metal clad withdrawable isolating removable type circuit breakers with provision for safe

maintenance.

- Closing mechanism
  - Independent manual spring operated.
- Provide automatic shutters to cover all live contacts when circuit breaker is isolated, withdrawn or removed from housing.
- Provide a padlock to lock circuit breaker in isolated/withdrawn position, and to lock automatic shutters covering live contacts when removed from housing.
- Provide withdrawable air circuit breakers with provision for safe maintenance.

#### 2090B UTILISATION A, DEMOUNTABLE MCCB AIR BREAK CIRCUIT BREAKERS:

- Provide circuit breakers in accordance with BS EN 60947. Ensure that uninterrupted current rating indicated applies when unit is enclosed and in operating environment at rated operational voltage.
- Standard
  - BS EN 60947-2
  - BS EN 62626-1
- Details of equipment - circuit breaker
  - Characteristics of circuit breakers
    - a.c. Interrupting medium - air.
- Rated and limiting values for the main circuit
  - Rated voltage - operational, 400V.
  - Rated frequency 50 Hertz.
  - Circuit breaker utilisation category - A.
  - Enclosure degree of protection IP 31.
- Circuit breakers and switches
  - Provide manual closing air-break circuit breakers, (MCCB).
  - Closing mechanism
    - Independent manual spring operated.
  - Provide automatic shutters to cover all live contacts when circuit breaker is isolated, withdrawn or removed from housing.
  - Provide a padlock to lock circuit breaker in isolated/withdrawn position, and to lock automatic shutters covering live contacts when removed from housing.
  - Provide demountable moulded case circuit breakers with provision for safe maintenance.

#### 2090C UTILISATION B, WITHDRAWABLE AIR BREAK CIRCUIT BREAKERS:

- Provide circuit breakers in accordance with BS EN 60947. Ensure that uninterrupted current rating indicated applies when unit is enclosed and in operating environment at rated operational voltage.
- Standard -
  - BS EN 60947-2
  - BS EN 62626-1
- Details of equipment - circuit breaker
  - Characteristics of circuit breakers
    - a.c. Interrupting medium - air.
- Rated and limiting values for the main circuit
  - Rated voltage - operational, 400V.
  - Rated frequency 50 Hertz.
  - Circuit breaker utilisation category - B (with intentional time delay and a short time withstand current

rating).

- Enclosure degree of protection IP 31.
- Circuit breakers and switches
  - Provide metal clad withdrawable isolating removable type air circuit breakers with provision for safe maintenance.
  - Closing mechanism
    - Independent manual spring operated.
  - Provide automatic shutters to cover all live contacts when circuit breaker is isolated, withdrawn or removed from housing.
  - Provide a padlock to lock circuit breaker in isolated/withdrawn position, and to lock automatic shutters covering live contacts when removed from housing.
  - Provide withdrawable air circuit breakers with provision for safe maintenance.

#### 2090D UTILISATION B, DEMOUNTABLE MCCB AIR BREAK CIRCUIT BREAKERS:

- Provide circuit breakers in accordance with BS EN 60947. Ensure that uninterrupted current rating indicated applies when unit is enclosed and in operating environment at rated operational voltage.
- Standard
  - BS EN 60947-2
  - BS EN 62626-1
- Details of equipment - circuit breaker
  - Characteristics of circuit breakers
    - a.c. Interrupting medium - air.
- Rated and limiting values for the main circuit
  - Rated voltage - operational, 400V.
  - Rated frequency 50 Hertz.
  - Circuit breaker utilisation category - B (with intentional time delay and a short time withstand current rating).
  - Enclosure degree of protection IP 31.
- Circuit breakers and switches
  - Provide manual closing air-break circuit breakers, (MCCB).
  - Closing mechanism
    - Independent manual spring operated.
  - Provide automatic shutters to cover all live contacts when circuit breaker is isolated, withdrawn or removed from housing.
  - Provide a padlock to lock circuit breaker in isolated/withdrawn position, and to lock automatic shutters

covering live contacts when removed from housing.

- Provide demountable moulded case circuit breakers with provision for safe maintenance.

#### 2100A SWITCH DISCONNECTORS:

- Supply switch disconnectors in accordance with BS EN 60947.
- Standard
  - BS EN 60947-3
  - BS EN 62626-1
- Details of equipment - switch-disconnector
  - a.c. Interrupting medium - air.
- Rated and limiting values for the main circuit
  - Rated voltage (Volts) 230/400.
  - Rated frequency 50 Hertz.
  - Utilisation category - AC 23A.
  - Enclosure degree of protection IP 65.
  - Fit each switch with facility to padlock in OFF position.
  - Provide switches with auxiliary contacts as indicated. Where switches isolate final connections between a starter and its motor, fit one set of contacts to open starter coil circuit when switch is opened.

#### 2100B FUSE COMBINATION UNITS:

- Supply fuse combination units in accordance with BS EN 60269 (BS 88).
- Standard
  - BS EN 60947-3
  - BS EN 62626-1
- Details of equipment - fuse combination unit
  - a.c. Interrupting medium - air.
- Rated and limiting values for the main circuit
  - Rated voltage (Volts) 230/400.
  - Rated frequency 50 Hertz.
  - Utilisation category - AC23A.
  - Enclosure degree of protection IP 31.
  - Fit removable neutral link in switches controlling circuits with neutral conductor.
  - Fit solid links in isolating switches.
  - Fit each switch with facility to padlock in OFF position.
  - Ensure that withdrawable chassis isolating type switches are provided with fully shrouded fixed contacts or insulated coverplates, to prevent accidental contact with live parts.
  - Ensure that switches in individual enclosures have an earth terminal, meet the degree of protection for the switchboard and have operating mechanisms interlinked with access door.
  - Provide switches with auxiliary contacts as indicated. Where switches isolate final connections between a starter and its motor, fit one set of contacts to open starter coil circuit when switch is opened.

#### 2110A AUTOMATIC RESET PROTECTION DEVICES INTERPOSING RELAYS AND INTER-TRIPPING RELAYS:

Standard - BS EN 61810.

- Housing
  - Flush panel mounting type. House all protection relays, excluding motor protection relays, in draw out

cases.

- Reset type - Automatic reset type.
- Overcurrent tripping device
  - Provide overcurrent tripping device with overcurrent characteristic similar to a BS 2692 high voltage cartridge fuse, sized to protect the equipment/load.

#### 2110B MANUAL RESET PROTECTION DEVICES INTERPOSING RELAYS AND INTERTRIPPING RELAYS:

- Standard - BS EN 61810.
- Housing
  - Flush panel mounting type. House all protection relays, excluding motor protection relays, in draw out cases.
- Reset type - Manual reset type.
- Overcurrent tripping device
  - Provide overcurrent tripping device with overcurrent characteristic similar to a BS 2692 high voltage cartridge fuse, sized to protect the equipment/load.

#### 2120 VOLTAGE SENSING RELAYS:

- Provide single-phase inverse time undervoltage type voltage sensing relays to monitor the voltage between respective phases of supply.
- Mounting
  - Supply suitable for flush panel mounting with relay trip indication.
- Voltage settings
  - 50-90% in five equal steps with automatic resetting at 105% of voltage setting.
- Relay Inverse time characteristics
  - When voltage increases from zero to rated voltage with time multiplier set at 1.0, set relay resetting times as follows:

Relay settings %	50	60	70	80	90
Resetting time (secs)	2	4	5	10	12

•

#### 2130 TRIP/CLOSE SWITCHES AND CONTROL SELECTOR SWITCHES:

- Provide a panel mounted heavy duty, spring return trip/close switch on each circuit breaker fitted with solenoid or motorized spring closing mechanisms.
- Ensure contacts have a continuous rating of 10A minimum at between 30V to 250V ac and dc, and make and break duty rating of 30A at 250V ac or dc for a minimum period of 3 secs.
- Where remote trip/close control is indicated, supply a panel mounted selector switch to select circuit breaker for local or remote closing. Ensure that selection of remote or local closing does not prevent circuit breaker tripping under operation of local or remote trip switch.

#### 2140 CURRENT TRANSFORMERS:

- Comply with BS EN 61869-2. 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.
- Ensure that current transformers are capable of withstanding maximum short time withstand current of

value and duration indicated for assembly.

- Provide test links in secondary connections of all current transformers to facilitate testing of instruments, meters and protection devices.

#### 2150A INSTRUMENTS AND METERS:

- Standards
  - Comply with BS 89 and BS EN 60051-1 for voltmeters, ammeters, watt meters, frequency indicators and power factor indicators.
  - Comply with BS 7856, BS EN 62053-11, BS EN 62053-22 or BS EN 62053-21 for kWh meters, kVA and kW maximum demand meters and polyphase reactive kVA meters, and BS EN 62053-23 for KVAhr meters.
- Protect wiring to voltmeters by separate fuses.
- Protect potential coils of watt meters, frequency indicators, power factor indicators and kWh meters, kVA and kW maximum demand meters and polyphase reactive kVA meters by separate fuses.
- Supply instruments and meters suitable for flush mounting and type, size and accuracy as indicated.
- Ensure that indicating scales for all instruments comply with BS 3693.
- Supply so that normal indication is 50% to 75% of full scale deflection.
- Completely segregate all instruments in instrument compartments. Panel mount meters on front of instrument compartment.

#### 2160A ELECTRICAL RECORDING INSTRUMENTS:

- Provide electrical recording instruments.
- Standard - BS EN 61143.

#### 2170A INDICATOR LIGHTS:

- Supply lamps of same type throughout. Provide indicator lamps with lamp test facility.
- Lamps
  - Supply interchangeable indicators for respective units.
- Protect wiring to indicator lamp units by separate cartridge fuses.
- Lens Colour in accordance with BS EN 60073.

#### 2180 LOW VOLTAGE COILS RATING:

- Ensure coils for switching relays, contactors and other applications are capable of withstanding inherent voltage drop within system without armature or switching apparatus dropping out of position.

#### 2190A FRAMEWORK:

- Construct framework for supporting electrical equipment from mild steel plate and strip, cold and hot rolled steel sections or slotted angles, in accordance with BS EN 10210 and BS 4345 respectively. Comply with BS EN 1011-2 for metal arc welding.
- Finish
  - Frameworks mounted inside building manufacturer's standard finish.
  - Frameworks mounted outside building hot dip galvanized to BS EN ISO 1461.
- Supply cadmium or zinc electroplated bolts, nuts, washers and screws.

#### 2200A FUSES:

- Supply cartridge fuse links including fuse carrier, bases and associated components that comply with BS

EN 60269 (BS 88), fusing factor category gG, unless otherwise indicated.

#### 2210A DISTRIBUTION BOARDS:

- Comply with BS EN 60439-3 as appropriate. Make internal separation Form 1 unless otherwise indicated. Make fuseboards fully shrouded. Fit each distribution board with an isolating switch. Install busbars in same position relative to their fuse carriers or miniature circuit-breakers (MCBs) for each pole. In TPN distribution boards supply neutral busbars with one outgoing terminal for each outgoing circuit.
- Provide a multi-terminal earthing bar for circuit protective conductors for both insulated and metal-cased boards, with one terminal for each outgoing circuit. Connect directly to earthing terminal without dependence on exposed conductive parts of enclosure.
- Identify each fuseway and MCB way by numbering. Identify each terminal on neutral busbar and earthing bar with its respective fuseway or MCB way.
- Where specific ratings are indicated incorporate fuses or MCBs, otherwise leave ways blank for future additions.
- Enclosures finish
  - Finish - Manufacturer's standard.
  - Colour - Manufacturer's standard colour.

#### 2220A CONSUMER UNITS:

- Comply with BS EN 60529, IP 31.
- Provide fuses or miniature circuit-breakers and means of isolation.

#### 2230A MINIATURE CIRCUIT BREAKERS:

- Standard - BS EN 60898-1.
- Supply miniature circuit-breakers with voltage and current ratings, type according to instantaneous tripping current, energy limiting class, category of duty and frequency in accordance with BS EN 60898-1.

#### 2240A RESIDUAL CURRENT DEVICE:

- Comply with BS EN 61008. Supply residual current devices (RCCDs) with rated voltage, rated current, rated tripping current, rated tripping time and rated breaking capacity as indicated.
- DC component
  - Ensure dc component does not affect operation.
- Overcurrent protection
  - Fit RCDs with integral overcurrent protection.

#### 2245 COMBINED RESIDUAL CURRENT/OVER CURRENT OPERATED CIRCUIT BREAKERS:

- Supply combined residual current/over current operated circuit breakers (RCBOs) in accordance with BS EN 61009.

#### 2250 CABLE TERMINATIONS:

- Ensure that switchgear and distribution boards are provided with facilities to terminate size, number and type of cable indicated. Where necessary use fabricated steel extension boxes for glanding large and

multiple cables.

- Provide non-ferrous metal glanding plates for single core cable terminations.

#### 2260A FREE STANDING, WALL MOUNTED STATIC CAPACITOR:

- Standard - BS EN 61921.
- Voltage rating of capacitor - 400V, 3-phase, 50 Hz. Unit - Free standing unit.
- Mounting - Wall mounting.
- Capacitor unit
  - Provide assembly housed in sheet steel enclosure complete with main terminals, comprising individual low loss, power capacitor elements and fuses to BS EN 60143-3 or BS EN 60871-4.
- Capacitor unit assembly
  - Incorporate thermal equalizers within assembly of elements.
  - Fill enclosure with inorganic, inert and non-flammable granules.
  - Fit discharge resistors.
  - Ensure all internal and external connections are adequately rated and fully insulated.
- Static capacitor enclosure
  - Material - Manufacturer's standard.
  - Colour - Manufacturer's standard.
  - Finish - Manufacturer's standard.
- Capacitor discharge devices - Manufacturer's standard.

#### 2260B FREE STANDING, FLOOR MOUNTED STATIC CAPACITOR:

- Standard - BS EN 61921.
- Voltage rating of capacitor - 400V, 3-phase, 50 Hz. Unit - Free standing unit
- Mounting - Floor mounting.
- Capacitor unit
  - Provide assembly housed in sheet steel enclosure complete with main terminals, comprising individual low loss, power capacitor elements and fuses to BS EN 60143-3 or BS EN 60871-4.
- Capacitor unit assembly
  - Incorporate thermal equalizers within assembly of elements.
  - Fill enclosure with inorganic, inert and non-flammable granules.
  - Fit discharge resistors.
  - Ensure all internal and external connections are adequately rated and fully insulated.
- Static capacitor enclosure
  - Material - Manufacturer's standard.
  - Colour - Manufacturer's standard.
  - Finish - Manufacturer's standard.
- Capacitor discharge devices - Manufacturer's standard.

#### 2260C WALL MOUNTED WITHIN SWITCHBOARD, STATIC CAPACITOR:

- Standard - BS EN 61921.
- Voltage rating of capacitor - 400V, 3-phase, 50 Hz. Unit - Within switchboard.
- Mounting - Wall mounting.
- Capacitor unit
  - Provide assembly housed in sheet steel enclosure complete with main terminals, comprising individual

- low loss, power capacitor elements and fuses to BS EN 60143-3 or BS EN 60871-4.
- Capacitor unit assembly
  - Incorporate thermal equalizers within assembly of elements.
  - Fill enclosure with inorganic, inert and non-flammable granules.
  - Fit discharge resistors.
  - Ensure all internal and external connections are adequately rated and fully insulated.
- Static capacitor enclosure
  - Material - Manufacturer's standard.
  - Colour - Manufacturer's standard.
  - Finish - Manufacturer's standard.
- Capacitor discharge devices - Manufacturer's standard.

#### 2260D FLOOR MOUNTED WITHIN SWITCHBOARD, STATIC CAPACITOR:

- Standard - BS EN 61921.
- Voltage rating of capacitor - 400V, 3-phase, 50 Hz.
- Unit - Within switchboard.
- Mounting - Floor mounting.
- Capacitor unit
  - Provide assembly housed in sheet steel enclosure complete with main terminals, comprising individual low loss, power capacitor elements and fuses to BS EN 60143-3 or BS EN 60871-4.
- Capacitor unit assembly
  - Incorporate thermal equalizers within assembly of elements.
  - Fill enclosure with inorganic, inert and non-flammable granules.
  - Fit discharge resistors.
  - Ensure all internal and external connections are adequately rated and fully insulated.
- Static capacitor enclosure
  - Material - Manufacturer's standard.
  - Colour - Manufacturer's standard.
  - Finish - Manufacturer's standard.
- Capacitor discharge devices - Manufacturer's standard.

#### 2270A FREE STANDING, WALL MOUNTED AUTOMATICALLY CONTROLLED CAPACITOR BANKS:

- Standard - BS EN 61921.
- Voltage rating of capacitor - 400V, 3-phase, 50 Hz.
- Bank unit
  - Provide free standing modular bank. Include in each module contactors, line fuses and control circuitry.
- Arrangement - Wall mounting.
- Switching - Block contactor switching.
- Control
  - Provide automatic control via an automatic multi-stage kVAr sensitive, solid state relay with stage switches to operate the capacitor contactors.
- Control relay
  - Incorporate relay into cubicle.
  - Fit relay with a loss of voltage no volt release re-setting feature to reset switching sequence to all

- contacts open position following failure of supply.
- Provide visual indication by means of LED's for capacitor stages and capacitor/inductive load.
- Provide Hand/Off/Auto selection switch.
- Isolator - Incorporate on load break isolator.
- Capacitor unit
  - Provide assembly housed in sheet steel enclosure complete with main terminals, comprising individual low loss, power capacitor elements and fuses to BS EN 60143-3 or BS EN 60871-4.
- Capacitor unit assembly
  - Incorporate thermal equalizers within assembly of elements.
  - Fill enclosure with inorganic, inert and non-flammable granules.
  - Fit discharge resistors.
  - Ensure all internal and external connections are adequately rated and fully insulated.
- Automatic bank enclosure
  - Material - Manufacturer's standard.
  - Finish and colour - Manufacturer's standard.
  - Access - Front access.
- Capacitor discharge devices - Manufacturer's standard.

2270B FREE STANDING, FLOOR MOUNTED AUTOMATICALLY CONTROLLED CAPACITOR BANKS:

- Standard - BS EN 61921.
- Voltage rating of capacitor - 400V, 3-phase, 50 Hz.
- Bank unit
  - Provide free standing modular bank. Include in each module contactors, line fuses and control circuitry.
- Arrangement - Floor mounting.
- Switching - Block contactor switching.
- Control
  - Provide automatic control via an automatic multi-stage kVAr sensitive, solid state relay with stage switches to operate the capacitor contactors.
- Control relay
  - Incorporate relay into cubicle.
  - Fit relay with a loss of voltage no volt release re-setting feature to reset switching sequence to all contacts open position following failure of supply.
  - Provide visual indication by means of LED's for capacitor stages and capacitor/inductive load.
  - Provide Hand/Off/Auto selection switch.
- Isolator - Incorporate on load break isolator.
- Capacitor unit
  - Provide assembly housed in sheet steel enclosure complete with main terminals, comprising individual

- low loss, power capacitor elements and fuses to BS EN 60143-3 or BS EN 60871-4.
- Capacitor unit assembly
  - Incorporate thermal equalizers within assembly of elements.
  - Fill enclosure with inorganic, inert and non-flammable granules.
  - Fit discharge resistors.
  - Ensure all internal and external connections are adequately rated and fully insulated.
- Automatic bank enclosure
  - Material - Manufacturer's standard.
  - Finish and colour - Manufacturer's standard.
  - Access - Front access.
- Capacitor discharge devices - Manufacturer's standard.

#### 2270C WALL MOUNTED WITHIN SWITCHBOARD, AUTOMATICALLY CONTROLLED CAPACITOR BANKS:

- Standard - BS EN 61921.
- Voltage rating of capacitor - 400V, 3-phase, 50 Hz.
- Bank unit
  - Provide modular bank within switchboard. Include in each module contactors, line fuses and control circuitry.
- Arrangement - Wall mounting.
- Switching - Block contactor switching.
- Control
  - Provide automatic control via an automatic multi-stage kVAr sensitive, solid state relay with stage switches to operate the capacitor contactors.
- Control relay
  - Incorporate relay into cubicle.
  - Fit relay with a loss of voltage no volt release re-setting feature to reset switching sequence to all contacts open position following failure of supply.
  - Provide visual indication by means of LED's for capacitor stages and capacitor/inductive load.
  - Provide Hand/Off/Auto selection switch.
- Isolator - Incorporate on load break isolator.
- Capacitor unit
  - Provide assembly housed in sheet steel enclosure complete with main terminals, comprising individual low loss, power capacitor elements and fuses to BS EN 60143-3 or BS EN 60871-4.
- Capacitor unit assembly
  - Incorporate thermal equalizers within assembly of elements.
  - Fill enclosure with inorganic, inert and non-flammable granules.
  - Fit discharge resistors.
  - Ensure all internal and external connections are adequately rated and fully insulated.
- Automatic bank enclosure
  - Material - Manufacturer's standard.
  - Finish and colour - Manufacturer's standard.
  - Access - Front access.
- Capacitor discharge devices - Manufacturer's standard.

#### 2270D FLOOR MOUNTED WITHIN SWITCHBOARD, AUTOMATICALLY CONTROLLED CAPACITOR

**BANKS:**

- Standard - BS EN 61921.
- Voltage rating of capacitor - 400V, 3-phase, 50 Hz.
- Bank unit
  - Provide modular bank within switchboard. Include in each module contactors, line fuses and control circuitry.
- Arrangement - Floor mounting.
- Switching - Block contactor switching.
- Control
  - Provide automatic control via an automatic multi-stage kVAr sensitive, solid state relay with stage switches to operate the capacitor contactors.
- Control relay
  - Incorporate relay into cubicle.
  - Fit relay with a loss of voltage no volt release re-setting feature to reset switching sequence to all contacts open position following failure of supply.
  - Provide visual indication by means of LED's for capacitor stages and capacitor/inductive load.
  - Provide Hand/Off/Auto selection switch.
- Isolator - Incorporate on load break isolator.
- Capacitor unit
  - Provide assembly housed in sheet steel enclosure complete with main terminals, comprising individual low loss, power capacitor elements and fuses to BS EN 60143-3 or BS EN 60871-4.
- Capacitor unit assembly
  - Incorporate thermal equalizers within assembly of elements.
  - Fill enclosure with inorganic, inert and non-flammable granules.
  - Fit discharge resistors.
  - Ensure all internal and external connections are adequately rated and fully insulated.
- Automatic bank enclosure
  - Material - Manufacturer's standard.
  - Finish and colour - Manufacturer's standard.
  - Access - Front access.
- Capacitor discharge devices - Manufacturer's standard.

**2270E SINGLE CUBICLE WITHIN SWITCHBOARD, AUTOMATICALLY CONTROLLED CAPACITOR BANKS:**

- Standard - BS EN 61921.
- Voltage rating of capacitor - 400V, 3-phase, 50 Hz.
- Bank unit
  - Provide modular bank within switchboard. Include in each module contactors, line fuses and control circuitry.
- Arrangement - Single cubicle.
- Switching - Block contactor switching.
- Control
  - Provide automatic control via an automatic multi-stage kVAr sensitive, solid state relay with stage switches to operate the capacitor contactors.
- Control relay
  - Incorporate relay into cubicle.
  - Fit relay with a loss of voltage no volt release re-setting feature to reset switching sequence to all

- contacts open position following failure of supply.
- Provide visual indication by means of LED's for capacitor stages and capacitor/inductive load.
- Provide Hand/Off/Auto selection switch.
- Isolator - Incorporate on load break isolator.
- Capacitor unit
  - Provide assembly housed in sheet steel enclosure complete with main terminals, comprising individual low loss, power capacitor elements and fuses to BS EN 60143-3 or BS EN 60871-4.
- Capacitor unit assembly
  - Incorporate thermal equalizers within assembly of elements.
  - Fill enclosure with inorganic, inert and non-flammable granules.
  - Fit discharge resistors.
  - Ensure all internal and external connections are adequately rated and fully insulated.
- Automatic bank enclosure
  - Material - Manufacturer's standard.
  - Finish and colour - Manufacturer's standard.
  - Access - Front access.
- Capacitor discharge devices - Manufacturer's standard.

#### 2280A HARMONIC FILTER:

- Unit - Filter conditioning to meet G5/4.
- Mounting - Floor mounting. Built-in type.
- Cubicle
  - Incorporating IGBTs, capacitors, reactors, block contactors and control gear.
- Cable termination chamber
  - Mount cable termination chamber on side of cubicle with access through removable plates.

#### 2290A MEDIUM VOLTAGE IRON CORE FILTER REACTOR:

- Provide 3-phase filter reactor in accordance with BS EN 60076 and relevant parts of BS EN 61558
- Reactor
  - Copper foil windings insulated between layers, impregnated under vacuum and in over pressure conditions with polyester resin and dried in furnace temperature of 150°C.
  - Ensure iron core flux density is designed for indicated harmonic loading. Ensure that saturation does not occur at switch-in of filter network.
  - Provide insulation for continuous operation at ambient temperature up to 40°C, temperature class T40/E.
- Electrical connections
  - To copper bars in accordance with DIN 46206.

#### 3010 FIXING:

- Fix all equipment independently of wiring system. Use cadmium or zinc electroplated bolts, nuts, washers and screws.

#### 3020 MOUNTING HEIGHT:

- Mount single items of equipment 1450mm above finished floor level to centre of equipment, unless otherwise indicated.
- Arrange groups of equipment, other than floor mounted assemblies, so that all parts of equipment requiring access for operation or maintenance are at least 500mm and no more than 2000mm above

finished floor level, unless otherwise indicated.

**3030 ACCESS:**

- Ensure that clearance in front of switchgear and controlgear is not less than 1m, or as indicated.

**3040A MARKING AND DRAWING:**

- Number terminals, cables and component parts to correspond with manufacturer's certified drawings.

**3050 CABLE TERMINATIONS:**

- Terminate paper-insulated cable by means of switchboard manufacturer's standard compound filled cable boxes.
- Terminate PVC SWA PVC and MICS cables inside enclosure by securing cables to switchboard with glanding plates or glanding brackets; and outside enclosure with glanding plates or fabricated steel extension boxes.

**3060A INSTALLATION AND COMMISSIONING:**

- Install and commission switchgear and controlgear in accordance with the appropriate standard and the manufacturer's recommendations. Include CT Polarity check in commission tests.

---

## Y72 CONTACTORS AND STARTERS

### 1000 GENERAL

#### 1010A 3-PHASE SUPPLY:

- Ensure all electrical equipment supplied and installed is suitable for 3-phase power supply to BS EN 60038.

#### 1010B SINGLE-PHASE ELECTRICAL SUPPLY:

- Ensure all electrical equipment supplied and installed is suitable for single-phase power supply to BS EN 60038.

#### 1010C 3-PHASE AND NEUTRAL SUPPLY:

- Ensure all electrical equipment supplied and installed is suitable for 3-phase and neutral power supply to BS EN 60038

#### 1020B INSTALLER FITTED SURGE SUPPRESSORS:

- Supply surge suppressors to star connected motors and to all motors subject to star-delta starting to limit peak voltage to 1200 volts. Fitted by installer.

#### 1030A MANUFACTURER FITTED TRANSIENT SUPPRESSORS:

- Supply transient suppressors in the form of resistor and capacitor networks across the starter contactor coils. Fitted by Manufacturer.

#### 2010A CONTROLGEAR ASSEMBLY:

- Standard
  - BS EN 61439-1.
  - BS EN 61439-2.
- External design - Cubicle type assembly.
- Usage - Control panel, Motor Control Centre (MCC) or single starter enclosure.
- Conditions of installation - Indoors.
- Electrical characteristics
  - Rated operational voltage, 400 V. Rated short-time withstand current, 20 times rated current.
- Service conditions - Ambient air temperature and altitude to relevant parts of BS EN 61439 and BS EN 60439.

#### 2020A ASSEMBLY CONSTRUCTION:

- Enclosure standard - BS EN 62208.
- Material of enclosure - Manufacturer's standard.
- Terminals for external conductors, main power circuits
  - Accommodate cross-sectional area of copper cables in accordance with relevant parts of BS EN

61439.

- Terminals for external conductor, control and auxiliary circuits
  - Terminal block. Mounting - top hat rails (35mm) to BS 5584 (EN 50022).
- Size of neutrals on 3-phase supplies
  - Full current-carrying capacity of phase conductor.
- Degree of protection to BS EN 60529
  - IP 31 for units installed inside buildings excluding boiler rooms and pump rooms.
  - IP 55 for units installed in boiler rooms, pump rooms and outside buildings.
- Protection against direct and indirect contact as Manufacturer's standard.
- Accessibility for inspection
  - Arrange for following operations to be performed when assembly is in service and under voltage.
  - Visual inspection of switching devices and other apparatus; settings and indicators of relays and releases; conductor connections and markings.
  - Adjusting and re-setting of relays, releases and electronic devices.
  - Replacement of fuselinks and indicating lamps.
  - Fault location by voltage and current measuring.
- Accessibility for maintenance
  - Provide space between functional unit or group and adjacent functional units or groups. Provide retainable fastening means for parts likely to be removed for maintenance.
  - Use barrier protected sub-sections for each functional unit or group.
  - Use compartments for each functional unit or group.
- Removable parts and withdrawable parts
  - Degree of protection of assembly after removal or withdrawal of part as manufacturer's standard.
- Internal separation - Manufacturer's standard.
- Input voltage variations for electronic equipment supply - relevant parts of BS EN 61439 and BS EN 60439.
- Supply frequency deviation - relevant parts of BS EN 61439 and BS EN 60439.
- Mounting - Floor standing or wall mounted.

2030A ENCLOSURE FINISH:

- Apply high standard finish to enclosure and supporting metalwork. Degrease metal and remove rust prior to applying finish.
- Comply with paint manufacturer's recommendations regarding preparation, stoving times, temperatures, mixing of finishes, application and coat thickness.
- Finish - Manufacturer's standard.
- Colour - Manufacturer's standard colour.

2040 SITE MODIFICATION:

- Do not make site alterations unless authorised. Where site modifications to assemblies are authorised make in accordance with manufacturer's certified drawings and instructions. Ensure that modifications

made comply with type test certificate obtained for arrangement of components.

#### 2050C CONTINUOUS LV CONTACTORS AND MOTOR STARTERS:

- Standard
  - BS EN 60947-4-1
  - BS EN 60947-4-2
  - BS EN 60947-4-3
  - BS EN 62626-1
- Type of equipment - A.c. mechanical contactor. Interrupting medium, air.
  - Operating condition.
    - Method of operation - Electromagnetic.
    - Method of control - Automatic.
- Rated and limiting values for the main circuit.
  - Rated voltage (Volts) - Operational, 400.
  - Rated duty - Continuous.
  - Operational performance.
    - One rotation direction, with motor stopping between operations.
  - Control circuits
    - Electrical - ac; rated frequency (Hertz), 50; rated voltage (Volts), 230.
  - Co-ordination with short-circuit protective devices - Type1
  - Enclosure degree of protection to BS EN 60529, IP 31.
  - Minimum mechanical and electrical endurance
    - Mechanical 0.3 million; electrical 15,000.
  - Provide mechanical and electrical interlocks to prevent simultaneous closure of paired contactors.

#### 2060A CONTROL CIRCUIT DEVICES:

- Standard
  - BS EN 60947-5-1
  - BS EN 62626-1
- Type of equipment.
  - a.c. control circuit device
  - Manual control switches; emergency stop; control relays; pilot switches; position switches; associated equipment; auxiliary contacts and indicating lamps.
  - Interrupting medium, Air.
  - Operating condition.
    - Method of operation - electromagnetic.
    - Method of control - automatic.
- Rated and limiting values for the main circuit.
  - Rated voltage (Volts) - operational, 230.
  - Rated frequency (Hertz), 50.
  - Contact element classification.
  - Enclosure degree of protection IP 31.

#### 2070A ISOLATING SWITCHES:

- Standard
  - BS EN 60947-3.
  - BS EN 62626-1
- Provide independent manual operation type isolating switches with rated duty, rated operational current

and utilization category compatible with contactor.

#### 2080A CONTROL SELECTOR SWITCHES:

- Standard
  - BS EN 60947-5-1
  - BS EN 62626-1
- Provide panel mounting independent manual operation rotary type switch to select local/off/remote control.
- Ensure switch rated thermal current, rated operational current, and utilization category are compatible with contactor control circuit characteristics and circuit protection device.

#### 2090A IN-BUILT PUSH BUTTONS:

- Provide panel mounting type push buttons with actuator colours to BS EN 60073.
- Standard
  - BS EN 60947-5-1.
  - BS EN 62626-1
- Pattern
  - Supply flush button type start/on and reset push buttons. Supply mushroom actuator type stop/off push buttons released by turning the actuator.
- Ensure rated thermal current, rated operational current and utilization category of push button contacts are compatible with contactor control circuit characteristics and circuit protection device.

#### 2100A INDICATOR LIGHTS:

- Supply lamps of same type throughout. Provide indicator lamps with lamp test facility.
- Standard
  - BS EN 842
  - BS EN 60947-5-1.
  - BS EN 62626-1
- Details
  - Supply interchangeable indicators for respective units. Provide neon indicators. Provide 230V indicator circuits and lamps.
- Protect wiring to indicator lamp units by separate cartridge fuses.
- Lens colour - In accordance with BS EN 60073.

#### 2110A CONTACTOR CONTROL RELAYS:

- Standard BS EN 60947-5-1, install relays in contactor enclosure.
- Provide isolation during repair and maintenance work in accordance with BS EN 62626-1
- Relay enclosure protection to BS EN 60529
  - Compatible with contactor enclosure.

#### 2120A CONTROL AND INDICATOR LIGHT CIRCUIT FUSES:

- Provide in contactor enclosure separate low voltage fuse bases, fuse carriers and cartridge fuses for protection of control circuits and indicator light circuits.
- Fuses
  - Fully shrouded impact resistant moulded plastic fuse bases and carriers in accordance with BS EN

60269 (BS 88).

2130A MOTOR STARTERS - MOTORS BELOW 0.37 KW:

- Provide fuses or circuit breakers for motors below 0.37 kW.

2130B MOTOR STARTERS - MOTORS OF 0.37KW AND ABOVE:

- Provide starters incorporating overcurrent protection for motors of 0.37kW and above.
  - Provide starter with manual reset, adjustable, inverse time delay, and ambient temperature compensated thermal overcurrent release to BS EN 60947-4-1. Ensure overcurrent release is compatible with starting, accelerating and running characteristics of motor, starter and driven machine combination. Use phase unbalance protection on 3-phase equipment.
- Provide isolation during repair and maintenance work in accordance with BS EN 62626-1

2150 DIRECT-ON-LINE MOTOR STARTERS:

- Use direct-on-line starter to BS EN 60947-4-1, with single-phase motors and 3-phase motors.
- Provide isolation during repair and maintenance work in accordance with BS EN 62626-1

2160 STAR DELTA MOTOR STARTERS:

- Use star delta starter to BS EN 60947-4-1 with 3-phase motors.
- Provide isolation during repair and maintenance work in accordance with BS EN 62626-1
- Incorporate adjustable time delay contactor relays, to control star delta changeover, ensuring electrical endurance compatible with starter contactors. Ensure starting sequence activated on voltage restoration.

2190# VARIABLE SPEED MOTOR DRIVES (VSD'S):

- Supply VSD's tailor made for HVAC application with two built in PID controllers, built in HVAC application macros and real-time clock and calendar to control speed of standard AC Squirrel cage motors.
  - VSD type - digital Pulse Width Modulation (PWM).
- Location
  - Control panel.
  - Motor Control Centre (MCC).
  - Exposed for wall or frame mounting
- Control range
  - 0.5 to 120 Hz
- Degree of protection from drive enclosure in accordance with BS EN 60529 - as detailed in particular

specification.

- Power factor
  - 0.97 lagging or better.
- Starting current
  - Not to exceed 1 x FLC.
- Provide integrated, lockable incoming mains isolation switch.
- Characteristics
  - Ensure acceleration and deceleration ramps are independently adjustable.
  - Allow connection to a turning motor without braking to a standstill.
  - Allow connection to a reverse windmilling fan without causing tripping and return fan to correct speed.
  - Ensure inverters require no additional means for starting.
  - Supply inverters that do not require electrical matching to motor.
  - Ensure inverters are capable of running motors in parallel.
  - Ensure electronic maintenance and commissioning can be carried out without motor being connected.
  - EMC characteristics to BS EN 61800-3, Category C2.
- Standards
  - Comply with relevant parts of BS EN 60204 for safety of electrical equipment.
  - Comply with relevant parts of BS EN 61800
  - Comply with relevant parts of BS EN 60068 for environmental testing.
- Harmonics
  - Comply with BS EN 61000-3-12
- Incorporate facilities into the drive to minimise harmonics generated at partial loads to ENA Engineering recommendation G5/4 limits.
- Mains interruption
  - Ensure VSD does not cause tripping through a mains interruption of
    - 500 msec.
    - 200 msec.
- Protection
  - Ensure VSD incorporates the following protection to cause electronic shut down without operating circuit protective devices.
    - Motor phase to phase fault.
    - Motor phase to earth fault.
    - Overvoltage.
    - Undervoltage.
    - Inverter overheat.
    - Motor overheat.
    - Stall protection.
    - Loss of control signal.
    - Loss of auxiliary control voltage.
    - Current limit.
    - Overcurrent protection.
    - Phase loss detection.
    - Underload supervision.
    - Overload supervision.
- VSD controls
  - Local/remote facility to be provided where appropriate for operational and maintenance use.
  - Provide a means of running at a fixed, selectable speed on closure of a remote volt free contact.

Ensure this over-rides the normal speed control reference signal.

- Display
  - Make provision for inverter to display externally, external and internal faults following a failure.
  - Show 1st, 2nd and 3rd up sequential faults.
  - Provide digital readout to show
    - Output frequency Hz.
    - Reference 1 (Hand).
    - Reference 2 (Auto).
    - Motor current (% or Amps).
    - Torque (% x PN).
    - DC Link voltage (%).
    - Temperature (°C).
    - Fault memory.
  - Provide volt free remote signalling contacts to indicate:
    - Overcurrent.
    - Frequency alarm.
    - Common fault.
    - Reference fail alarm.
    - Running/stopped conditions.
    - Healthy/tripped conditions.
- Ensure parameters can be set and fault memory interrogated with door closed, and without additional instrumentation.
- Mounting
  - Wall mount vertically in accordance with the manufacturer's recommendations.
  - Mount vertically on a wall or a flange mount within a control panel or MCC in accordance with the manufacturer's recommendations.
  - Free standing.
- Cooling
  - Ensure the free space around the drive is in accordance with the manufacturer's recommendations for ventilation and maintenance.
  - When installing a VSD in a control panel cabinet or MCC, provide ventilation openings and if required cooling fans in the cabinet to ensure air cannot be recirculated such that the cooling air does not exceed the unit ambient maximum operating temperature.

#### 2190A VARIABLE SPEED MOTOR DRIVES - LOCATED IN LOCAL CONTROL PANEL OR EXPOSED WALL OR FRAME MOUNTED:

- Supply VSD's tailor made for HVAC application with two built in PID controllers, built in HVAC application macros and real-time clock and calendar to control speed of standard AC squirrel cage motors.
  - VSD type - digital Pulse Width Modulation PWM.
  - Location - control panel.
  - Control range - 0.5 to 120 Hz.
  - Power factor - 0.97 lagging or better.
  - Starting current - not to exceed 1 x FLC.
  - Provide integrated, lockable incoming mains isolation switch.
  - Characteristics
    - Ensure acceleration and deceleration ramps are independently adjustable.
    - Allow connection to a turning motor without braking to a standstill.
    - Allow connection to a reverse windmilling fan without causing tripping and return fan to correct speed.
- Ensure VSD's require no additional means for starting. Supply VSD's that do not require electrical

- matching to motor. Ensure VSD's are capable of running motors in parallel.
- EMC characteristics to BS EN 61800-3, Category C2.
  - Standards
    - Comply with relevant parts of BS EN 60204 for safety of electrical equipment.
    - Comply with relevant parts of BS EN 61800
    - Comply with relevant parts of BS EN 60068 for environmental testing.
  - Harmonics
    - Comply with BS EN 61000-3-12
    - Incorporate facilities into the drive to minimise harmonics generated at partial loads to ENA Engineering recommendation G5/4 limits.
  - Mains interruption
    - Ensure VSD does not cause tripping through a mains interruption of 200 msec.
  - Protection
    - Ensure VSD incorporates the following protection to cause electronic shut down without operating circuit protective devices.
      - Motor phase to phase fault; motor phase to earth fault; overvoltage; undervoltage; inverter overheat; motor overheat; loss of control signal; loss of auxiliary control voltage; current limit.
  - VSD controls - local/remote facility to be provided where appropriate for operational and maintenance use.
  - Display
    - Make provision for inverter to display externally, external and internal faults following a failure.
    - Show 1st, 2nd and 3rd up sequential faults.
    - Provide digital readout to show output frequency Hz; reference 1 (Hand); reference 2 (Auto); motor current (% or Amps); fault memory.
    - Provide volt free remote signalling contacts to indicate common fault; running/stopped conditions; healthy/tripped conditions.
    - Ensure parameters can be set and fault memory interrogated with door closed, and without additional instrumentation.
  - Mounting
    - Wall mount vertically in accordance with the manufacturer's recommendations or mount within a control panel cabinet in accordance with the manufacturer's recommendations.
  - Cooling
    - Ensure the free space around the drive is in accordance with the manufacturer's recommendations for ventilation and maintenance.
    - When installing a VSD in a control panel cabinet, provide ventilation openings and if required cooling fans in the cabinet to ensure air cannot be recirculated such that the cooling air does not exceed the unit ambient maximum operating temperature.

#### 2190B VARIABLE SPEED MOTOR DRIVES (LOCATED IN MOTOR CONTROL CENTRES) :

- Supply frequency converters (inverters) tailor made for HVAC application with two built in PID controllers, built in HVAC application macros and real-time clock and calendar to control speed of

standard AC squirrel cage motors.

- Inverter type - digital Pulse Width Modulation PWM.
- Location - Motor Control Centre (MCC) (MCC).
- Control range - 0.5 to 120 Hz power factor - 0.97 lagging or better.
- Starting current - not to exceed 1 x FLC.
- Provide integrated, lockable incoming mains isolation switch.
- Characteristics
  - Ensure acceleration and deceleration ramps are independently adjustable.
  - Allow connection to a turning motor without braking to a standstill.
  - Allow connection to a reverse windmilling fan without causing tripping and return fan to correct speed. Ensure VSD's require no additional means for starting. Supply VSD's that do not require electrical matching to motor. Ensure VSD's are capable of running motors in parallel.
  - EMC characteristics to BS EN 61800-3, Category C2.
- Standards
  - Comply with relevant parts of BS EN 60204 for safety of electrical equipment.
  - Comply with relevant parts of BS EN 61800
  - Comply with relevant parts of BS EN 60068 for environmental testing.
- Harmonics
  - Comply with BS EN 61000-3-12
  - Incorporate facilities into the drive to minimise harmonics generated at partial loads to ENA Engineering recommendation G5/4 limits.
- Mains interruption
  - Ensure VSD does not cause tripping through a mains interruption of 200 msec.
- Protection
  - Ensure VSD incorporates the following protection to cause electronic shut down without operating circuit protective devices.
    - Motor phase to phase fault; motor phase to earth fault; overvoltage; undervoltage; VSD overheat; motor overheat; loss of control signal; loss of auxiliary control voltage; current limit.
- VSD controls - local/remote facility to be provided where appropriate for operational and maintenance use.
- Display
  - Make provision for inverter to display externally, external and internal faults following a failure.
  - Show 1st, 2nd and 3rd up sequential faults.
  - Provide digital readout to show output frequency Hz; reference 1 (hand); reference 2 (auto); motor current (% or Amps); fault memory.
  - Provide volt free remote signalling contacts to indicate common fault; running/stopped conditions; healthy/tripped conditions.
  - Ensure parameters can be set and fault memory interrogated with door closed, and without additional instrumentation.
- Mounting
  - Flange mount vertically within the MCC in accordance with the manufacturer's recommendations.
- Cooling
  - Ensure the free space around the drive is in accordance with the manufacturer's recommendations for ventilation and maintenance.
  - When installing a VSD in a cabinet to ensure air cannot be recirculated such that the cooling air does not exceed the unit ambient maximum operating temperature.

#### 2200 AUTOMATIC CHANGEOVER FOR RUN/STANDBY DUTY - SINGLE POWER SUPPLY:

- Fit a control switch to starter enclosure arranged to select either motor for "run" or "standby" duty.

Indicate selection of respective motor by illumination of indicator lights on starter enclosure.

- Provide facilities for connection of remote indicator lights to indicate selection/operation of system and for connection of a system malfunction audible alarm where indicated.
- Arrange for selected "run" duty motor to operate in response to system controls, and in event of operation of duty motor starter overcurrent trip, for automatic changeover to "standby" motor.
- Control power supply to starter by an air break isolating switch interlocked with starter enclosure access door.

#### 2210 AUTOMATIC CHANGEOVER FOR RUN/STANDBY DUTY - DUAL POWER SUPPLY:

- Fit a control switch to starter enclosure arranged to select either motor for "run" or "standby" duty.
- Indicate selection of respective motor and availability of the two power supplies by illumination of indicator lights on starter enclosure.
- Provide facilities for connection of remote indicator lights to indicate selection/operation of system and for connection of a system malfunction audible alarm where indicated.
- Arrange for selected "run" duty motor to operate in response to system controls, and on loss of power supply to "run" duty motor or operation of motor starter overcurrent trip, for automatic changeover to "standby" motor.
- Control the two power supplies by a single air break multiple isolating switch interlocked with starter enclosure access door.

#### 2220 CONTROL CIRCUIT TRANSFORMERS:

- Provide control circuit transformers to supply power at voltages to suit control components.
- Standard
  - Use transformers in accordance with BS EN 61558-2-9 or BS EN 61558-1 and provide an external label of approved type and size.
- Protection - Primary and secondary fuses.

#### 2230A SWITCHING AND INDICATION:

- Provide switches, indicating lamps, instruments and controls of uniform appearance and physically protected.
- Switches and indicators
  - Fit on panel or access doors Stop/Start/Reset push buttons; Auto/Off/Manual control selector switch; run and trip indicator lights.

#### 2240 AUDIBLE ALARMS:

- Ensure that operation of any starter trip lamp, safety circuit lamp or alarm lamp operates a common audible alarm with mute and test facilities and terminals for remote alarm signal.
- When an alarm condition has had the audible alarm muted, ensure that terminals for a remote "alarm accepted" light are energised. The audible alarm circuit and terminals for remote alarm signal must still be capable of indicating another fault occurring even though original fault has not been cleared. The test facilities are to test momentarily both the audible alarm and all alarm indicator lamps, whilst the push button is depressed.
- Use alarms that interface with a sensor or controller to sense set-point and measured value. Provide adjustable upper and lower limits on face of unit. Provide unit with indicating lamps to show which limit has

been exceeded. Provide each unit with connections for remote alarm.

#### 2250A PROGRAMMABLE LOGIC CONTROLLERS:

- Provide programmable logic controllers in accordance with the manufacturer's recommendations and the specified control requirements.
- Standard - BS EN 61131.
  - Provide fuse and isolator for the Programmable Logic Controller. Install PLC with control components.
  - Programming language standard - BS EN 61131-3

#### 2260A STARTER AND CONTROL PANEL INTERNAL WIRING:

- Standard - BS 6231.
- Wiring coding - Random colours and CPC green/yellow.
- Control wiring
  - Segregate control wiring from power circuits. Contain control wiring in ventilated plastic trunking. Identify each end of each wire with a unique number.
- Power wiring
  - Take account of thermal effects of grouping when routing power wiring. Identify each end of each wire with a unique number.

#### 2270A COMPONENT MOUNTING:

- Mount all components of the switchgear and controlgear in accordance with the manufacturer's instructions.
- Mount control components on top hat rails (35mm) to BS 5584 (EN 50022).

#### 2280A CONTROL SYSTEM FUNCTION CHARTS:

- Prepare function charts for the control system in accordance with BS EN 60848. Obtain approval of function chart before design of system hardware or writing control software.
  - Function chart format - Combined function chart/circuit diagram.

#### 3010 INSTALLATION:

- Install control panels, Motor Control Centre (MCC)s, contactors and starters in accordance with BS EN 60947 and manufacturer's recommendations.

---

## Y73 LUMINAIRES AND LAMPS

### 1000 GENERAL

#### 2005 LAMP EFFICACY:

- For non-domestic buildings, the system is designed to achieve an average initial circuit of at least 60 lumens/watt for fixed lighting equipment within the building.

#### 2010A LUMINAIRES - GENERAL PURPOSE:

- Standards
  - Supply luminaires with photometric data in accordance with BS EN 13032-1.
  - Supply luminaires in accordance with BS EN 60598
- Classification - To BS EN 60598-1.
- Safety Support for Components
  - Provide secondary support for translucent covers, diffusers and gear trays so they are prevented from falling when their primary fixing is released.
- Photometric performance
  - Ensure luminaires of similar type have same photometric performance as published data within the tolerances defined by BS EN 13032-1.
- Electromagnetic compatibility
  - Ensure luminaires comply with BS EN 61547 for EMC immunity.

#### 2010B LUMINAIRES - GENERAL PURPOSE WITH SAFETY GLASS:

- Standards
  - Supply luminaires with photometric data in accordance with BS EN 13032-1.
  - Supply luminaires in accordance with BS EN 60598
- Classification - to BS EN 60598-1.
- Safety
  - Fit luminaire with cover glass to protect against ultra-violet emission and risk from explosion of lamps.
- Safety Support for Components
  - Provide secondary support for translucent covers, diffusers and gear trays so they are prevented from falling when their primary fixing is released.
- Photometric performance
  - Ensure luminaires of similar type have same photometric performance as published data within the

tolerances defined by BS EN 13032-1.

- Electromagnetic compatibility
  - Ensure luminaires comply with BS EN 61547 for EMC immunity.

#### 2010C LUMINAIRES - SPECIAL APPLICATIONS:

- Standards
  - Supply luminaires with photometric data in accordance with BS EN 13032-1.
  - Supply luminaires in accordance with BS EN 60598
- Classification - to BS EN 60598-1.
- Electromagnetic compatibility
  - Ensure luminaires comply with BS EN 61547 for EMC immunity.

#### 2020A EMERGENCY LIGHTING LUMINAIRES:

- Comply with BS EN 60598-2-22.
- Comply with ICEL:1001. Ensure emergency lighting luminaires are marked with ICEL certification label.

#### 2060A LAMPHOLDERS - GENERALLY:

- Lamp caps - BS EN 60061-1.
- Lamp holders - BS EN 60061-2.
- Lampholders with enhanced safety features - BS 7895.
- Bayonet lampholders - BS EN 61184.
- Lampholders for tubular fluorescent lamps and starter holders - BS EN 60400.
- Edison screw lampholders - BS EN 60238.
- Interchangeability
  - Ensure lampholders in luminaires of similar type and rating are identical.
- Earthing
  - Ensure metal lampholders incorporate an earthing terminal.

#### 2070 LAMPHOLDERS - TUNGSTEN FITTINGS:

- Use following lampholders for tungsten filament lamps unless indicated otherwise.
  - Lamp      Lampholder.
  - Up to 150 W      bayonet B22d.
  - 200 W      edison screw E27 2A.
  - 300 W      edison screw 16A.
- Shade rings
  - Provide a shade carrier ring for separately mounted lampholders for GLS tungsten filament lamps.
- Polarity of Edison Screw Lampholders
  - Ensure phase conductor is connected to centre contact.

#### 2080A LAMPHOLDERS - MOUNTING:

- Securely mount lampholder in luminaire when it is sole support for lamp.
- Cord grip
  - Provide integral cord grip type when lampholders are suspended by cord.
- Conduit Mounted
  - When mounted directly to conduit system use backplate lampholder for conduit box.

#### 2090A CONTROL GEAR AND COMPONENTS:

- Compatibility
  - Ensure control gear and components are suitable for lamp type, wattage and starting characteristics. Obtain from manufacturers written confirmation of compatibility.
- Efficiency tested in accordance with the relevant parts of BS EN 62442
- 

#### 2095 CIRCUIT LOSSES:

- Use high frequency ballasts to ensure the installed circuit load does not exceed  $3 \text{ W/m}^2 / 100 \text{ lux}$ .
- Efficiency tested in accordance with relevant parts of BS EN 62442

#### 2100A FLUORESCENT LAMP BALLASTS AND STARTERS:

- Ballasts
  - BS EN 61347-2-8
  - BS EN 60921
  - For d.c. supplied electronic ballasts
    - BS EN 61347-2-3
    - BS EN 61347-2-7
    - BS EN 60929
  - BS EN 60081
  - BS EN 60901
  - Supply thermal protectors for ballasts for tubular fluorescent lamps to BS EN 60730-2-3.
- Starters
  - BS EN 61347-2-1
  - BS EN 60927
- Use low distortion type.

#### 2110A DISCHARGE LAMP BALLASTS AND STARTERS:

- Ballasts
  - BS EN 61347-2-9
  - BS EN 60923.
- Starters
  - BS EN 61347-2-1
  - BS EN 60927

#### 2120A CAPACITORS:

- Use capacitors in accordance with BS EN 61048 and BS EN 61049 in tubular fluorescent, high pressure mercury and low pressure sodium vapour discharge lamp circuits.

#### 2130 SUPPLY TERMINALS:

- Use screw terminals for supply cables and circuit protective conductors, sized to terminate up to three  $2.5\text{mm}^2$  conductors. Provide separate terminal blocks for each incoming circuit, with marking to identify

each circuit.

2140 FUSE:

- Include a fuse holder and BS 1362 fuse in each incoming circuit phase connection.

2160 REMOTE GEAR:

- Locate control gear in separate lockable cabinet of sheet steel with same degree of protection and finish specified for luminaire. Comply with manufacturer's recommendations for maximum cable length between

gear and lamp.

#### 2165 TYPES OF HIGH EFFICIENCY LAMP FOR NON-DAYLIT AREAS:

Light Source	Type
High pressure sodium	All ratings above 70W
Ceramic metal halide	All ratings above 20W
LED	Refer to lm/W efficacy
Metal halide	All ratings above 70W
Tubular fluorescent	16mm (T5) lamps rated above 11W
Compact fluorescent	All ratings above 26W

#### 2170A TUNGSTEN FILAMENT LAMPS:

- Comply with
  - BS EN 60064
  - BS EN 60432-1
  - BS EN 60630.
- Supply electronic step-down converters for filament lamps to
  - BS EN 61047
  - BS EN 61347-2-2.
- Comply with BS EN 61549 for double capped and ELV lamps.

#### 2180A FLUORESCENT LAMPS:

- Internationally specified tubular fluorescent lamps to BS EN 60081.
- UK tubular fluorescent lamps to BS 1853-2.
- Single capped fluorescent lamps to
  - BS EN 60901
  - BS EN 61199
- Double capped fluorescent lamps to
  - BS EN 60081
  - BS EN 61195
- Self ballasted lamps to BS EN 60968

#### 2185A TUNGSTEN HALOGEN LAMPS:

- Comply with
  - BS EN 60432-2
  - BS EN 60357

#### 2190 HIGH PRESSURE MERCURY VAPOUR LAMPS:

- Comply with
  - BS EN 60188

- BS EN 62035

2215A LED LAMPS:

- Comply with
  - BS EN 62031
  - DD IEC/PAS 62612
  - BS EN 62386-207
  - BS EN 61347-2-13

2215B LED MODULES:

- Comply with
  - BS EN 62384

2220A TRANSFORMERS FOR LV LUMINAIRES:

- Type
  - Electronic.
  - Single luminaire.
- Duty
  - Input voltage 230 volts.
  - Output voltage to suit lamp.
  - Single-phase.
  - Frequency 50 Hz.
  - Rating (kVA) to suit lamp.
- Standards
  - Relevant parts of BS EN 55014.
  - BS EN 61000.
  - BS EN 61047.
  - BS EN 61347-2-2.
  - or BS EN 61558 as appropriate.
- Construction
  - Manufacturer's standard.
- Protection
  - Thermal cut out with automatic reset.
- Location
  - Be accessible.
- Cabling
  - Secondary maximum cable length as manufacturer's recommendations.
  - Separate transformer from secondary low voltage cables (m)
- Connections to luminaires
  - Hard wired
  - Plug and socket

2240A SUPPORT SYSTEM - CONDUIT:

Use not less than 20mm conduit of same type as main conduit system.

Material - steel.

2250A SUPPORT SYSTEM - ROD:

- Use continuously threaded rods with matching washers and nuts.
- Diameter - 6mm.
- Material - Cadmium plated steel.

2260A SUPPORT SYSTEM - CHAIN:

- Use cadmium plated steel chain with load carrying capacity of not less than twice weight of complete luminaire.

2270A SUPPORT SYSTEM - FLEXIBLE CORD:

- Use size and type as indicated.
- Confirm temperature rating is suitable for operating temperature of luminaire or lampholder. Confirm that

cord is adequate for mass to be supported.

**2280A SUPPORT SYSTEM - WALL BRACKETS:**

- Provide wall brackets. Confirm wall brackets are suitable for supporting luminaire.

**2290 SUPPORT SYSTEM - BALL AND SOCKET:**

- Provide ball and socket as top support, complete with cover fixed to circular conduit box.

**2295 SUPPORT SYSTEM - WIRE ROPE:**

- Provide wire rope support system. Confirm wire rope is suitable for supporting luminaires.

**2300A STEEL COLUMNS AND BOLLARDS:**

- Standards
  - BS EN 40-2
  - BS EN 40-5
- Material - Steel.
- Bracket - Match column.
- Earthing
  - Include earthing terminal fixed within service compartment.
- Column base plate - Standard.

**2300C ALUMINIUM COLUMNS AND BOLLARDS:**

- Standards
  - BS EN 40-2
  - BS EN 40-6
- Material - Aluminium.
- Bracket - Match column.
- Earthing
  - Include earthing terminal fixed within service compartment.
- Column base plate - Standard.

**3010A TRACK LIGHTING:**

- Where indicated provide track for fixing fittings in accordance with BS EN 60570.

**3030A AIR HANDLING LUMINAIRES:**

- Provide assembly of luminaire and exhaust air device or luminaire and supply air device to meet design requirements for illumination and air flow. Ensure assembly can be integrated into a false ceiling, flush

mounted.

- Diffuser
  - Allow for the path of exhaust air in the diffuser.
  - Exhaust air outlet
  - Provide an outlet for the air via a series of circular openings in top of assembly casing.
- Supply air diffuser
  - Supply the air diffuser as a component of the assembly.
- Fixing
  - Ensure the fixing is capable of carrying the weight of the whole assembly.

#### 4060 MATERIAL OF SUPPORTING SURFACE:

- Ensure classification of luminaires is appropriate. Do not mount luminaires on readily flammable surfaces.

#### 4100 INSTALLATION OF EXTRA LOW VOLTAGE TUNGSTEN HALOGEN LAMPS:

- Use same wattage lamp on luminaires fed from common transformer. Supply each luminaire on common transformer by separate cable of same cross-sectional area.

#### 4110 SUPPORT:

- Ensure support is adequate for weight of luminaires.
- Number
  - Provide the following minimum number of supports for each luminaire longer than 600mm.

Luminaire width (mm)	Minimum number of supports
Up to and including 300	2
Over 300	4

•

#### 4140A SUPPORT BY DIRECT FIXING:

- Refer to fixing methods, use luminaire supporting coupler to follow manufacturer's recommendations.

#### 4180 SUSPENSION BY CHAIN:

- Use hook cover for suspension from circular conduit box. For connection to luminaires use luminaire manufacturer's own chain hook, but if not available use hook with standard screw threaded body to be secured to luminaire body with nuts and washers. Where indicated use captive hooks.

#### 4210A COLUMNS AND BOLLARDS:

- Location - Confirm location before excavation.
- Bases - Install bases in accordance with bollard or column manufacturer's instructions.
- Mounting
  - Mount column or bollard on base as recommended by manufacturer.
  - Ensure columns and bollards are vertical unless otherwise indicated.
- Earthing
  - Install circuit protective conductor to connect luminaire to earthing terminal in service compartment; size circuit protective conductor same as live conductors. Bond accessible metal parts of column or

bollard to earthing terminal.

#### 4220 CONNECTIONS TO LUMINAIRES

- Cable Protection
  - Use appropriate size of grommet where cables enter through hole in luminaire body.
- Earthing
  - Ensure that the earthing terminal of Class 1 luminaires is connected to the conduit protective conductor of the supply circuit.
- Loose Wiring
  - Clip or tie back with suitable proprietary devices loose wiring within luminaire, at 300mm intervals.

#### 4230A CONNECTIONS TO LUMINAIRES - DIRECT TO CONDUIT - TERMINAL BOX:

- Terminate circuit wiring in terminal block within supporting conduit box. Use flexible cord from terminal block to luminaire.

#### 4230B CONNECTIONS TO LUMINAIRES - DIRECT TO CONDUIT - AT LUMINAIRE:

- Terminate circuit wiring at supply terminals of luminaire. Take all conductors through same cable entry into luminaire.

#### 4240B CONNECTIONS TO LUMINAIRES - DIRECT TO TRUNKING - AT LUMINAIRE:

- Terminate circuit wiring at supply terminals of luminaire. Take all conductors through same cable entry into luminaire.

#### 4260A CONNECTIONS TO LUMINAIRES - RECESSED FITTINGS - PLUG AND SOCKET:

- Where luminaires are recessed in a suspended ceiling, terminate circuit wiring at plug and socket to BS 546, located not more than 500mm from the access through the ceiling. Use flexible cord from plug of ceiling rose to supply terminals of luminaire.

#### 4270 CONNECTIONS TO LUMINAIRES - CONDUIT SUSPENSION:

- Terminate circuit wiring in terminal block within supporting conduit box. Use flexible cable from terminal block to luminaire, installed within tube.

#### 4280 CONNECTIONS TO LUMINAIRES - ROD OR CHAIN SUSPENSION:

- Terminate circuit wiring in terminal block within supporting conduit box. Use flexible cord from terminal block to luminaire and clip cable to one of the rods or chains, do not weave cable through links of the

chain.

4290 CONNECTIONS TO LUMINAIRES - MICS CABLE:

- Fix cable gland to luminaire and continue conductors to supply terminals of luminaire.

4300A SEPARATE LIGHTING SWITCHES ON DIFFERENT PHASES:

- Install lighting switches on different phases at least 2m apart.

4300B PHASE BARRIER LIGHTING SWITCHES ON DIFFERENT PHASES:

- When lighting switches on different phases are in a common box, use phase barrier switches in accordance with BS 7671.

---

## Y74 ACCESSORIES FOR ELECTRICAL SERVICES

### 2010A ACCESSORIES COMMON REQUIREMENTS - WHITE PLASTIC PLATES GRID, FLUSH INSTALLATION:

- Area of installation - Interior.
- Enclosure pattern - Flush.
- Accessory mounting
  - Adjustable steel grid for grid switches or direct to enclosure for all other accessories.
- Enclosure material - Pressed steel.
- Enclosure finish - Galvanized.
- Coverplate finish, all accessories to match
  - Moulded plastic, colour - white.
- Coverplate pattern - Overlapping; with architrave where indicated.
- Ancillaries
  - Earthing terminal integral within switch box.
  - Neon indicator with red lens, illuminated in "ON" position, for connection units.
  - Switch rocker bar colour - white.
  - Operating keys for key operated switches, minimum number 2.
  - Fuses to BS 1362.
  - Blank inserts for spare ways on grid switches.
- Marking
  - Method - engraving. Mark front plate to indicate equipment served on connection units.
- Conduit and cable entries
  - Knockouts side, top and rear.
- Cable termination - Manufacturer's standard.

### 2010B ACCESSORIES COMMON REQUIREMENTS - MATT CHROME FINISH METAL PLATES,

#### FLUSH INSTALLATION:

- Area of installation - Interior.
- Enclosure pattern - Flush.
- Accessory mounting
  - Adjustable steel grid for grid switches or direct to enclosure for all other accessories.
- Enclosure material - Pressed steel.
- Enclosure finish - Galvanized.
- Coverplate finish, all accessories to match
  - Brass with matt chrome surface.
- Coverplate pattern - Overlapping; with architrave where indicated.
- Ancillaries
  - Earthing terminal integral within switch box.
  - Neon indicator with red lens, illuminated in "ON" position, for connection units.
  - Switch rocker bar colour as indicated.
  - Operating keys for key operated switches, minimum number 2.
  - Fuses to BS 1362.
  - Blank inserts for spare ways on grid switches.
- Marking
  - Method - engraving. Mark front plate to indicate equipment served on connection units.
- Conduit and cable entries
  - Knockouts side, top and rear.
- Cable termination - Manufacturer's standard.

#### 2010D ACCESSORIES COMMON REQUIREMENTS - METAL CLAD PLATES, SURFACE STEEL CONDUIT INSTALLATION:

- Area of installation - Interior.
- Enclosure pattern - Surface.
- Accessory mounting - Direct to enclosure.
- Enclosure material
  - Pressed steel or cast iron.
- Enclosure finish
  - As conduit system or galvanized.
- Coverplate finish, all accessories to match
  - Metal clad.
- Coverplate pattern - Surface type.
- Ancillaries
  - Earthing terminal integral within switch box.
  - Neon indicator with red lens, illuminated in "ON" position, for connection units.
  - Switch rocker bar colour as indicated.
  - Operating keys for key operated switches, minimum number 2.
  - Fuses to BS 1362.
- Marking
  - Method - engraving. Mark front plate to indicate equipment served on connection units.
- Conduit and cable entries
  - Threaded entries, top, bottom or side to suit conduit system.
- Cable termination - Manufacturer's standard.

#### 2010E ACCESSORIES COMMON REQUIREMENTS - SURFACE, STEEL CONDUIT, WEATHERPROOF

INSTALLATION:

- Area of installation - Exterior.
- Enclosure pattern - Surface and weatherproof.
- Accessory mounting - Direct to enclosure.
- Enclosure material - Cast iron.
- Enclosure finish - As conduit system or galvanized.
- Coverplate finish, all accessories to match
  - As enclosure.
- Coverplate pattern - Surface type.
- Ancillaries
  - Earthing terminal integral within switch box.
  - Neon indicator with red lens, illuminated in "ON" position, for connection units.
  - Screwed weathering cap and chain for socket outlets.
  - Operating keys for key operated switches, minimum number 2.
  - Fuses to BS 1362.
- Marking
  - Method - engraving. Mark front plate to indicate equipment served on connection units.
- Conduit and cable entries
  - Threaded entries, top, bottom or side to suit conduit system.
- Cable termination - Manufacturer's standard.

2010F ACCESSORIES COMMON REQUIREMENTS - SURFACE, PLASTIC, WEATHERPROOF

INSTALLATION:

- Area of installation - Exterior.
- Enclosure degree of protection to BS EN 60529, IP54.
- Enclosure pattern - Surface and weatherproof.
- Accessory mounting - Direct to enclosure.
- Enclosure material - Impact resistant plastic.
- Enclosure finish - Natural or self coloured.
- Coverplate finish, all accessories to match
  - Moulded plastic, colour as indicated.
- Coverplate pattern - Surface type.
- Ancillaries
  - Earthing terminal integral within switch box.
  - Neon indicator with red lens, illuminated in "ON" position, for connection units.
  - Protective shrouds to rocker bars.
  - Screwed weathering cap and chain for socket outlets.
  - Switch rocker bar colour as indicated.
  - Operating keys for key operated switches, minimum number 2.
  - Fuses to BS 1362.
- Conduit and cable entries
  - Threaded entries to suit cable/conduit system.
- Cable termination - Manufacturer's standard.

2020A INTERIOR LIGHTING SWITCHES - GENERAL PURPOSE MOULDED PLASTIC:

- Standard
  - BS EN 60669-1
  - Enclosure box to BS 4662
- Switch type - Rocker bar - moulded plastic.
- Rating - 6A.
- Gangs as indicated.
- Switch mechanism - Snap action microgap.
- Pole configurations
  - Single pole.
  - Double pole.
  - 2 way.
  - Intermediate.

2020B INTERIOR LIGHTING SWITCHES - GRID MOULDED PLASTIC:

- Standard
  - BS EN 60669-1
  - Enclosure box to BS 4662
- Switch type - Rocker bar - moulded plastic.
- Rating - 6A.
- Switch mechanism - Snap action microgap.
- Pole configurations
  - Single pole.
  - 1 way.
  - 2 way.
  - Intermediate.

2020C INTERIOR LIGHTING SWITCHES - PULL CORD:

- Standard
  - BS EN 60669-1
  - Enclosure box to BS 4662
- Switch type - Cord to BS EN 61058-2-1
- Rating - 6A. Pole configurations - Single pole.

2020D INTERIOR LIGHTING SWITCHES - GENERAL PURPOSE SECRET KEY:

- Standard
  - BS EN 60669-1
  - Enclosure box to BS 4662
- Switch type - Rocker bar - secret key.
- Rating - 6A.
- Gangs as indicated.
- Switch mechanism - Snap action microgap.
- Pole configurations
  - Single pole.
  - Double pole.
  - 2 way.
  - Intermediate.

2020F INTERIOR LIGHTING SWITCHES - GRID SECRET KEY:

- Standard
  - BS EN 60669-1
  - Enclosure box to BS 4662
- Switch type - Rocker bar - secret key.
- Rating - 6A.
- Switch mechanism - Snap action microgap.
- Pole configurations
  - Single pole.
  - 1 way.
  - 2 way.
  - Intermediate.

2030A EXTERIOR LIGHTING SWITCHES - METAL CLAD ROTARY:

- Standard
  - BS EN 60669-1
  - Enclosure box to BS 4662
- Switch type - Rotary disc or lever operating through sealing gland.
- Rating - 6A.
- Gangs as indicated.
- Action - Two position.
- Pole configurations as indicated.

2030B EXTERIOR LIGHTING SWITCHES - SEALED ROCKER BAR:

- Standard

- BS EN 60669-1
- Enclosure box to BS 4662
- Switch type - Rocker bar with sealed in plastic membrane.
- Rating - 6A.
- Gangs as indicated.
- Action - Two position.
- Pole configurations as indicated.

#### 2040B TIME SWITCHES - 7 DAY:

- Wire timer and switch circuits to separate terminals.
- Standard - BS EN 60730-2-7.
- Time switch type
  - Quartz stabilized solid state 50 hour nickel cadmium battery backup.
- Contacts duty - Inductive.
- Contacts rating - 15A.
- Special programme facilities
  - Number of "ON" and "OFF" operations - 4.
- Programme repeat cycle - 7 day.

#### 2050A LUMINAIRE CONNECTORS - GENERAL AND EMERGENCY LIGHTING:

- Rating - 2A.
- Connector type
  - Fixed terminal strip, screw cover and cord grip to BS 67.
- Load carrying capacity to match selected luminaire.

#### 2050B LUMINAIRE CONNECTORS - GENERAL LIGHTING:

- Rating - 2A.
- Connector type
  - 3 pin plug/socket to BS 546.
- Load carrying capacity to match selected luminaire.

#### 2050C LUMINAIRE CONNECTORS - CORD GRIP GENERAL AND EMERGENCY LIGHTING:

- Rating - 2A.
- Connector type
  - Cord grip type plug/socket and screw on retaining cover to BS 5733 3 pin or 4 pin.
- Load carrying capacity to match selected luminaire.

#### 2060A LAMPHOLDERS - BC TYPE:

- Standard - BS EN 61184.
- Lampholder type
  - Bayonet clip.
  - B22.
- Fixing - Bracket
  - Straight.
  - Angle.
  - Suspension.

- Finish - Manufacturer's standard.
- Material - Heat resistant moulded plastic.
- Ancillaries
  - Cord grip.
  - Lampshade ring.
  - Protective lampshade ring.

2060B LAMPHOLDERS - ES TYPE:

- Standard - BS EN 60238.
- Lampholder type
  - Edison screw.
  - E27.
- Fixing - Bracket
  - Straight.
  - Angle.
  - Suspension.
- Finish - Manufacturer's standard.
- Material - Heat resistant moulded plastic.
- Ancillaries
  - Cord grip.
  - Lampshade ring.
  - Protective lampshade ring.

2070A ISOLATING SWITCHES - BS EN 60669-1:

- Provide isolating switches for fixed appliances.
- Utilization category as indicated.
- Making capacity as indicated.
- Standard
  - BS EN 60669-1
  - Enclosure box to BS 4662.
- Switch type - Rocker bar.
- Rating as indicated on schedule.
- Pole configuration
  - DP.
  - Three pole.
  - TPN.

2070B ISOLATING SWITCHES - BS EN 60947-3:

- Provide isolating switches for fixed appliances.
- Utilization category as indicated on schedule.
- Making capacity as indicated.
- Standard
  - Enclosure box - BS 4662, BS EN 60947-3.
  - Isolation during repair and maintenance - BS EN 62626-1
- Switch type - Rocker bar.
- Rating as indicated on schedule.
- Pole configuration
  - DP.

- Three pole.
- TPN.

2080A FUSE CONNECTION UNITS - SWITCHED:

- Standard
  - BS 1363-4
  - Enclosure box to BS 4662 and switched.
- Unit type - Rocker bar - plastic.
- Pole configuration - DP.
- Ancillaries
  - Cord outlet.
  - Cord grip and fuse.

2080B FUSE CONNECTION UNITS - UNSWITCHED:

- Standard
  - BS 1363-4
  - Enclosure box to BS 4662 and unswitched.
- Pole configuration - DP.
- Ancillaries
  - Cord outlet
  - Cord grip and fuse.
  - Lockable fuse carrier.

2090A SOCKET-OUTLETS - SINGLE, SWITCHED:

- Standard
  - 13A socket-outlet to BS 1363
  - Enclosure box to BS 4662
- Switching - Switched.
- Switch type - Rocker bar - plastic.
- Rating - 13A.
- Ancillaries
  - Plug tops 25% of number of sockets, fused as indicated.
- Gangs - 1.

2090B SOCKET-OUTLETS - SINGLE WITH INTEGRAL RCD, SWITCHED:

- Standard - Enclosure box to BS 4662, BS 7288.
- Switching - Switched
- Switch type - Rocker bar - plastic.
- Rating - 13A.
- Ancillaries
  - RCD, BS 7288
  - Mains failure trip, sensitivity 30mA.
  - Plug tops 25% of number of sockets, fused as indicated.
- Gangs - 1.

2090C SOCKET-OUTLETS - DOUBLE SWITCHED:

- Standard
  - 13A socket-outlet to BS 1363
  - Enclosure box to BS 4662
- Switching - Switched
- Switch type - Rocker bar - plastic.
- Rating - 13A.
- Ancillaries
  - Plug tops 25% of number of sockets, fused as indicated.
- Gangs - 2.

2090D SOCKET-OUTLETS - SINGLE, UNSWITCHED:

- Standard
  - 13A socket-outlet to BS 1363
  - Enclosure box to BS 4662
- Switching - Unswitched.
- Rating - 13A.
- Gangs - 1

2100A COOKER CONTROL UNIT - WITH INTEGRAL SOCKET:

- Standard
  - BS 4177
  - Enclosure box to BS 4177
- Unit type - With integral 13A switched socket-outlet and pilot lamp.
- Pole configuration - DP.
- Rating - 45A.

2100B COOKER CONTROL UNIT - WITHOUT SOCKET:

- Standard
  - BS 4177
  - Enclosure box to BS 4177
- Unit type - With pilot lamp.
- Pole configuration - DP.
- Rating - 45A.

2120A CABLE AND APPLIANCE COUPLERS - 16A, 240V SINGLE-PHASE, GENERAL PURPOSE:

- Standard
  - BS EN 60309-2
- Material - Polycarbonate male and female connectors.
- Rating - Voltage 220 - 240V; Current 16A.
- Configuration - 2PE.
- Colour - 220 - 240V, Blue.
- Ancillaries as indicated.
  - ON/OFF switch; gang combinations 1, 2, 3 and 4; RCD. BS 7288 sensitivity 30mA.

2130A TELEPHONE AND DATA OUTLET SOCKETS - GENERAL PURPOSE:

- Standard

- For jack socket to telephone service provider requirements and enclosure box to BS 4662.
- Size - Standard.
- Circuit configurations as indicated.

2140A TELEPHONE CORD OUTLETS - GENERAL PURPOSE:

- Standard - BAPT approved.
- Circuit configurations - Single or twin as indicated.

2190A SHAVER POINTS - BATHROOM AND WASHROOM USE:

- Provide shaver points, internally switched by plug insertion.
- Standard
  - BS EN 61558-2-9
  - BS EN 61558-1
  - BS EN 61558-2-23
  - Enclosure box to BS 4662
- Rating - 20VA.
- Components
  - Double wound single-phase transformer 240/240V and 110V to
    - BS EN 61558-2-9
    - BS EN 61558-1
    - BS EN 61558-2-23
  - Internal overload protection.
- Marking - Input and output voltages and "SHIVERS ONLY".

2200A INDICATOR LAMPS - GENERAL PURPOSE LED:

- Standard BS EN 62094-1.
- Lamp - LED.
- Lamp rating - 230V supply.
- Lens cover - Moulded plastic.
- Lens colour - BS EN 60073.
- Lens retaining rings - Moulded plastic.

3010 EARTHING:

- Ensure metal framework of equipment is bonded to main earth point. Ensure that cable CPC's are connected to earth bar.
- Provide earth CPC between earth lug on metal box and accessory casing except where accessory is encased in plastic.

3020 PROTECTION:

- Ensure there is no physical or electrical damage to accessories when they are removed from their

packaging and during installation.

- Provide masking covers for surface mounted accessories to protect surface from paint.
- Where accessories are flush mounted install front plate after painting is finished.

#### 3030 FIXING:

- Align accessories horizontally and vertically. Where accessories are grouped, mount horizontally in line and parallel to each other and equidistant.
- Fix cover plates to boxes with brass fixing screws.

#### 3040 MEASURING MOUNTING HEIGHTS:

- Take measurement for position of electrical accessories to the centre line of equipment from either finished floor or worktop. Where specified height coincides with top of tiling, leave a clear gap of 50mm above tiling.
- Mount equipment below a worktop 100mm below underside of worktop.

#### 3050 STANDARD ACCESSORIES MOUNTING HEIGHTS:

Accessory	Location	Height (mm)
Lighting switch		1200
Socket outlet	General	450
	Kitchen	1000
	Above worktop	200
Shaver socket outlet		1000
Fused connection unit	General	450
	Above worktop	200
	Radiator heater, wall	1800
Fused connection unit controlling	Radiator heater, focal point	450
	Tubular heater	450
	Clock	1900
Cooker control unit	Above worktop	200
Cooker connection unit		600
Safety isolating transformer		1200
Room thermostat		1400
Telephone outlet		450
Radio/TV outlet		450
Push button		1200
Fire alarm manual call point		1200
Bell or buzzer		2000
Visible alarm indicator		2000

- In car parks and garages comply with appropriate petroleum regulation for mounting heights of socket

outlets.

**3070 ACCESSORIES MOUNTING HEIGHTS:**

- Provide switches and socket outlets for lighting and other equipment in habitable rooms at appropriate heights between 450mm and 1200mm from finished floor level, in accordance with Building Regulations Approved Document M and BS 8300.

## **Y80 EARTHING AND BONDING**

### 1000 GENERAL

#### 2010A CONDUCTORS FOR LIGHTNING PROTECTION SYSTEMS - HORIZONTAL AIR TERMINATIONS:

- Use - Horizontal air termination or down conductor.
- Minimum dimension - BS EN 62561-2.
- Form - Strip.
- Material - Copper, annealed.
- Coverings - None or PVC.
- Accessories - Ridge Saddle; conductor clips - non-metallic; glazing bar holdfast; slate holdfast; backplate holdfast; all accessories sized to suit conductors.

#### 2010B CONDUCTORS FOR LIGHTNING PROTECTION SYSTEMS - SELF SUPPORTING AIR

TERMINATIONS:

- Use - Air termination, vertical.
- Minimum dimension - BS EN 62561-2.
- Form - Rod.
- Material - Copper, hard drawn.
- Coverings - None.
- Accessories - Terminal base; ridge saddle; rod brackets; rod to tape coupling.

2010C CONDUCTORS TO EARTHING SYSTEMS TO BS 7430:

- Use - Earthing conductor.
- Minimum dimension - BS 7430, current density 50A/mm<sup>2</sup>.
- Form - Strip.
- Material - Copper, annealed.
- Coverings - None.
- Accessories - Conductor clips, metallic.

2020A LIGHTNING PROTECTION CONDUCTOR JOINTS:

- First Conductor
  - Form - strip; material - copper.
  - Dimensions - To BS EN 62561-2.
- Second conductor
  - Form - rod; material - copper.
  - Dimensions - To BS EN 62561-2.
- Solid joint - Brazed or welded, thermic.
- Disconnecting test joint
  - Square clamp, oblong clamp, plate clamp or screw-down clamp.

2020B EARTHING SYSTEMS CONDUCTOR JOINTS:

- First Conductor
  - Form - strip; material - copper.
  - Dimensions - For conductor current density 50A/mm<sup>2</sup> earthing systems.
- Second conductor
  - Form - rod; material - copper.
  - Dimensions - For conductor current density 50A/mm<sup>2</sup> earthing systems.
- Solid joint - Brazed or welded, thermic.
- Disconnecting test joint
  - Square clamp, oblong clamp, plate clamp or screw-down clamp.

2030A TAPE FIXING DEVICES:

- Secure bare conductor tape to structure with fixing devices which avoid piercing tape and ensure 3mm

(minimum) clearance of tape from structure, at 450mm maximum, centres.

- Material for lightning protection systems
  - Non-conducting.
- Material for system earthing
  - Bronze.

#### 2040B ROD EARTH ELECTRODES FOR SYSTEM EARTHING:

- Standard - BS 7430.
- Form - rod with female thread each end.
- Dimensions
  - Rod Diameter - 15 mm - nominal.
  - Rod Length - 2.4m (2 x 1.2) minimum.
- Earth electrode couplings
  - Use high strength driving cap in contact with driven rod and couplings of compatible material fully enclosing the rod threads.
- Interconnect electrodes using bare copper tape 25mm x 6mm.
- Earth electrodes in drawpits
  - Provide concrete cover, permanently labelled, for electrodes installed through cable drawpit bases.
- Main earth conductor connection
  - Connect main earth conductor to first electrode using heavy duty purpose made silicon aluminium bronze body conductor clamp and high tensile phosphor bronze bolt.
- Material, minimum size as BS 7430 Table 4 - Copper.
- Accessories
  - Rod to tape clamp. Sized to suit earth rod and connector.

#### 2040D BUILDING OR STRUCTURAL ELEMENT EARTH ELECTRODES FOR SYSTEM EARTHING:

- Standard - BS 7430.
- Form - Building or structural element, as shown on the drawings.
- Interconnect electrodes using bare copper tape 25mm x 6mm.

#### 2060A EARTH ELECTRODE CLAMPS:

- Connect tape to electrode head using heavy duty purpose made silicon aluminium bronze body connector clamps or leaded gunmetal body connector clamps, and high tensile phosphor bronze bolts to BS EN 12163.

#### 2070A EARTH ELECTRODE INSPECTION FACILITIES:

- Provide enclosure for each connection between earth conductor and associated earth electrode system. Install so that top is flush with finished ground or floor level. Ensure enclosure provides adequate access

for testing purposes. Provide pit details for builders work.

- Labelling - Wording, Earth.

#### 2090A MAIN EQUIPOTENTIAL BONDS:

- Provide main equipotential bonds in accordance with BS 7671.
- Material - Insulated cable, single core to BS 6004.
- Use no joints in main equipotential bonds.

#### 2100A SUPPLEMENTARY EQUIPOTENTIAL BONDS:

- Provide supplementary equipotential bonds to BS 7430, BS 7671 and BS EN 50310. Do not use joints in supplementing bonds.
- Material - Insulated cable, single core to BS 6004.

#### 2110A CIRCUIT PROTECTIVE CONDUCTORS:

- Material
  - Insulated cable, single core to BS 6004 as indicated; metallic screwed conduits (excluding flexible); metallic trunking with tinned copper links; armouring and/or metallic sheathing of armoured cables or integral conductor of multi-core cable.
- Size
  - Provide protective conductors sized in accordance with BS 7671 (IET Regulations) 543.1.4 and Table 54.7.

#### 2120 EARTHING CLAMPS:

- Use clamps complying with BS 951, for bonding pipes and earthing of conductors. For bonding of lead sheathed cables use soldered or spring clamps.

#### 2130A EARTH BUSBARS:

- Material
  - Manufacture earth busbars from hard drawn, tinned, high conductivity copper bar.
- Substation Earth busbar
  - 75 x 13mm cross section 600mm minimum length.
- Main Earth Terminal busbar
  - 25 x 6 mm minimum for incoming live conductor not exceeding 50mm and 50 x 6 mm minimum for incoming live conductor over 50mm<sup>2</sup>.

#### 2140 TEST LINKS:

- Provide two test links, in connections between main earth conductors and earth busbar. Fabricate each from two additional sections of earth busbar. Mount one section on stand-off insulators matching earth busbar; use remaining section as removable test link. Secure 12mm high tensile brass studs to fixed sections of busbar and drill corresponding clearance holes in test links and provide brass washers, nuts

and locking devices to secure frame/neutral earthing and test links.

**2150 LUGS/TAGS:**

- Provide lugs or tags to enable connection of bonding conductors to equipment earth terminals.

**2160 PROTECTIVE CABLE TERMINATIONS:**

- For bolted connections use crimp type lugs compressed by automatic tool to achieve correct pressure and crimp depth.

**2170 PROTECTIVE CONDUCTOR WARNING NOTICES/LABELS:**

- 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.

**2180 MAIN EARTH CONDUCTOR - WARNING TAPES:**

- Provide green/yellow PVC tapes labelled "EARTHING CONDUCTOR" over complete external lengths of main earth conductors at 300mm depth below finished ground.

**2190 EARTH BAR LABEL:**

- Label earth bar "SAFETY ELECTRICAL CONNECTION - DO NOT REMOVE" with wall mounted laminated plastic tablet engraved in 10mm high red letters on white ground.

**3010 LOW NOISE EARTH DISTRIBUTION:**

- Install low noise earth distribution in double insulated cables from earth electrodes to equipment points. Mount all busbars with insulators and separate from other earthing systems.

**3020 DISSIMILAR METALS:**

- Ensure, where dissimilar metals are used for system, that purpose made jointing materials are used such that corrosion and deterioration of the electrical connection are not caused.
- Ensure bonding connections to other metal parts of building are electrolytically compatible with those metal parts. Use the guidance given in BS 7430 Table 8 when bonding dissimilar materials.

**3030A COPPER TAPE JOINTS:**

- Provide waterproof protection at joints subject to moisture.
- Joint copper tapes by brazing, using zinc-free brazing metal with melting point at least 600°C or thermic

welding.

#### 3030B ALUMINIUM TAPE JOINTS:

- Provide waterproof protection at joints subject to moisture.
- Joint aluminium tapes by welding to BS EN 1011-4.

#### 3040 STRANDED CONDUCTOR JOINTS:

- Provide waterproof protection at joints subject to moisture.
- Joint copper stranded conductors with compression joints to BS EN 61284.

#### 3050A PROTECTIVE CABLE TERMINATIONS:

- For bolted connections use crimp type lugs compressed by automatic tool to achieve correct pressure and crimp depth.
- Make connections between tape and equipment using high tensile grade brass bolts with brass nuts, washers and locking devices. Use phosphor bronze bolts, nuts and washers where connections are liable to corrosion.

#### 3060A EARTH ELECTRODES:

- Location
  - Locate electrodes not less than 2m distant from building/structure protected, and away from telecommunication and pilot cables and metallic fences.
- Driving
  - Drive rods vertically into ground with purpose designed electric hammer. (Where impenetrable strata encountered at shallow depth, drive at 30° to horizontal).
- Depth of rod
  - 2.4m minimum below finished ground surface.
- Depth of Electrode heads
  - Locate electrode heads just below ground level.
- Spacing
  - Where electrodes are installed in a group ensure minimum distance between electrodes is twice depth of rods. Where rods for clean earth are installed ensure distance from any other system rods is six times depth of clean rods.
- Tape Depth
  - Install interconnecting or electrode tape 750mm below finished ground level, rising vertically at each electrode.
- Connect groups of electrodes to main earth conductor via bolted link in inspection pit as BS 7430 for test purposes.

---

## Y81 TESTING AND COMMISSIONING OF ELECTRICAL SERVICES

### 1000 GENERAL

#### 2010A INCORPORATED EQUIPMENT CHARACTERISTICS:

- Obtain and use information from manufacturers of equipment provided.
- Use information provided, for equipment supplied by others and incorporated into installation.

#### 2020A PROSPECTIVE SHORT CIRCUIT CURRENT:

- Determine values of  $I_p$  by measurement, unless other means are indicated. Determine  $I_p$  at all necessary points within installation to confirm correct equipment selections.
- Obtain from supply undertaker written confirmation of maximum and minimum values of  $I_p$  at origin of installation. Adjust subsequent measured values of  $I_p$  accordingly.

#### 2030A INITIAL VERIFICATION:

- Carry out detailed inspection to verify the requirements of BS 7671, Section 611 in the order given in clause 611.3.

#### 2040A TEST EQUIPMENT AND CONSUMABLES:

- Provide test equipment and consumables to complete tests satisfactorily, and to retest any failed installations following corrective measures.
  - Test equipment quality assurance requirements to BS EN ISO 10012.

#### 2050A TESTING

- Carry out in the same order as published the tests required by BS 7671, Section 612 for New Installation or Altered or Added Installation as appropriate.

#### 2070A EARTH FAULT LOOP IMPEDANCE:

- Use 25 A test current. Measure and record source impedance ( $Z_E$ ).
- If alternative LV supply arrangements are available, measure  $Z_S$  when using supply with highest impedance.
- Measure  $Z_S$  with main equipotential bonding conductors connected. Do not summate values of several parts of each loop.

#### 2080 SETTINGS AND ADJUSTMENTS:

- Confirm characteristics and settings of protective devices are within maximum and minimum specified tripping times. Check correct operation of devices. Confirm interlocks and sequences operate safely and as indicated.

#### 2090A STANDBY GENERATORS:

- Perform works tests on standby generators and provide test certificates. Comply with BS 5000-3 and BS

5000-11 or BS EN 60034-3 as appropriate.

**2100A HV AND LV SWITCHGEAR:**

- Perform works tests on HV and LV switchgear in accordance with BS EN 62271-200 and BS EN 61439-1, as appropriate, and provide test certificates.

**2110A HV POWER TRANSFORMERS:**

- Perform works tests on HV power transformers in accordance with BS EN 60076-3, BS EN 60076-4 and BS EN 60076-5. Provide test certificates.
- Perform all routine tests.
- Perform energy efficiency test.

**2120A FIRE DETECTION AND ALARM INSTALLATIONS:**

- Carry out site testing and inspection and provide test certificates for fire detection and alarm systems in accordance with BS 5839-1.

**2120B LIGHTNING PROTECTION INSTALLATIONS:**

- Carry out site testing and inspection and provide test certificates for lightning protection installations in accordance with BS EN 62305.

**2120E EMERGENCY LIGHTING INSTALLATIONS:**

- Carry out site testing and inspection and provide test certificates for emergency lighting installations in accordance with BS EN 50172.

**2130 CALIBRATION:**

- Provide current certificates of calibration for all instruments used during test procedures. Record particular instrument identity on record sheets.

**2140A CERTIFICATION AND REPORTING:**

- Complete and hand over to the Client a Completion and Inspection Certificate to BS 7671 Appendix 6 for New Installation or Altered or Added Installation as appropriate.

**2150A INSTALLATION CERTIFICATES:**

- Provide installation certificates for electrical installations in accordance with BS 7671 (IET Regulations).
- Record details of departures from BS 7671 (IET Wiring Regulations) on certificate.
- Provide copies of calculations justifying departure from BS 7671 (IET Wiring Regulations) and attach to certificates.

**2160 RECORDS:**

- Record all results and instrument readings on approved Record Sheets and hand over to the client two

copies for each inspection and test.

- Hand over copies of complete Record Sheets to
  - Client.
- Provide copies of Record Sheets
  - 2.

#### 3010 CONDUCTIVE PARTS:

- Test conductive parts simultaneously accessible with exposed conductive parts of extraneous conductive parts. Establish that they are either not an extraneous conductive part, or that they are reliably connected by metal to main equipotential bonding.
- Confirm conductive parts which are not extraneous conductive parts are separated from earth by an impedance greater than 50,000 Ohms. Confirm other conductive parts are bonded to equipotential zone earthbar by an impedance not exceeding 0.1 Ohms.

#### 3030# HIGH VOLTAGE TESTS:

- Conduct high voltage tests for equipment indicated.
- Comply with BS 923-1, BS EN 61180 and BS EN 60060-2.
- Minimum acceptable values
- Comply with BS EN 61180.

#### 3030A HIGH VOLTAGE TESTS:

- Conduct high voltage tests for equipment indicated. Comply with BS 923-1, BS EN 61180 and BS EN 60060-2. Comply with BS EN 61180.

#### 3040A LV BURIED CABLES:

- Test continuity and insulation of buried cables immediately after back-filling. Test continuity and insulation of buried cables prior to handover.

## Y82 IDENTIFICATION - ELECTRICAL

### 1000 GENERAL

#### 2010A LABELS AND NOTICES:

- Apply identification labels and notices in accordance with BS 7671 (IET Wiring Regulations), section 514 to all electrical cables plant and equipment including components of mechanical systems.
- Identification of protective devices.
  - Diagrams, charts or tables to comply with Clauses 514.9 and 560.7.9.
  - Warning notices, voltages in excess of 250 volts.
  - Periodic inspection and test notices.
  - Residual current device notices.
  - Earth electrode safety electrical connection label.
  - Bonding conductor connector point to extraneous conductive parts label.
  - Earth free local equipotential bonding areas warning notice.
  - Electrical separation areas warning notice.
  - Outdoor equipment socket outlet notice.

#### 2020A MATERIALS:

- Use materials for labels and notices with a predicted life equal to or greater than the design life of the electrical cables, plant, equipment or installation to which it refers.
- External
  - Signwritten, or stencil in paint compatible with surface.
  - Colour - Background, plant standard finish. Lettering, white.
- Internal
  - Engraved thermosetting plastic laminate.
  - Colour - Background, white or red. Lettering, red or white.

#### 2030A FIXING - INTERNAL:

- Fix labels and notices using materials compatible with label or notice and surface to which it is fixed by screws into tapped hole or bolted complete with washer nut and locking device.

#### 2040A ARRANGEMENT:

- Obtain approval prior to manufacture, with regard to style, colour, lettering, size and position of all labels and notices.
  - Provide sample showing style, colour, lettering and size, for approval.

#### 2050A LETTERING AND SIZE OF LABELS AND NOTICES:

- Ensure that all lettering and symbols comply with the requirements laid out in BS ISO 3864-1 for height of lettering where not otherwise indicated. Ensure labels and notices of adequate size for the lettering required, and allow a minimum margin around all lettering of one line space vertically and two letter

spacing horizontally.

- Font - Helvetica Medium.
- Size - BS EN ISO 7010 or 5mm minimum high letters.

#### 2060A CONDUCTOR ARRANGEMENT:

- Arrange circuit polarity so that phases read in phase rotation order followed by the neutral, if any, from top to bottom in horizontal conductor layouts and left to right in vertical conductor layouts. Ensure flat horizontal arrays have leading phase to the left and neutral to the right from left to right when viewed from supply point. Arrange phase or live pole of two wire apparatus at top or left hand and neutral and earth both at bottom or right hand side. In all cases, ensure conductor arrangements defined are when viewed from front face of all equipment and terminating facilities. Apply identification markers in accordance with BS 7671 (IET Wiring Regulations), section 514 to all conductor termination points.

#### 2070A SAFETY SIGNS:

- Label all electrical plant and equipment using safety sign 8.A.0044 of BS 5499-5 where voltages above ELV exist.
- Provide supplementary or text signs complying with BS 5499-5 with each safety sign 8.A.0044 as indicated.
- Label all electrical plant and equipment with the labels specified in the appropriate British Standards for that plant or equipment.
- Identify each substation and main switchroom with safety sign 8.A.0044 to BS 5499-5 for any fire extinguishing system and notice giving details of,
  - Name of the Substation or switchroom
  - The presence of Medium and Low Voltages.
  - Administrative instructions for access.
  - Location and method of contacting controlling authority.
  - Actions to be taken in an emergency.

#### 2080A PLANT AND EQUIPMENT LABELS:

- Fit labels on all items of plant, equipment, switches, etc., include the following information: service controlled, circuit reference, voltage, type of supply and phase etc., circuit protection type and rating.

#### 2090 MAINTENANCE NOTICES:

- Fix notices giving warning of, and instructions on, any special maintenance procedures to plant and equipment.

#### 2100 COLOUR CORRECTED LIGHT FITTINGS:

- Fix a warning or identification disc to light fittings containing colour corrected fluorescent tubes or other colour corrected light sources to ensure that maintenance staff install the correct lamps.

#### 2110A MOTORS AND STARTERS LABELS:

- Fit identification labels to all motors, starters and starter panels. Ensure positive identification of respective motors and starters. Provide motors with non-corrodible labels attached adjacent to each bearing giving details of the lubricant to be used. Mark direction of normal rotation on motor casing. Provide labels to identify motor equipment fitted with surge suppressors and thermistors stating that insulation test voltages must not be applied to thermistors and thermistor control units. Ensure labelling is

compatible with schematic and wiring diagrams, and complies with BS EN 60034-8.

#### 2120A LABELLED ACCESSORY PLATES - ENGRAVED:

- Label accessory plates, including lighting switches, socket outlets and connection units to indicate their use. Label by engraving, lettering 6mm high colour red.

#### 2130A SWITCHGEAR:

- Fit labels on switchgear to relevant parts of BS EN 61439 and BS EN 60439 to indicate duty of unit, its voltage, phase and current rating, protective device rating size of conductor involved, and all other necessary details.
- Use an agreed serial coding system, provide at the switch a key to the coding system.

#### 2140 DISTRIBUTION BOARDS:

- On each distribution board identify every outgoing way with a renewable circuit chart in a transparent plastic envelope permanently fitted inside distribution board cover. Clearly indicate in typed script, circuit identification number, cable size, fuse or circuit breaker rating and a description of item supplied and area supplied by circuit.

#### 2150A SCHEMATIC DIAGRAMS:

- Provide a purpose made schematic diagram permanently fixed showing the connections of the equipment and plant.
- Locations and materials as indicated in contract preliminaries.

#### 2160A SPECIAL PURPOSE EARTHING:

- Fit labels to special purpose earthing conductors and connection points, describing their purposes and any instructions necessary for their operation and maintenance.
- IT equipment "Clean Earths".
- Telecommunications functional earths as BS 6701.

#### 2170A INDICATOR LAMPS AND PUSH BUTTONS FOR POWER SYSTEMS:

- Use indicator lamp and push button colours in accordance with BS EN 60073.
- Indicator lamp
- Red, danger or alarm; yellow, caution; green, safety.
- Push buttons
- Red, emergency action; red, stop or off; yellow, intervention; green, start or on.
- Illuminated push buttons - Type a.

#### 2180A CONDUIT AND TRUNKING COLOUR CODING:

- In areas of mechanical plant or voids accommodating mechanical services, or where otherwise indicated, identify electrical conduits and ducts in accordance with BS 1710. Apply colour orange to BS 4800 by painting on service as a band over 150mm or applying an adhesive tape type wrap around services over a length of 150mm.
- Place identification colours at bulkheads, wall penetrations and any other place where identification is

necessary.

#### 2190A CABLE IDENTIFICATION:

- Provide all cables, other than final sub-circuit wiring enclosed in conduits or trunking, with labels fixed at each end of cable either side of wall and floor penetrations at approximately 12m intervals at convenient inspection points by means of non-releasable plastic straps, minimum width 4mm.
- Ensure labels show the reference number of cable.

#### 2200A TERMINAL MARKING AND CONDUCTOR IDENTIFICATION:

- Provide for switchgear and control gear elements whose terminals are marked in accordance with BS 5472 (EN 50005) and BS 6272 (EN 50042). Use a unique reference to identify each element in the switchgear or control gear. Mark on or adjacent to each element its reference. Identify each terminal for connection to external wiring or cabling using a reference system complying with BS EN 60445 based on the element reference and the appropriate element terminal reference.
  - Adjacent to terminals.
- Use lettered or numbered ferrules or sleeves to BS 3858 to mark each auxiliary conductor or control cable core with the identity of the terminal to which it is connected and the reference of plant or equipment to which it is connected and the identity of the terminal at the remote end. Ensure that main circuit conductors are identified in accordance with BS 7671 (IET Wiring Regulations) section 514. Ensure that all identification of terminals and conductors is recorded and included on record drawings and in operation and maintenance documentation.

#### 2210A UNDERGROUND CABLE IDENTIFICATION:

- Identify external underground cable routes by means of approved markers along their length at distances not exceeding 50m and where a change of direction occurs on such routes. Provide cables markers with a brass plate or impress concrete to clearly indicate the reference of group of cables or reference number of cable and operating voltage of cable. Provide key to any reference system used at switchgear. Mark and protect direct buried cables with plastic tape yellow printed black "DANGER ELECTRIC CABLES" elsewhere.

#### 2220A CABLE CONDUCTOR COLOUR CODING:

- Identify cable conductors in accordance with BS 7671 (IET Wiring Regulations) section 514 and Appendix 7, note that a lighting sub-circuit switch wire is a phase conductor in a single-phase circuit.

#### 2230 CABLE JOINTING AND TERMINATION:

- Connect all cables in the installation so that the correct sequence of phase rotation is maintained throughout. Where straight through joints are approved joint medium voltage conductors as they lie, ensuring their complete length is phased out on completion. Ensure connections at terminations of MV cables are made in the correct phase rotation and ensure cable conductor termination marking if any, complies with this phase sequence. Where straight through joints are approved on low voltage cables, whether power cables or control or auxiliary cables, joint conductors strictly in accordance with their colour or numeric coding. Where such joints are approved on mineral insulated or other non-coded conductor

cables, identify each core at the joint and make the joint core to core.

#### 2260A ADDITIONAL SAFETY SIGNS:

- Provide at locations shown or as appropriate safety signs to BS ISO 3864-1.
- Application
  - For main switch and electrical plant room access doors, BS EN ISO 7010 complete with supplementary signs as shown with "Authorised persons only".
  - For use with permit to work systems, BS EN ISO 7010 complete with supplementary signs as shown "Do not operate. Work in progress".
  - For use at each emergency stop, BS EN ISO 7010 complete with supplementary signs as shown "Emergency stop push-button".

---

## Y90 FIXING TO BUILDING FABRIC

### 1000 GENERAL

#### 2010 STANDARDS:

- Ensure that fixings such as expanding anchors are tested for tensile loading in accordance with BS 5080-1.

#### 2020 PLUGS:

- Use plugs of suitable size and length for fixings. Use plastic, fibrous or soft metal non-deteriorating plugs to suit application. Do not use wood plugs.
- Ensure that when screw is in place, threaded length is in plug. Ensure plugs used for screw fixing are set-in to correct depth prior to final tightening.

#### 2030 SCREWS:

- Use screws to BS 1210. Generally use sherardized steel wood screws for fixing to concrete, brickwork or blockwork.
- In damp or exposed situations use greased brass wood screws.

#### 2080 NON-PENETRATIVE SUPPORT SYSTEMS FOR ROOF MOUNTED EQUIPMENT:

- Obtain approval prior to using non-penetrative support systems for roof mounted equipment.

#### 3010 DRILLING:

- Drill holes squarely. Use drills of requisite size and depth, and appropriate to fabric. Do not flame-cut holes in metal work.

#### 3050 FIXING TO TIMBER RAILS:

- Fix equipment, brackets and supports by drilling hole through timber rail and fixing with bolt, back plate, washer and loose nut.

#### 3060A FIXING TO HOLLOW STUD/TILE/BLOCK WALLS:

- Fix equipment, brackets and supports where there is access at rear of wall, by drilling hole through wall and fixing with bolt, back-plate, washer and loose nut.
- Fix equipment, brackets and supports where there is no access at rear of wall, drill hole and use screw anchor type fixing or gravity type toggle fixing.

#### 3070A FIXING TO CONCRETE, BRICKWORK OR BLOCKWORK:

- Fix equipment, brackets and supports using wood screws in plugs or, as appropriate, drill holes and fix using steel bolts of grouted bolt type or expanding bolt type fixing.

#### 3080A FIXING TO METALWORK:

- Fix equipment, brackets and supports by drilling holes and fixing using set screws or bolts complete with

washers, shakeproof washers and loose nuts.

**3090A FIXING TO STRUCTURAL STEELWORK AND CONCRETE STRUCTURES:**

- Provide manufacturer's information on recommended fixing. Obtain approval for any fixing to structure steel work and concrete structures.
- Generally use proprietary fixings to structural steelwork and concrete structures.
- Obtain approval to cut holes in structural steelwork or concrete structures or weld to structural steelwork.

**3100# NON-PENETRATIVE SUPPORT SYSTEMS FOR ROOF MOUNTED EQUIPMENT:**

- Provide manufacturer's information on recommended support systems.
- Obtain the necessary approvals to use non-penetrative support systems as follows:
  - Ensure that the roof build-up is suitable for non-penetrative supports.
  - Ensure that necessary approval is given by
    - The Structural Engineer
    - The Architect
- Mounting positions
- Roof load management parameters (if known)
  - UDL deck loading  $\text{kN/m}^2$
  - Maximum Point Loads  $\text{kN}$
  - Maximum Base Pressures  $\text{kN/m}^2$
- Components  
Provide support manufacturer's information on recommended free-standing systems
  - Support leg type
  - Support frame type
- Roof maintenance building clearance
  - Ensure that future roof maintenance access to roof finish is provided under each support system
  - Minimum building clearance
- Documentation required for Project Team approval:
  - CAD drawings of supports
  - Roof load management calculations
  - O&M documentation
  - Warranty information
- Manufacturer

---

## Y91 PAINTING AND ANTI-CORROSION TREATMENTS

### 1000 GENERAL

#### 2010A PAINT MATERIALS:

- Use the following materials as appropriate
  - Solvent borne priming paint to BS 7956 for bare woodwork.
  - Red Oxide priming paint for bare iron and steelwork.
  - Zinc Chromate priming paint for bare ferrous and non-ferrous metals.
  - Calcium Plumbate priming paint to BS 3698 for galvanized steel or composite wood/metal components.
  - Undercoating paint for previously primed or painted surfaces before the application of finishing coats.
  - Gloss finishing paint for previously primed or painted/undercoated surfaces.
  - Epoxy resin paint for specialist coatings requiring resistance to acids, alkalis, oils, solvents, abrasion or high humidity.
  - Aluminium paint to BS 388 for structural steelwork, storage vessels, heated metallic surfaces and similar applications where moisture and heat resistant properties are required.
  - Cold galvanizing paint for making good damage to previously galvanized surfaces and protection to galvanized materials modified during installation.
  - Zinc-rich metallic to BS 4652 for bare iron and steelwork where electrical conductivity has to be assured.
  - Black tar-based paint to BS 1070 for moisture resistant protection to metal surfaces where decorating appearance is not important.
  - Bitumen based coatings for cold application to BS 3416 protection to iron and steel, particularly pipelines and fittings for use in contact with potable water.
  - Bitumen based coatings for cold application to BS 6949 not to be used in contact with potable water.

#### 2020 PAINT QUALITY:

- Ensure paints used are of quality and type to suit application and that:-
  - primers have good adhesion, covering power, rust-inhibiting and grain filling properties.
  - gloss finishing paints are of machine finish grade having high adhesion and high resistance to solvents, mineral oils, cutting oils, detergents, chipping and impact damage.

---

## Y92 MOTOR DRIVES - ELECTRIC

### 1040A MANUFACTURER FITTED SURGE SUPPRESSORS:

- Supply built-in surge suppressors to star connected motors and to all motors subject to star-delta starting to limit peak voltage to 1200 volts. Fitted by manufacturer.

### 2010A STANDARD OPERATING CONDITIONS:

- Ensure motors, starters and ancillary equipment are suitable for operation at full capacity at heights above sea level not exceeding 1000m, with air cooling at an average temperature over 24 hours not exceeding 35°C dry bulb with maximum conditions of 40°C dry bulb and 50 per cent RH.

### 2020 MOTORS - GENERAL:

- Standard
    - Use motors which conform to BS EN 60034, as applicable, which operate at lowest possible speed, compatible with performance requirements.
    - Terminal markings and direction of rotation to be in accordance with BS EN 60034-8
    - Provide isolation during repair and maintenance work in accordance with BS EN 62626-1
  - Ratings
    - Select maximum continuous rating (MCR) such that driven machine operates at correct speed or speeds at design duty.
  - When running continuously at design rated duty, the temperature of the motor parts is within limits defined in BS EN 60034-1
  - When provided with excess motor current (over-load) protection of thermal overcurrent release type, ensure operation is within tolerances of tripping as defined in BS EN 60947-4-1.
- Insulation
- Use motors with Class 130 or 155 to BS EN 60085 insulation, with temperature rise as defined in BS EN 60085
  - Conduit entry
    - Fit motor bodies with conduit entry terminal box or cable gland as required, and to suit type and size of cable being terminated.
  - Comply with BS EN 60034-5 and BS EN 62262 to achieve the specified degrees of protection classification provided by the integral design.

### 2025A MOTOR EFFICIENCY:

- Supply an IE2 motor with a minimum efficiency compliant with BS EN 60034-30-1 as shown in the table

below:

IE2 Motor Efficiency Limits (%) for 50 Hz: figures taken from BS EN 60034-30-1 Table 5				
Rated Power (kW)	No. of Poles/Synchronous Speed (RPM)			
	2/3000	4/1500	6/1000	8/750
0.12	53.6	59.1	50.6	39.8
0.18	60.4	64.7	56.6	45.9
0.20	61.9	65.9	58.2	47.4
0.25	64.8	68.5	61.6	50.6
0.37	69.5	72.7	67.6	56.1
0.40	70.4	73.5	68.8	57.2
0.55	74.1	77.1	73.1	61.7
0.75	77.4	79.6	75.9	66.2
1.1	79.6	81.4	78.1	70.8
1.5	81.3	82.8	79.8	74.1
2.2	83.2	84.3	81.8	77.6
3	84.6	85.5	83.3	80.0
4	85.8	86.6	84.6	81.9
5.5	87.0	87.7	86.0	83.8
7.5	88.1	88.7	87.2	85.3
11	89.4	89.8	88.7	86.9
15	90.3	90.6	89.7	88.0
18.5	90.9	91.2	90.4	88.6
22	91.3	91.6	90.9	89.1
30	92.0	92.3	91.7	89.8
37	92.5	92.7	92.2	90.3
45	92.9	93.1	92.7	90.7
55	93.2	93.5	93.1	91.0
75	93.8	94.0	93.7	91.6
90	94.1	94.2	94.0	91.9
110	94.3	94.5	94.3	92.3
132	94.6	94.7	94.6	92.6
160	94.8	94.9	94.8	93.0
200	95.0	95.1	95.0	93.5

2025B MOTOR EFFICIENCY:

- Supply a IE3 motor with a minimum efficiency compliant with BS EN 60034-30-1 as shown in the table

below:

IE3 Motor Efficiency Limits (%) for 50 Hz: figures taken from BS EN 60034-30-1 Table 7				
Rated Power (kW)	No. of Poles/Synchronous Speed (RPM)			
	2/3000	4/1500	6/1000	8/750
0.12	60.8	64.8	57.7	50.7
0.18	65.9	69.9	63.9	58.7
0.20	67.2	71.1	65.4	60.6
0.25	69.7	73.5	68.6	64.1
0.37	73.8	77.3	73.5	69.3
0.40	74.6	78.0	74.4	70.1
0.55	77.8	80.8	77.2	73.0
0.75	80.7	82.5	78.9	75.0
1.1	82.7	84.1	81.0	77.7
1.5	84.2	85.3	82.5	79.7
2.2	85.9	86.7	84.3	81.9
3	87.1	87.7	85.6	83.5
4	88.1	88.6	86.8	84.8
5.5	89.2	89.6	88.0	86.2
7.5	90.1	90.4	89.1	87.3
11	91.2	91.4	90.3	88.6
15	91.9	92.1	91.2	89.6
18.5	92.4	92.6	91.7	90.1
22	92.7	93.0	92.2	90.6
30	93.3	93.6	92.9	91.3
37	93.7	93.9	93.3	91.8
45	94.0	94.2	93.7	92.2
55	94.3	94.6	94.1	92.5
75	94.7	95.0	94.6	93.1
90	95.0	95.2	94.9	93.4
110	95.2	95.4	95.1	93.7
132	95.4	95.6	95.4	94.0
160	95.6	95.8	95.6	94.3
200	95.8	96.0	95.8	94.6

2025C MOTOR EFFICIENCY:

- Supply an IE4 motor with a minimum efficiency compliant with BS EN 60034-30-1 as shown in the table

below:

IE4 Motor Efficiency Limits (%) for 50 Hz: figures taken from BS EN 60034-30-1 Table 9				
Rated Power (kW)	No. of Poles/Synchronous Speed (RPM)			
	2/3000	4/1500	6/1000	8/750
0.12	66.5	69.8	64.9	62.3
0.18	70.8	74.7	70.1	67.2
0.20	71.9	75.8	71.4	68.4
0.25	74.3	77.9	74.1	70.8
0.37	78.1	81.1	78.0	74.3
0.40	78.9	81.7	78.7	74.9
0.55	81.5	83.9	80.9	77.0
0.75	83.5	85.7	82.7	78.4
1.1	85.2	87.2	84.5	80.8
1.5	86.5	88.2	85.9	82.6
2.2	88.0	89.5	87.4	84.5
3	89.1	90.4	88.6	85.9
4	90.0	91.1	89.5	87.1
5.5	90.9	91.9	90.5	88.3
7.5	91.7	92.6	91.3	89.3
11	92.6	93.3	92.3	90.4
15	93.3	93.9	92.9	91.2
18.5	93.7	94.2	93.4	91.7
22	94.0	94.5	93.7	92.1
30	94.5	94.9	94.2	92.7
37	94.8	95.2	94.5	93.1
45	95.0	95.4	94.8	93.4
55	95.3	95.7	95.1	93.7
75	95.6	96.0	95.4	94.2
90	95.8	96.1	95.6	94.4
110	96.0	96.3	95.8	94.7
132	96.2	96.4	96.0	94.9
160	96.3	96.6	96.2	95.1
200	96.5	96.7	96.3	95.4

**2060A MOTORS - OVER TEMPERATURE PROTECTION, THERMISTORS:**

- Fit positive temperature coefficient thermistors to BS EN 60034-11. Provide a minimum of 3 PTC thermistors in each motor with 2 ends terminated in motor terminal box clearly and permanently marked.
  - For motors rated between 30kW and 75kW provide a single thermistor in each phase.
  - For motors rated above 75kW provide two thermistors in each phase.
- Provide control unit to BS EN 60034 to motors fitted with thermistors. Interconnect control unit with thermistors and starter to trip starter when one or all of thermistors detect overheating.

**2085 VARIABLE SPEED DRIVE:**

- Use variable speed drive to match design and installed flow volumes. Ensure the drive meets the safety

requirements of BS EN 61800-5-1

- Load characteristic - variable torque for fans and pumps; constant torque for positive displacement equipment such as positive displacement pumps and air compressors.
- Electrical and control characteristics - CE marked and conforming to EMC and the Machinery Directives. The drives should be equipped with overcurrent and fault protection means; clearly indicate the range of operational supply and control voltages (AC/DC / no. of wires), with communication and BMS capabilities e.g. MODBUS; and be configurable using bluetooth and/or ethernet and/or BACnet protocols.

2090A GUARDS:

- Totally protect drives and couplings. Fit purpose made guards around all exposed or otherwise accessible drive shafts, pulleys, V-belts or couplings.
- Ensure guards comply with national or local safety codes, Acts and Bylaws and incorporate following

features

- Construction to BS EN ISO 12100 and generally of galvanized steel wire mesh
- Stiffening within the guards to ensure rigidity and freedom from vibration
- Allowance for prime mover adjustment during belt tensioning procedures
- Temporary access to all shafts for use of Tachometer

---

## Appendix One - Drawing Schedule

# Document Issue Register

Project **DFT Electrical Infrastructure Works 2017**

Service **Electrical**

Job Number **18080**

Sheet Number **1 OF 1**

Drawing Series Number <b>SMS 1 8 0 8 0</b>	DAY	15	15																
	MONTH	5	6																
	YEAR	17	17																

**DISTRIBUTION:**

Name	Company	1																	
Alex Pope	Faithful + Gould	1																	
Monika Polaszyk	Faithful + Gould	1																	
Simon Guild	Faithful + Gould		1																

ISSUED:	<b>BIW/Cloud/Disk/Email/FTP/Paper/ScanDocs/Questa/4Projects</b>	E	E																
	<b>Approval/COmment/Information/Preliminary/Tender/Contract</b>	CO	CO																
	Issue check by:	JC	JC																
	(hand signed initials)																		

TITLE	No.	Format	Scale	Size	Revision														
<b>LV Distribution Upgrade</b>																			
Basement Strip Out Works	18080-DB-B-00	pdf	NTS	A0	P1 T1														
Basement Proposed Works	18080-DB-B-01	pdf	NTS	A0	P1 T1														
Ground Floor Strip Out Works	18080-DB-G-00	pdf	NTS	A0	P1 T1														
Ground Floor Proposed Works	18080-DB-G-01	pdf	NTS	A0	P1 T1														
First Floor Strip Out Works	18080-DB-01-00	pdf	NTS	A0	P1 T1														
First Floor Proposed Works	18080-DB-01-01	pdf	NTS	A0	P1 T1														
Seond Floor Strip Out Works	18080-DB-02-00	pdf	NTS	A0	P1 T1														
Second Floor Proposed Works	18080-DB-02-01	pdf	NTS	A0	P1 T1														
Third Floor Strip Out Works	18080-DB-03-00	pdf	NTS	A0	P1 T1														
Third Floor Proposed Works	18080-DB-03-01	pdf	NTS	A0	P1 T1														
Seventh Floor Strip Out Works	18080-DB-07-00	pdf	NTS	A0	P1 T1														
Seventh Floor Proposed Works	18080-DB-07-01	pdf	NTS	A0	P1 T1														
Eigth Floor Strip Out Works	18080-DB-08-00	pdf	NTS	A0	P1 T1														
Eigth Floor Proposed Works	18080-DB-08-01	pdf	NTS	A0	P1 T1														
<b>Emergency Lighting</b>																			
Basement Proposed Works	18080-EL-B-01	pdf	NTS	A0	P1 T1														
Ground Floor Proposed Works	18080-EL-G-01	pdf	NTS	A0	P1 T1														
First Floor Proposed Works	18080-EL-01-01	pdf	NTS	A0	P1 T1														
Second Floor Proposed Works	18080-EL-02-01	pdf	NTS	A0	P1 T1														
Third Floor Proposed Works	18080-EL-03-01	pdf	NTS	A0	P1 T1														
Fourth Floor Proposed Works	18080-EL-04-01	pdf	NTS	A0	P1 T1														
Fifth Floor Proposed Works	18080-EL-05-01	pdf	NTS	A0	P1 T1														
Sixth Floor Proposed Works	18080-EL-06-01	pdf	NTS	A0	P1 T1														
Seventh Floor Proposed Works	18080-EL-07-01	pdf	NTS	A0	P1 T1														
Eigth Floor Proposed Works	18080-EL-08-01	pdf	NTS	A0	P1 T1														
<b>Control Panel Works</b>																			

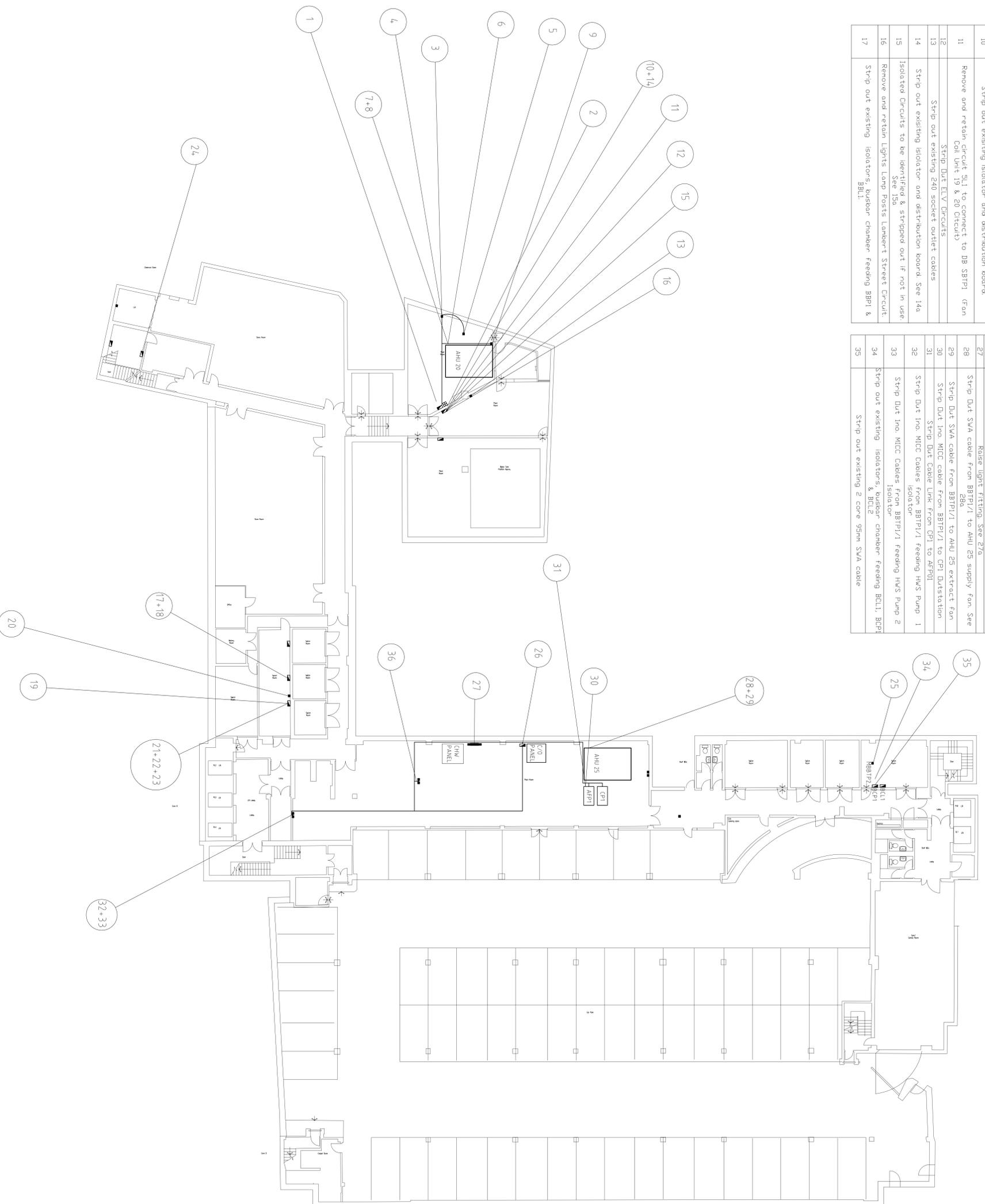


## Appendix Two - LV Upgrade Works

### A2.1 - Drawings

REF. NO.	DESCRIPTION
1	Strip out existing isolator and distribution board
2	Strip out Ino. MCCC Cable from SBPPI to Control Panel 8
3	Strip out Ino. MCCC Cable from SBPPI Feeding AHU 20 Extract Fan Isolator.
4	Strip out Ino. MCCC Cable from AHU 25 Extract Fan Isolator to Inverter.
5	Strip out Ino. MCCC Cable from AHU 25 Extract Fan Isolator to Extract Fan.
6	Strip out Ino. MCCC Cable from SBPPI Feeding AHU 25 Supply Fan Isolator.
7	Strip out Ino. MCCC Cable from SBPPI Feeding AHU 25 Light Switch
8	Remove Light Switch
9	Strip out Ino. MCCC Cable from SBPPI to AHU 20 Heat Recovery Pump.
10	Strip out existing isolator and distribution board
11	Remove and retain circuit SLL1 to connect to DB SBPPI (from Coil Unit 19 & 20 Circuit)
12	Strip out existing 240 socket outlet cables
13	Strip out existing isolator and distribution board. See 14a
14	Strip out existing isolator and distribution board. See 14a
15	Isolated Circuits to be identified & stripped out if not in use. See 15a
16	Remove and retain Lights Lamp Posts Lambert Street Circuit
17	Strip out existing Isolators, Busbar Chamber Feeding BBP1 & BBL1

18	Strip out existing Isolators, Busbar Chamber Feeding BBP1 & BBL1
19	Strip out existing isolator, and distribution board
20	Strip out FCU conductor
21	Strip out Ino. MCCC Cable from MBPPI Feeding Car Park Sump Pump
22	Strip out Ino. MCCC Cable from MBPPI Feeding Car Park Extract Fan no. 1
23	Strip out Ino. MCCC Cable from MBPPI Feeding Car Park Extract Fan no. 2
24	Strip out Isolator for Hydraulic Lift L8
25	Strip out existing isolator, and distribution board
26	Strip out Distribution panel for BBPPI/1 + 2
27	Raise Light Fitting. See 27a
28	Strip out SWA cable from BBPPI/1 to AHU 25 supply fan. See 28a
29	Strip out SWA cable from BBPPI/1 to AHU 25 extract fan
30	Strip out Ino. MCCC cable from BBPPI/1 to CFI Distribution
31	Strip out Cable Link from CFI to AFPU
32	Strip out Ino. MCCC Cables from BBPPI/1 Feeding HWS Pump 1 Isolator
33	Strip out Ino. MCCC Cables from BBPPI/1 Feeding HWS Pump 2 Isolator
34	Strip out existing Isolators, Busbar Chamber Feeding BCL1, BCPI & BCL2
35	Strip out existing 2 core 95mm SWA cable

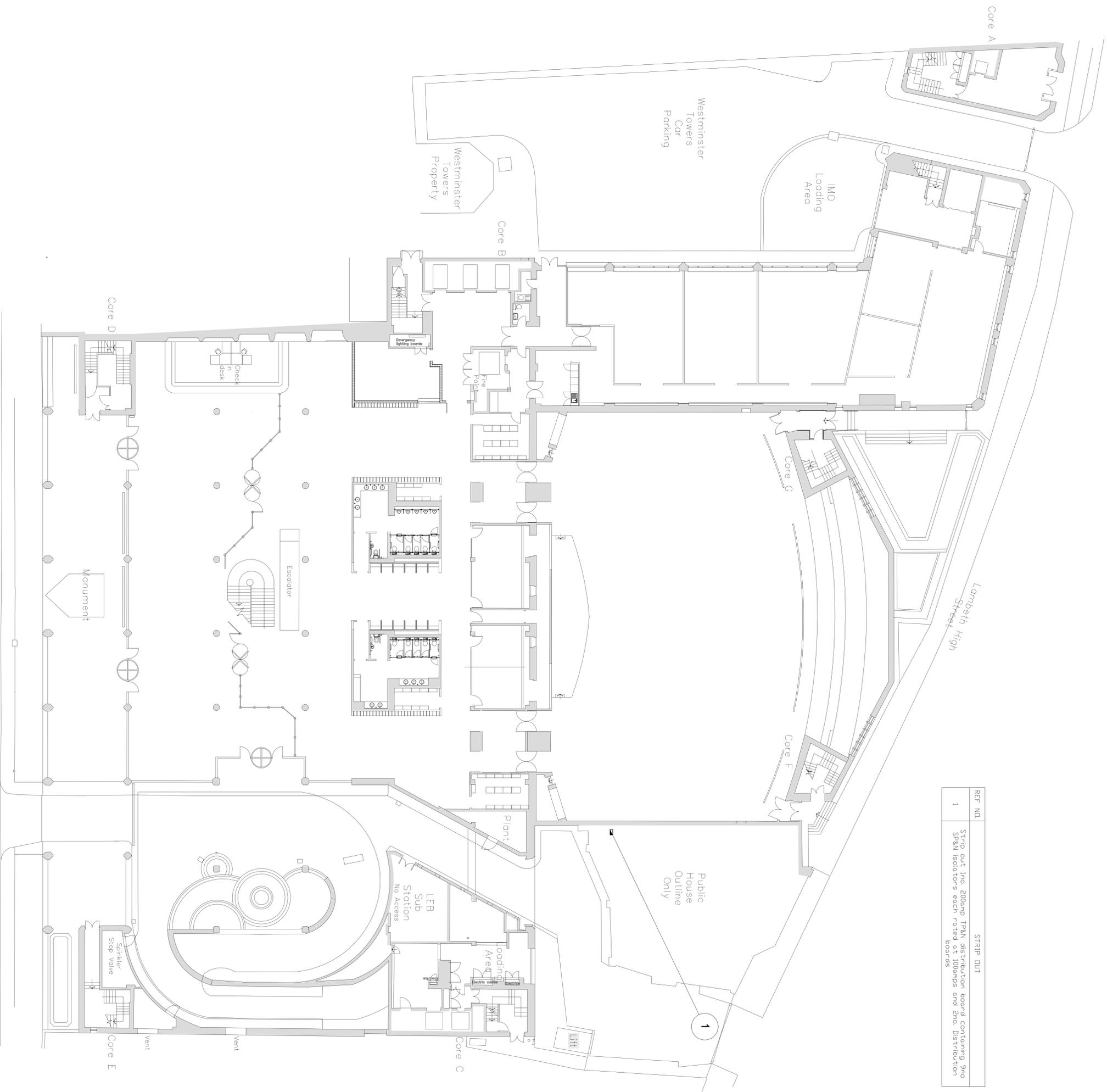


NOTES

- DO NOT SCALE THIS DRAWING. ALL DIMENSIONS TO BE TAKEN FROM THE DRAWING.
- THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH THE SPECIFICATION AND ANY OTHER DOCUMENTS REFERRED TO IN THE SPECIFICATION.
- EXISTING SUB-MAN-CABLING IS TO BE RETAINED AND RE-USED.
- INDEPENDENT LOCAL ISOLATORS TO SUIT NEW BB SIZE CABLES BETWEEN NEW ISOLATOR AND BB TO BE INSTALLED.
- EXACT LOCATIONS OF ALL NEW SERVICES AND EQUIPMENT SHALL BE DETERMINED BY THE CONTRACTOR UPON BREAKEWORKS COMMENCEMENT.
- THE CONTRACTOR SHALL PROVIDE ALL NECESSARY MATERIALS AND LABOR FOR THE WORKS.
- THE CONTRACTOR SHALL FURNISH ALL NECESSARY MATERIALS AND LABOR FOR THE WORKS.
- THE CONTRACTOR SHALL FURNISH ALL NECESSARY MATERIALS AND LABOR FOR THE WORKS.
- THE CONTRACTOR SHALL FURNISH ALL NECESSARY MATERIALS AND LABOR FOR THE WORKS.
- THE CONTRACTOR SHALL FURNISH ALL NECESSARY MATERIALS AND LABOR FOR THE WORKS.

Project	ELECTRICAL INFRASTRUCTURE WORK 2017
Title	LV DISTRIBUTION UPGRADE BASEMENT STRIP OUT WORKS
Client	DEPARTMENT FOR TRANSPORT
Architect	FAIRFIELD + GOULD
Project No.	8080
Drawn By	SP
Date	14/02/17
Checked	K
Status	N/S
Drawn To Scale	1:1
Revision	T1

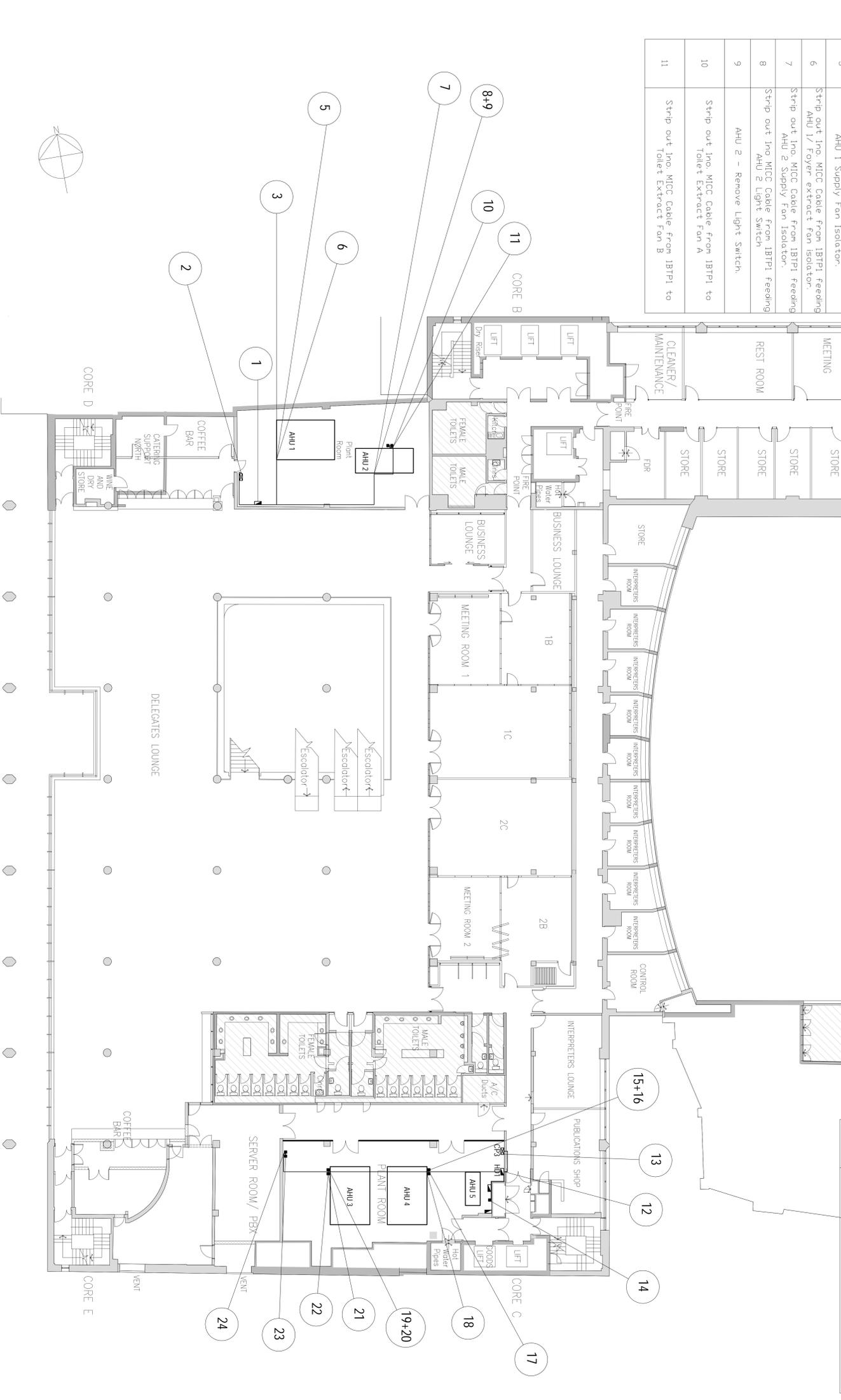
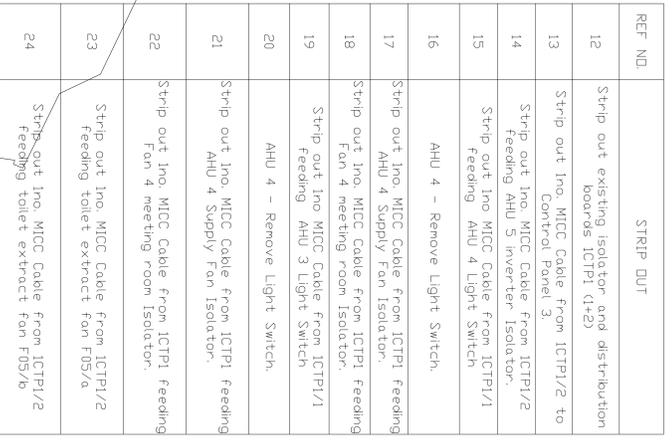
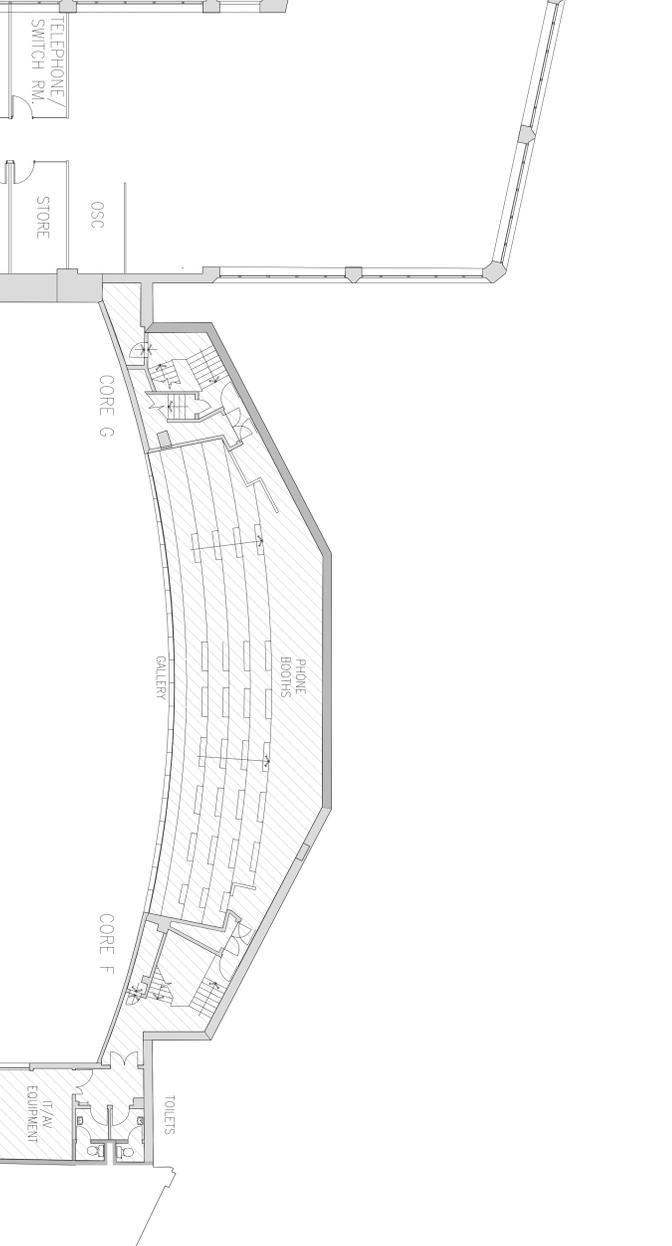
**TROJUP BYWATERS + ANDERS**  
 201 Fenchurch Lane  
 London EC3A 3AB  
 T: +44 (0)20 7324 1400  
 F: +44 (0)20 7324 1401  
 www.trojup.com



REF. NO.	DESCRIPTION
1	Strip out 300mm TRN distribution board containing 300mm span isolators each rated at 100amps and 250V. Distribution boards

- NOTES**
1. DO NOT SCALE THIS DRAWING. ALL DIMENSIONS TO BE CHECKED ON SITE BEFORE COMMENCEMENT OF WORKS.
  2. REFER TO THE SPECIFICATIONS AND DRAWINGS FOR THE SPECIFICATION. ANY DIFFERENCES OR DISCREPANCIES MUST BE REFERRED TO THE SERVICES ENGINEER.
  3. ALL NEW DISTRIBUTION BOARDS TO BE INSTALLED WITH 100mm SPAN ISOLATORS AND TO BE INSTALLED BY CONTRACTORS.
  4. EXACT LOCATIONS OF ALL NEW SERVICES AND EQUIPMENT TO BE DETERMINED BY THE SERVICES ENGINEER.
  5. THE CONTRACTOR SHALL FURNISH AND INSTALL WITHIN THE WORKS COMMENCEMENT DATE ALL NEW SERVICES AND EQUIPMENT TO BE INSTALLED WITHIN THE WORKS COMMENCEMENT DATE.
  6. THE CONTRACTOR SHALL FURNISH AND INSTALL WITHIN THE WORKS COMMENCEMENT DATE ALL NEW SERVICES AND EQUIPMENT TO BE INSTALLED WITHIN THE WORKS COMMENCEMENT DATE.
  7. THE CONTRACTOR SHALL FURNISH AND INSTALL WITHIN THE WORKS COMMENCEMENT DATE ALL NEW SERVICES AND EQUIPMENT TO BE INSTALLED WITHIN THE WORKS COMMENCEMENT DATE.
  8. THE CONTRACTOR SHALL FURNISH AND INSTALL WITHIN THE WORKS COMMENCEMENT DATE ALL NEW SERVICES AND EQUIPMENT TO BE INSTALLED WITHIN THE WORKS COMMENCEMENT DATE.
  9. THE CONTRACTOR SHALL FURNISH AND INSTALL WITHIN THE WORKS COMMENCEMENT DATE ALL NEW SERVICES AND EQUIPMENT TO BE INSTALLED WITHIN THE WORKS COMMENCEMENT DATE.
  10. THE CONTRACTOR SHALL FURNISH AND INSTALL WITHIN THE WORKS COMMENCEMENT DATE ALL NEW SERVICES AND EQUIPMENT TO BE INSTALLED WITHIN THE WORKS COMMENCEMENT DATE.

<p><b>TRCUP</b>  <b>ST WATERS</b>  <b>+ ANDREWS</b></p> <p><small>Architects and Engineers Ltd</small>          182 Cavendish Street          London W1D 7JF          T: +44 (0)20 7091 1000          F: +44 (0)20 7091 1001          E: info@trcup.co.uk          W: www.trcup.co.uk</p>	<p><b>PROJECT</b>          ELECTRICAL INFRASTRUCTURE WORKS          2017</p>	<p><b>THE</b>          DEPARTMENT FOR TRANSPORT          FAITHFUL + GOULD</p>	<p><b>DATE</b>          2017</p>
---	--	---	--------------------------------------



NOTES

- DO NOT SCALE THIS DRAWING. ALL DIMENSIONS TO BE TAKEN FROM THE DRAWING.
- THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH THE SPECIFICATION. ANY REFERENCES OR DISCREPANCIES MUST BE REFERRED TO THE SPECIFICATION.
- EXISTING SUB MAIN CABLES TO BE REMOVED AND RE-USED WHERE APPROPRIATE.
- ALL NEW DISTRIBUTION EQUIPMENT TO BE INSTALLED WITHIN THE EXISTING SUB MAIN CABLES TO BE REMOVED AND RE-USED WHERE APPROPRIATE.
- SHALL BE FULLY COORDINATED ON SITE.
- ALL REMOVED EQUIPMENT ARE TO BE CONNECTED TO NEW DISTRIBUTION BOARDS AND PROVIDED WITH THE APPROPRIATE ISOLATION AND PROVIDED WITH THE APPROPRIATE ISOLATION.
- ALL DISTRIBUTION BOARDS ARE TO BE PROVIDED WITH A SELECTION OF TESTS ON SPARE MAINS.
- ALL DISTRIBUTION BOARDS ARE TO BE PROVIDED WITH A SELECTION OF TESTS ON SPARE MAINS.
- THE EXISTING INSTALLATIONS BEFORE WORKS COMMENCE.
- ALL WORKS TO BE COMPLETED WITHIN THE SPECIFIED TIME FRAME.
- ALL WORKS TO BE COMPLETED WITHIN THE SPECIFIED TIME FRAME.
- ALL WORKS TO BE COMPLETED WITHIN THE SPECIFIED TIME FRAME.

**TROUP BYWATERS + ANDERS**  
*Developing Buildings as Life Generators*

18080-DB-01-00

PROJECT: ELECTRICAL INFRASTRUCTURE WORKS  
 2017

CLIENT: DEPARTMENT FOR TRANSPORT  
 ARCHITECT: FAITHFUL + GUILD

DATE: 18/08/2017

PROJECT NO: 18080-DB-01-00

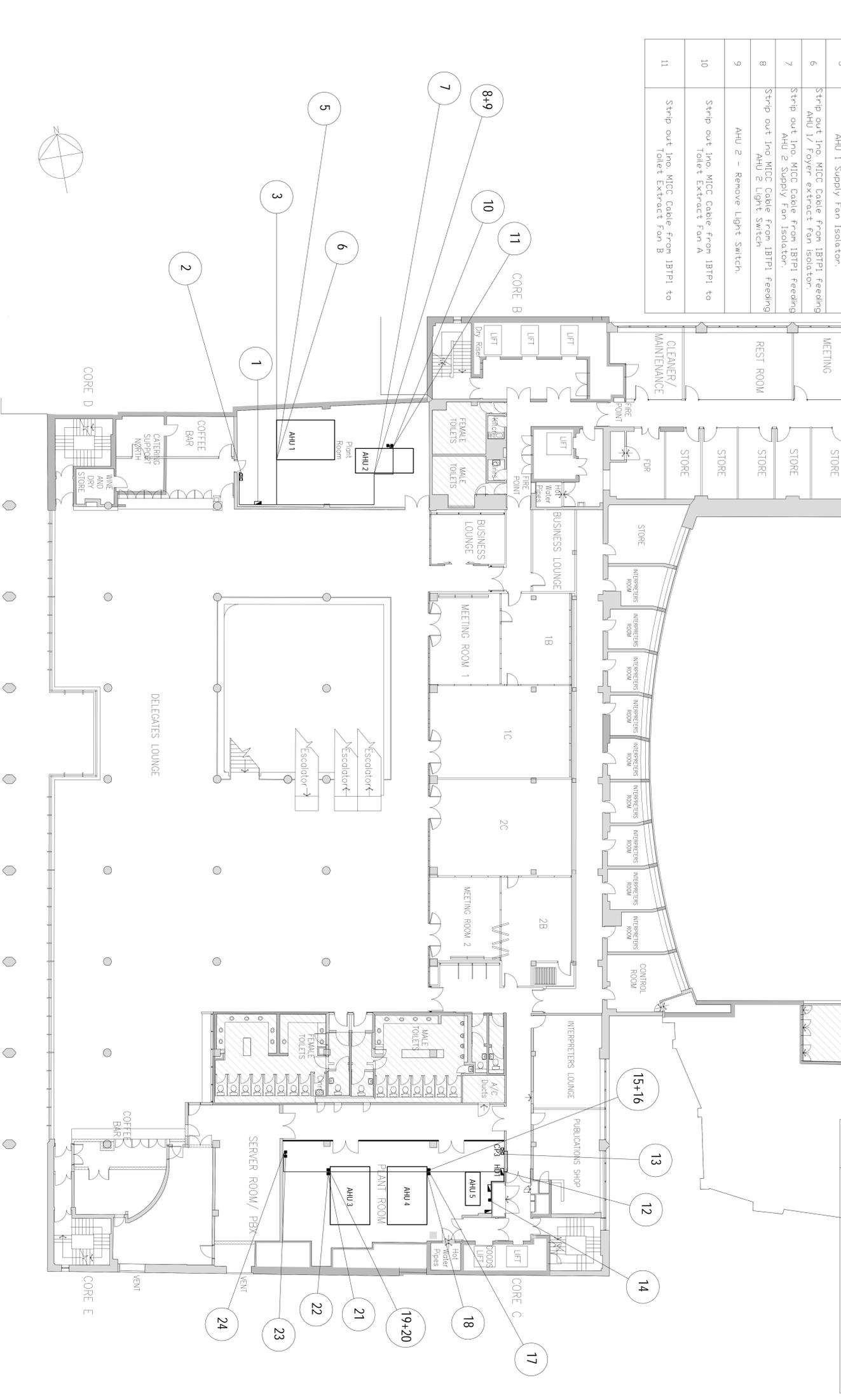
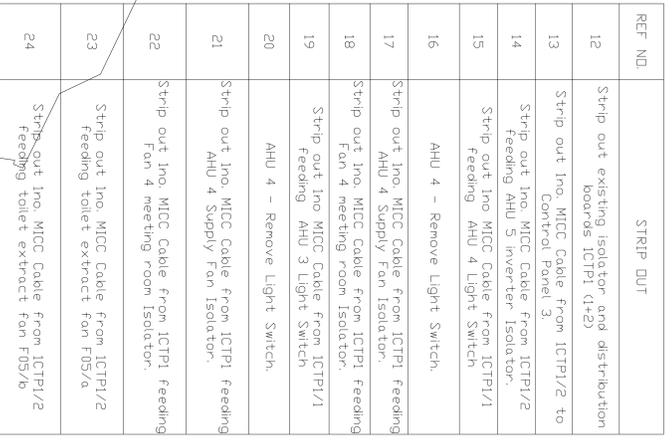
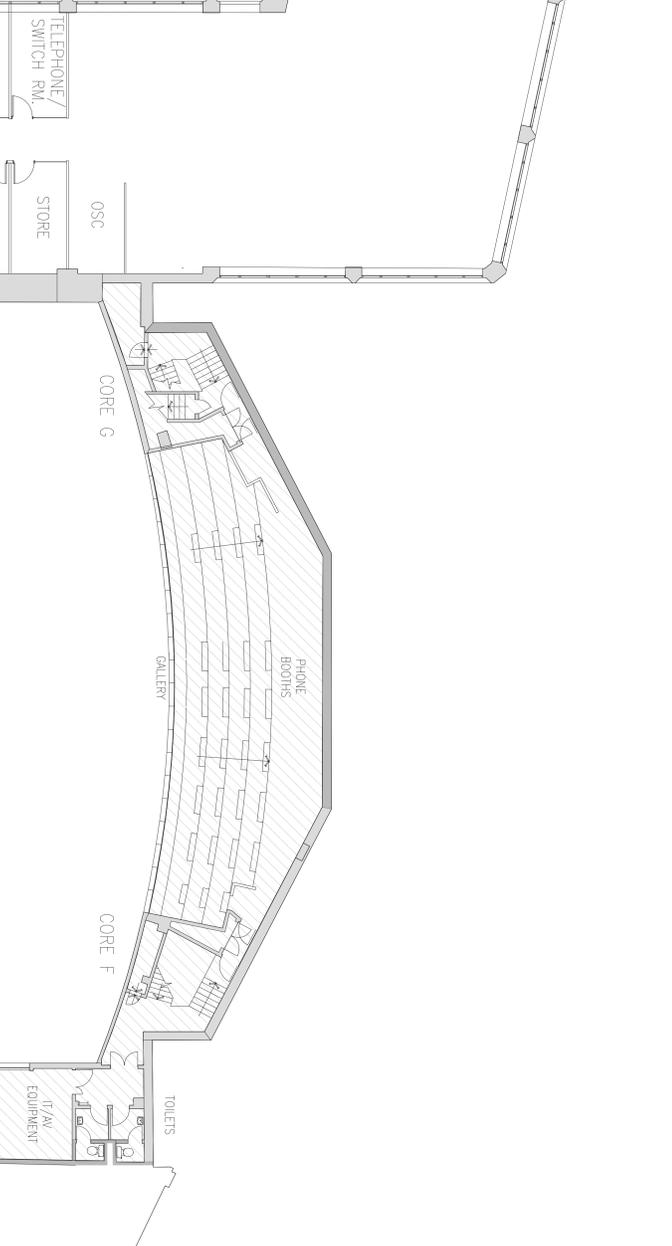
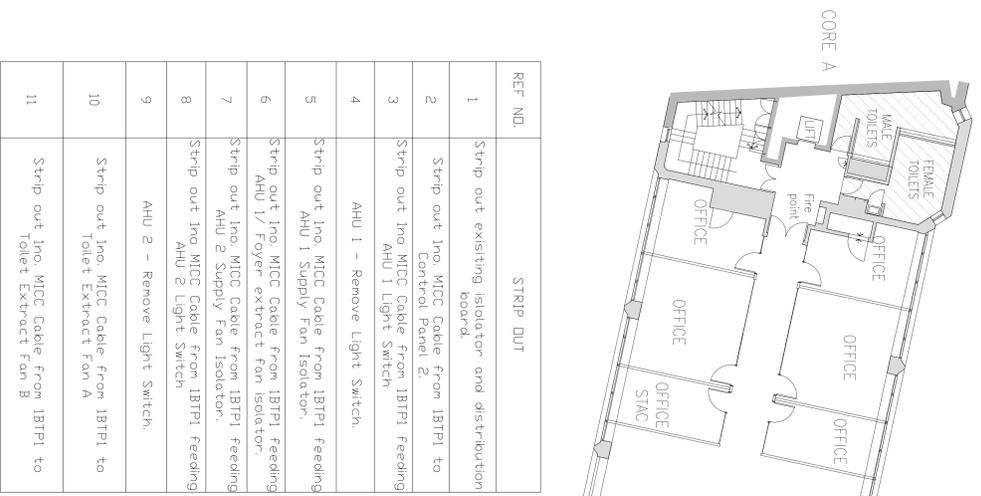
SCALE: A1:1

DATE: 18/08/2017

PROJECT NO: 18080-DB-01-00

SCALE: A1:1

DATE: 18/08/2017



NOTES

- DO NOT SCALE THIS DRAWING. ALL DIMENSIONS TO BE TAKEN FROM THE DRAWING.
- THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH THE SPECIFICATION. ANY REFERENCES OR DISCREPANCIES MUST BE REFERRED TO THE SPECIFICATION.
- EXISTING SUB MAIN CABLES TO BE REMOVED AND RE-USED WHERE POSSIBLE.
- ALL NEW DISTRIBUTION EQUIPMENT TO BE INSTALLED WITHIN THE EXISTING SUB MAIN CABLES TO BE REMOVED AND RE-USED WHERE POSSIBLE.
- SHALL BE FULLY COORDINATED ON SITE.
- PROVISIONS OF ALL WORKS TO BE AGREED UPON BEFORE COMMENCEMENT OF WORK.
- ALL REMOVED EQUIPMENT ARE TO BE CONNECTED TO NEW DISTRIBUTION BOARDS AND PROVIDED WITH THE APPROPRIATE LABELLING.
- ALL DISTRIBUTION BOARDS ARE TO BE PROVIDED WITH A LABELLING SYSTEM.
- THE EXISTING INSTALLATIONS BEFORE WORKS COMMENCEMENT AND WORKINGS ARE TO BE SUBJECT TO FINAL RESONANCE TESTS TO BE CARRIED OUT BY THE SERVICES ENGINEER.

**PROJECT:** ELECTRICAL INFRASTRUCTURE WORKS 2017

**CLIENT:** DEPARTMENT FOR TRANSPORT

**ARCHITECT:** FAITHFUL + GOULD

**ENGINEER:** TROUP BYWATERS ANDERSON

**DATE:** 18080-DB-01-00

**SCALE:** 1:1

**PROJECT NO.:** 18080-DB-01-00

**DATE:** 2017

**SCALE:** 1:1

**PROJECT NO.:** 18080-DB-01-00

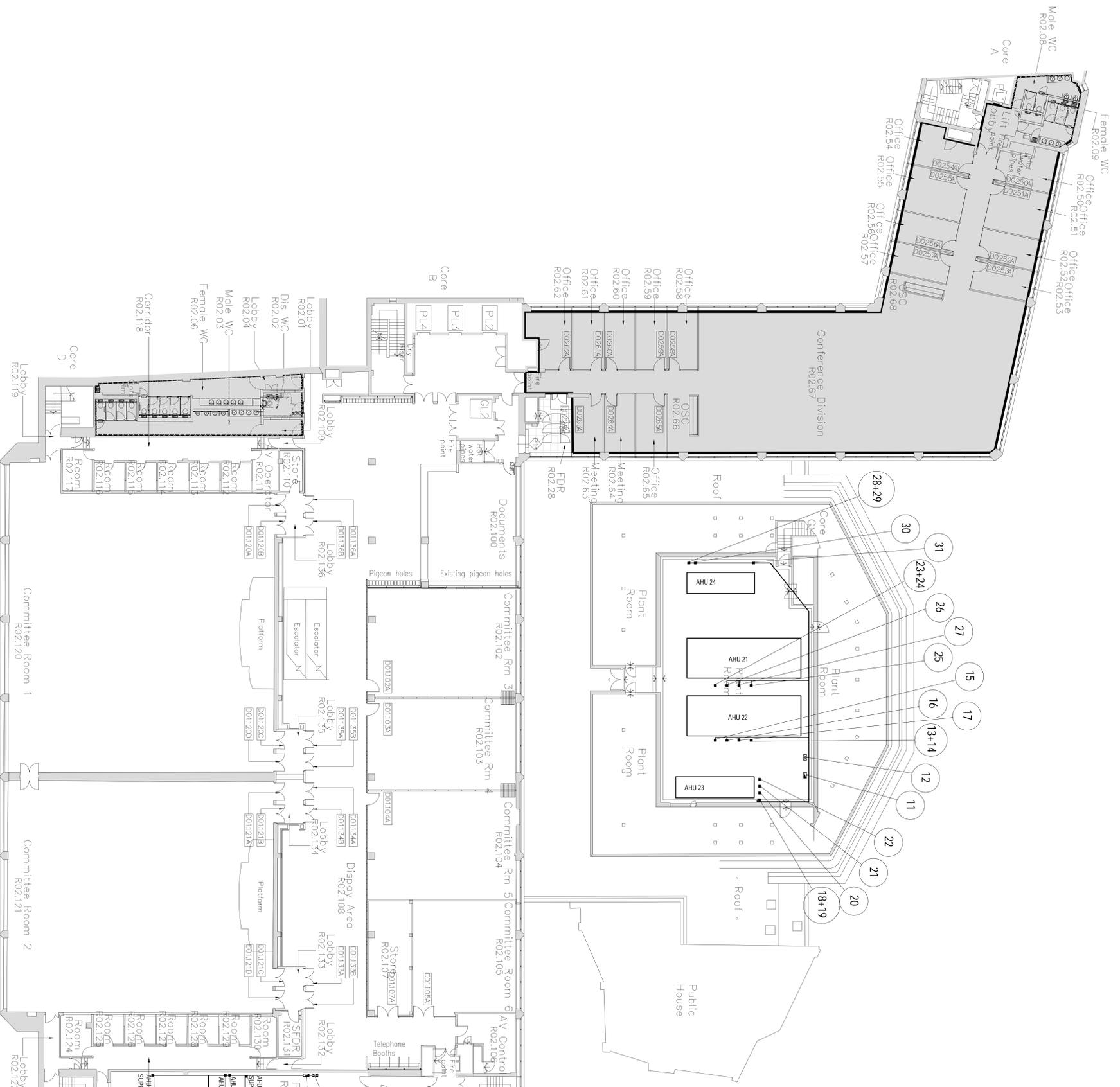
**DATE:** 2017

**SCALE:** 1:1

**PROJECT NO.:** 18080-DB-01-00

**DATE:** 2017

**SCALE:** 1:1



REF. NO.	STRIP OUT
1	Strip out existing isolator and distribution boards 2CTP2
2	Strip out Ino. MICC Cable from 2CTP2 to Control Panel 4.
3	Strip out Ino. MICC Cable from 2CTP2 feeding AHU 7 Light Switch
4	AHU 7 - Remove Light Switch.
5	Strip out Ino. MICC Cable from 2CTP2 feeding AHU 7 Supply Fan Isolator.
6	Strip out Ino. MICC Cable from 2CTP2 feeding AHU 7 extract fan Isolator.
7	Strip out Ino. MICC Cable from 2CTP2 feeding AHU 6 Light Switch
8	AHU 6 - Remove Light Switch.
9	Strip out Ino. MICC Cable from 2CTP2 feeding AHU 6 Supply Fan Isolator.
10	Strip out Ino. MICC Cable from 2CTP2 feeding AHU 6 extract fan Isolator.
11	Strip out existing isolator and distribution boards CHTP2 (1+2)
12	Strip out Ino. MICC Cable from CHTP2/2 to Control Panel 9.
13	Strip out Ino. MICC Cable from CHTP2/2 feeding AHU 22 Light Switch
14	AHU 22 - Remove Light Switch.
15	Strip out Ino. MICC Cable from CHTP2/2 feeding AHU 22 Supply Fan Isolator.
16	Strip out Ino. MICC Cable from CHTP2/2 feeding AHU 22 extract fan Isolator.
17	Strip out Ino. MICC Cable from CHTP2/2 feeding AHU 22 Heat Recovery Pump Isolator.
18	Strip out Ino. MICC Cable from CHTP2/2 feeding AHU 23 Light Switch
19	AHU 23 - Remove Light Switch.
20	Strip out Ino. MICC Cable from CHTP2/2 feeding AHU 23 Supply Fan Isolator.
21	Strip out Ino. MICC Cable from CHTP2/2 feeding AHU 23 extract fan Isolator.
22	Strip out Ino. MICC Cable from CHTP2/2 feeding AHU 23 Heat Recovery Pump Isolator.
23	Strip out Ino. MICC Cable from CHTP2/1 feeding AHU 21 Light Switch
24	AHU 21 - Remove Light Switch.
25	Strip out Ino. MICC Cable from CHTP2/1 feeding AHU 21 Supply Fan Isolator.
26	Strip out Ino. MICC Cable from CHTP2/1 feeding AHU 21 extract fan Isolator.
27	Strip out Ino. MICC Cable from CHTP2/1 feeding AHU 21 Heat Recovery Pump Isolator.
28	Strip out Ino. MICC Cable from CHTP2/1 feeding AHU 24 Light Switch
29	AHU 24 - Remove Light Switch.
30	Strip out Ino. MICC Cable from CHTP2/1 feeding AHU 24 Supply Fan Isolator.
31	Strip out Ino. MICC Cable from CHTP2/1 feeding AHU 24 extract fan Isolator.

### NOTES

- DO NOT SCALE THIS DRAWING. ALL DIMENSIONS TO BE TAKEN FROM THE DRAWING.
- THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH THE SPECIFICATION. ANY DIFFERENCES OR DISCREPANCIES MUST BE REFERRED TO THE DESIGNER.
- EXISTING SUB-MAN OVERHEADS TO BE REMOVED AND RE-USED WHERE APPROPRIATE.
- ALL NEW DISTRIBUTION EQUIPMENT TO BE INSTALLED WITHIN THE EXISTING SUB-MAN OVERHEADS TO BE REMOVED AND RE-USED WHERE APPROPRIATE.
- ALL NEW SERVICES AND COMPONENTS TO BE INSTALLED WITHIN THE EXISTING SUB-MAN OVERHEADS TO BE REMOVED AND RE-USED WHERE APPROPRIATE.
- ALL REMOVED COMPONENTS ARE TO BE PROVIDED WITH A LABEL AND STORED IN THE APPROPRIATE MANNER.
- ALL DISTRIBUTION BOARDS ARE TO BE PROVIDED WITH A LABEL AND STORED IN THE APPROPRIATE MANNER.
- ALL REMOVED COMPONENTS ARE TO BE PROVIDED WITH A LABEL AND STORED IN THE APPROPRIATE MANNER.
- THE EXISTING INSTALLATIONS BEFORE WORKS COMMENCE MUST BE FULLY INSPECTED AND RECORDED.
- ALL WORK MUST BE SUBJECT TO FINAL DESIGN APPROVAL BY THE DESIGNER.
- ALL WORK MUST BE COMPLETED WITHIN THE SPECIFIED TIME FRAME.
- ALL WORK MUST BE COMPLETED WITHIN THE SPECIFIED TIME FRAME.
- ALL WORK MUST BE COMPLETED WITHIN THE SPECIFIED TIME FRAME.
- ALL WORK MUST BE COMPLETED WITHIN THE SPECIFIED TIME FRAME.
- ALL WORK MUST BE COMPLETED WITHIN THE SPECIFIED TIME FRAME.
- ALL WORK MUST BE COMPLETED WITHIN THE SPECIFIED TIME FRAME.

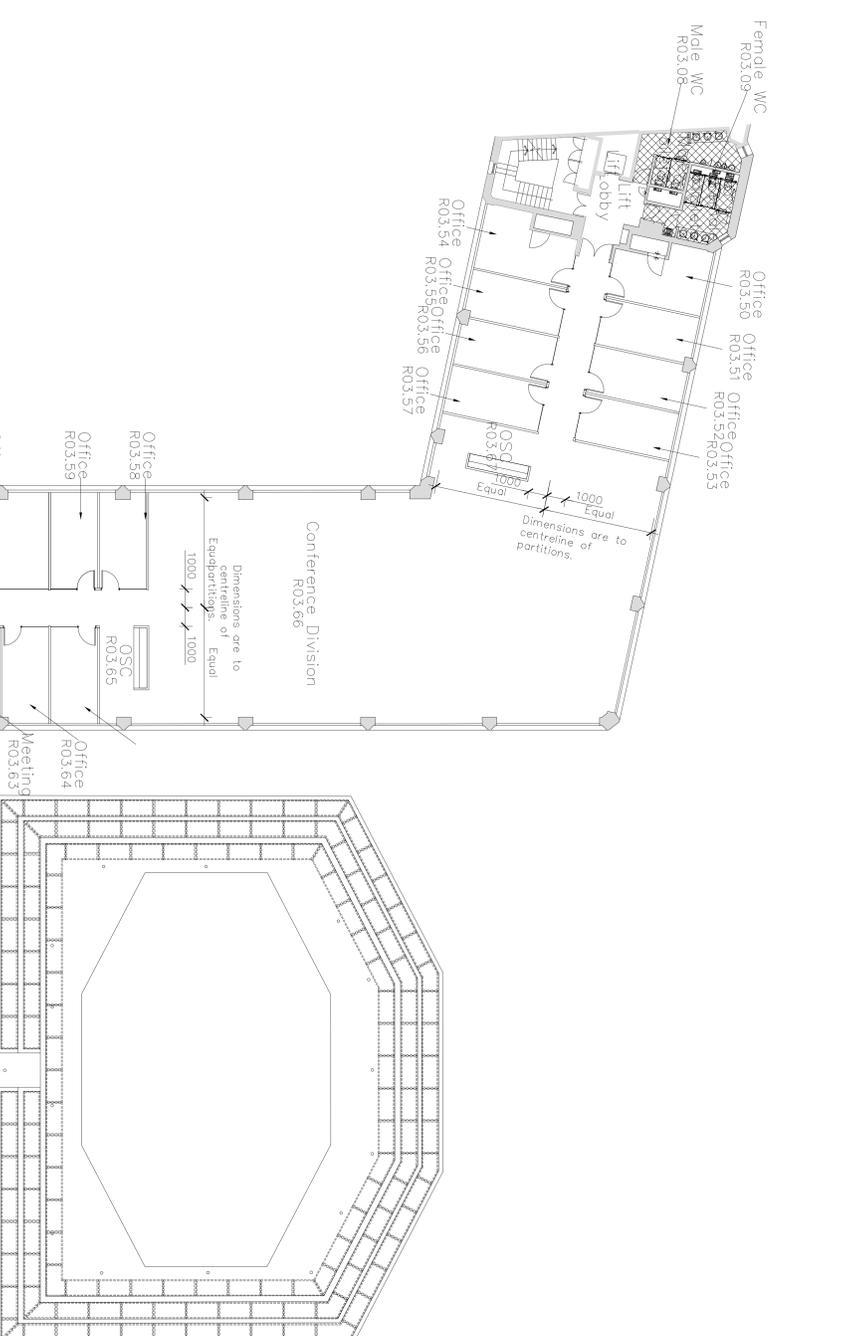
Project No.	18080-DB-02-00
Client	DEPARTMENT FOR TRANSPORT
Contract	FATHULL + GOUND
Project No.	18080
Drawn By	SM
Checked	JC
Date	JUNE 17
Scale	N/S
Author	SM
Revision	1

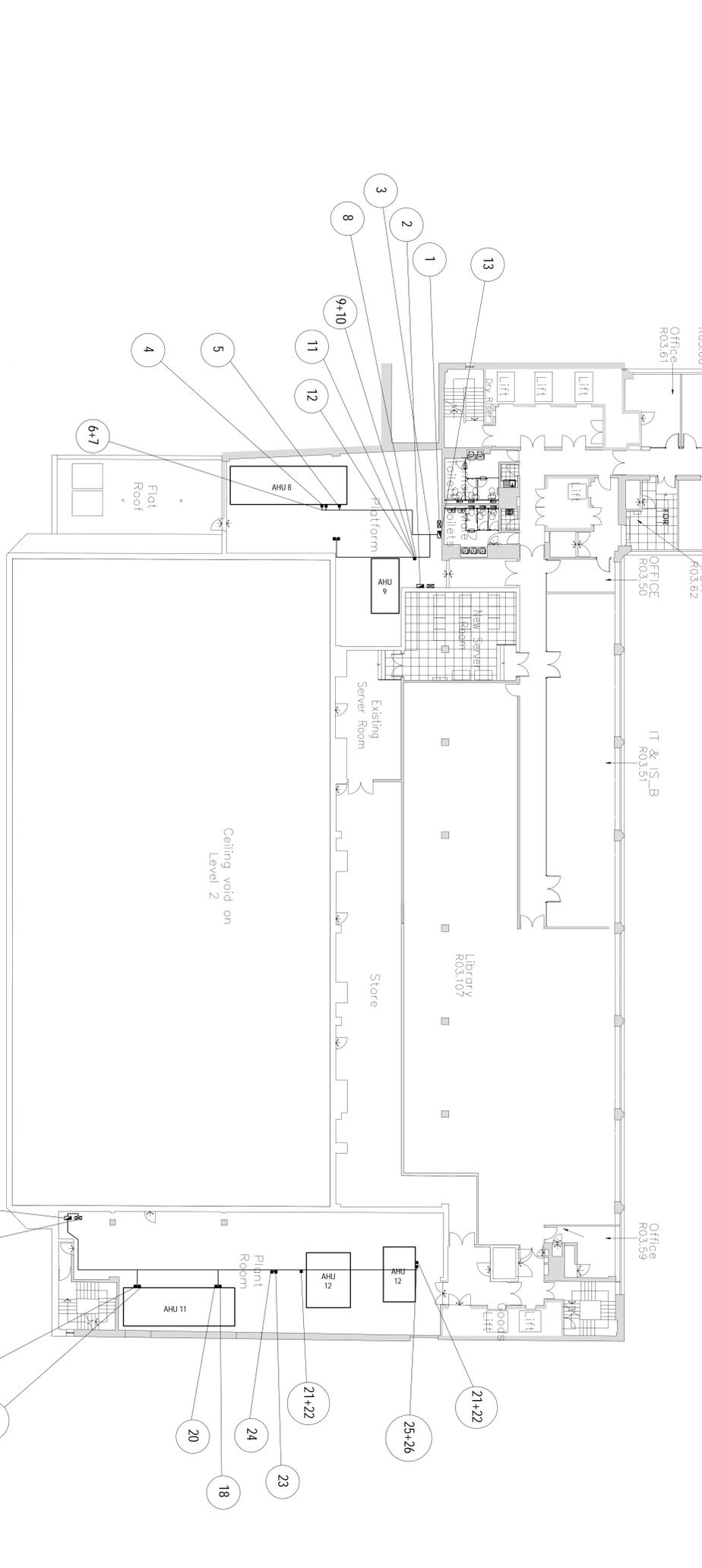
Rev	Desc	Drawn	Check	Date

**TROJUP**  
**BYWATERS**  
**+ ANDERS**  
Architects  
101 Park Street  
London W1P 100  
T: +44 (0)20 706 1000  
F: +44 (0)20 706 1001  
www.trojupbywatersandanders.com



REF. NO.	Strip Out
1	Strip out existing isolator and distribution boards 3B1P1 (1+2)
2	Strip out Ino. MICC Cable from 3B1P1 feeding AHU 10 extract fan Isolator.
3	Strip out Ino. MICC Cable from 3B1P1 feeding AHU 10 Supply Fan Isolator.
4	Strip out Ino. MICC Cable from 3B1P1/1 feeding AHU 8 Supply Fan Isolator.
5	Strip out Ino. MICC Cable from 3B1P1/1 feeding AHU 8 extract fan Isolator.
6	Strip out Ino MICC Cable from 3B1P1/2 feeding AHU 8 Light Switch
7	AHU 8 – Remove Light Switch.
8	Strip out Ino. MICC Cable from 3B1P1/1 feeding AHU 9 Supply and Extract Starter Panel Isolator.
9	Strip out Ino MICC Cable from 3B1P1/2 feeding AHU 9 Light Switch
10	AHU 9 – Remove Light Switch.
11	Strip out Ino. MICC Cable from 3B1P1/1 feeding AHU 8 tablet extract fan standby Isolator.
12	Strip out Ino. MICC Cable from 3B1P1/1 feeding AHU 8 Heat Recovery Pump Isolator.
13	Strip out Ino. MICC Cable from 3B1P1/2 to Plant Room lighting.
14	Strip out existing isolator and distribution boards 3C1P2 (1+2)
15	Strip out Ino MICC Cable from 3C1P2/1 feeding AHU 11 Light Switch
16	AHU 11 – Remove Light Switch.
17	Strip out Ino. MICC Cable from 3C1P2/1 feeding AHU 11 Supply Fan Isolator.
18	Strip out Ino. MICC Cable from 3C1P2/1 feeding AHU 11 extract fan Isolator.
19	Strip out Ino. MICC Cable from 3C1P2/2 feeding Control Panel 6 Outstation
20	Strip out Ino. MICC Cable from 3C1P2/2 feeding AHU 11 Heat Recovery Pump
21	Strip out Ino MICC Cable from 3C1P2/2 feeding AHU 12 & 13 Light Switch
22	AHU 12 & 13– Remove Light Switch.
23	Strip out Ino. MICC Cable from 3C1P2/1 feeding AHU 12 Supply Fan Isolator.
24	Strip out Ino. MICC Cable from 3C1P2/1 feeding AHU 12 extract fan Isolator.
25	Strip out Ino. MICC Cable from 3C1P2/1 feeding AHU 13 Supply Fan Isolator.
26	Strip out Ino. MICC Cable from 3C1P2/2 feeding AHU 13 extract fan Isolator.



27/03/2017 10:00:00 AM  
 27/03/2017 10:00:00 AM  
 27/03/2017 10:00:00 AM

- DO NOT SCALE THIS DRAWING. ALL DIMENSIONS TO BE TAKEN FROM THE DRAWING.
- THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH THE SPECIFICATION. ANY DIFFERENCES OR DISCREPANCIES MUST BE CLARIFIED BY THE CLIENT.
- EXISTING SUB MAIN CABLES TO BE REMOVED AND RE-USED WHERE APPROPRIATE.
- ALL NEW DISTRIBUTION EQUIPMENT TO BE INSTALLED WITHIN THE EXISTING SUB MAIN CABLES TO BE REMOVED AND RE-USED WHERE APPROPRIATE.
- SHALL BE FULLY COORDINATED ON SITE.
- PROVISION OF ALL NEW SERVICES AND COMMENTS SHALL BE FULLY COORDINATED ON SITE.
- ALL REMOVED EQUIPMENT ARE TO BE CONNECTED TO NEW DISTRIBUTION BOARDS AND PROVIDED WITH THE APPROPRIATE ISOLATION.
- ALL DISTRIBUTION BOARDS ARE TO BE PROVIDED WITH A SELECTION OF TESTS ON SPARE MAINS.
- THE EXISTING INSTALLATIONS BEFORE WORKS COMMENCE MUST BE FULLY TESTED AND CERTIFIED BY A COMPETENT ENGINEER.
- ALL WORKS MUST BE SUBJECT TO FINAL DESIGN APPROVAL BY THE CLIENT.
- ALL WORKS MUST BE COMPLETED WITHIN THE SPECIFIED TIME FRAME.
- ALL WORKS MUST BE COMPLETED WITHIN THE SPECIFIED TIME FRAME.
- ALL WORKS MUST BE COMPLETED WITHIN THE SPECIFIED TIME FRAME.
- ALL WORKS MUST BE COMPLETED WITHIN THE SPECIFIED TIME FRAME.
- ALL WORKS MUST BE COMPLETED WITHIN THE SPECIFIED TIME FRAME.

Project	ELECTRICAL INFRASTRUCTURE WORKS 2017		
Client	DEPARTMENT FOR TRANSPORTATION		
Architect	FAITHFUL + GOULD		
Project No.	18080	Drawn By	SM
Scale	M/S	Checked	JC
Revision		Date	JUNE 17
Drawing No.	18080-DB-03-00	Scale	M/S
		Revision	11

**TROJUP**  
**BYWATERS**  
**+ ANDERS**

Architects, Engineers & Planners  
 101 Finchley Road  
 London NW11 7BU  
 T: +44 (0)20 7091 1000  
 F: +44 (0)20 7091 1001  
 W: www.trojup.com

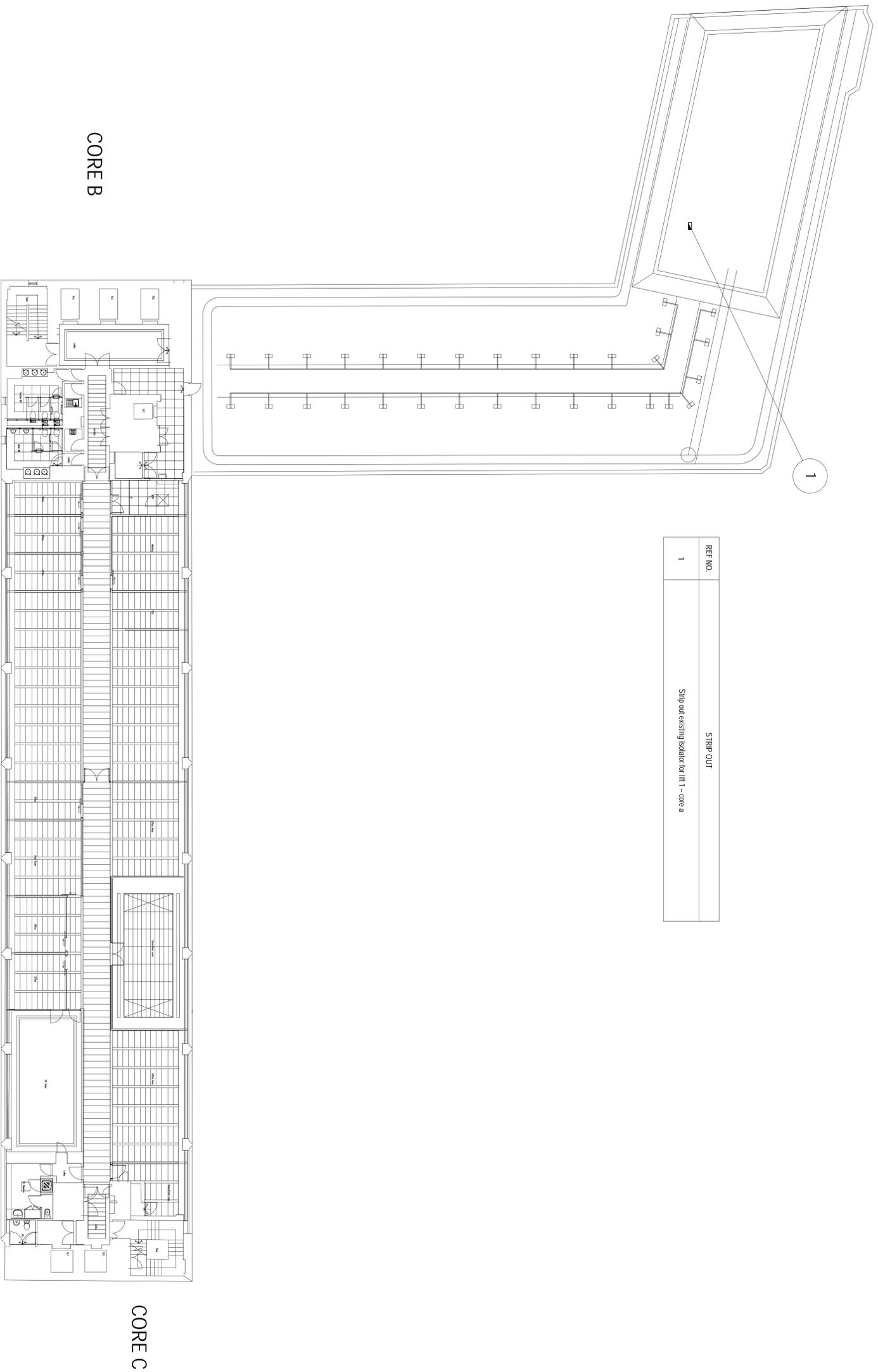
Rev / Desc

Desc / Rev

Rev / Desc

Desc / Rev

CORE A



REF NO.	STRIP OUT
1	Strip out existing isolator for lift 1 - core a

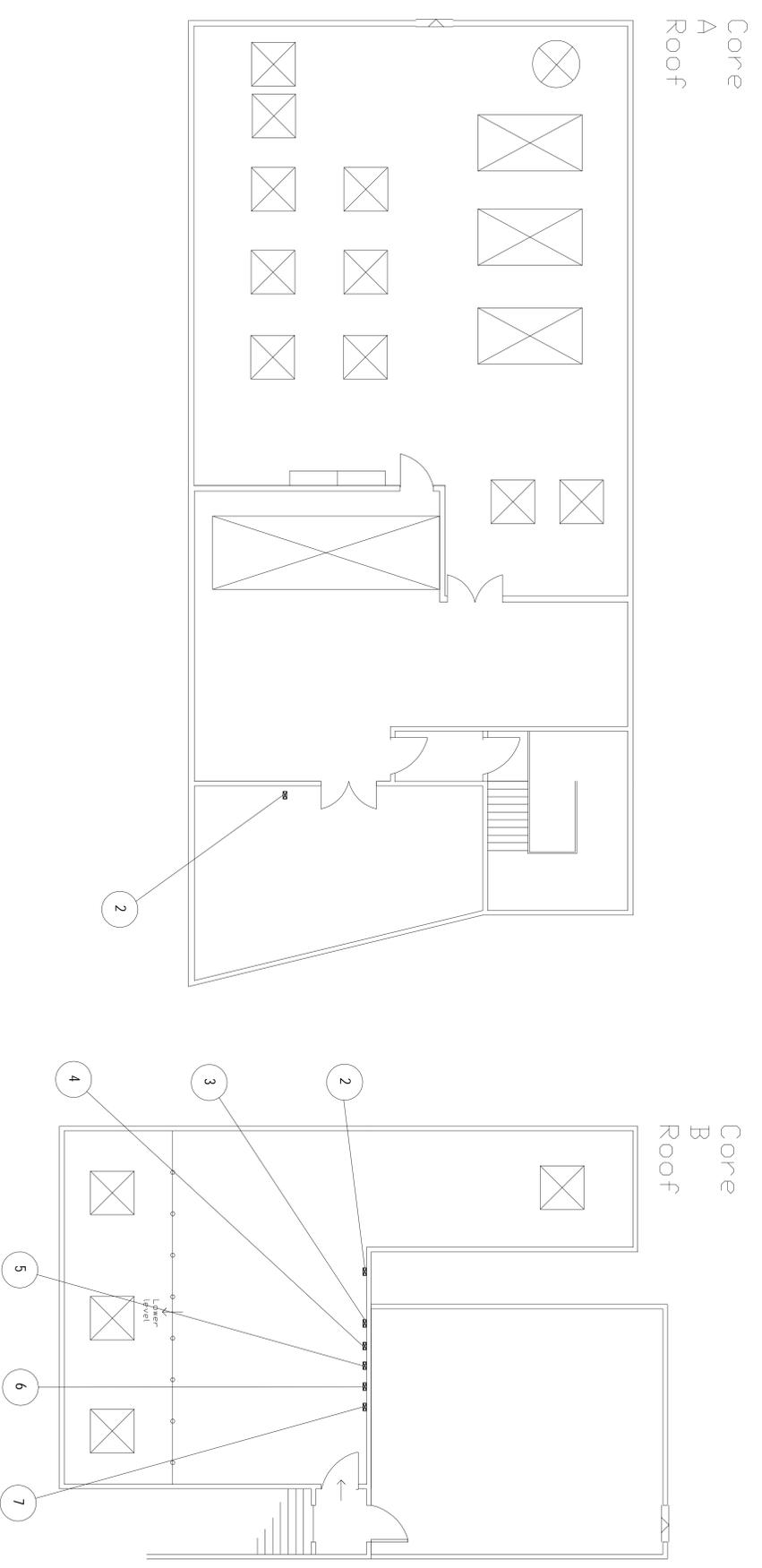
NOTES

1. DO NOT SCALE THIS DRAWING. ALL DIMENSIONS TO BE CHECKED ON SITE BEFORE COMMENCEMENT OF WORKS. THE SPECIFICATION, ANY DIFFERENCES OR DISCREPANCIES MUST BE REFERRED TO THE SERVICES ENGINEER.
2. ALL NEW DISTRIBUTION BOARDS TO BE INSTALLED WITH ANDEPARENT LOCAL SOLUTIONS TO SUIT NEW SIZE BY CONTRACTORS.
3. EXACT LOCATIONS OF ALL NEW SERVICES AND EQUIPMENT TO BE DETERMINED AND PROVIDED WITH THE APPROPRIATE WORKS COMMENCE.
4. DISTRIBUTIONS AND PROVIDED WITH THE APPROPRIATE RATED EACH TYPE.
5. SELECTION OF WCES ON SPARE WMS.
6. THE CONTRACTOR SHALL FURNISH/ARRANGE THESELVES WITH MCB AND WCB RATINGS MAY BE SUBJECT TO FINAL DESIGN AND SELECTIONS TO BE AGREED WITH THE SERVICES ENGINEER.

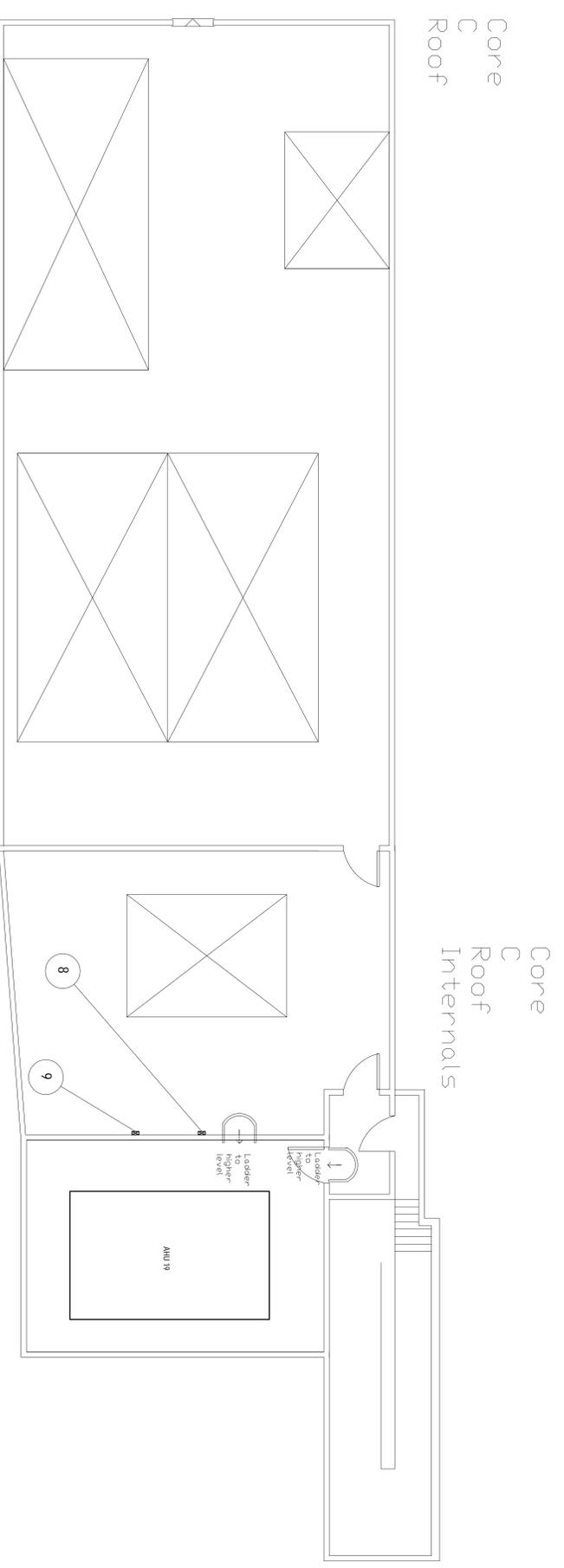
Client: DEPARTMENT FOR TRANSPORTATION  
 Address: FAITHFUL + GUILD  
 Project No: 18080-DB-07-00  
 Date: 2017  
 Scale: AS SHOWN  
 Revision: T1

**TRCUP**  
**BY WATERS**  
**+ ANDREWS**  
 Architects and Engineers Ltd  
 185 Liverpool Street  
 London EC3A 3DF  
 T: +44 (0)20 7596 1000  
 E: info@trcup.co.uk  
 W: www.trcup.co.uk

Project: ELECTRICAL INFRASTRUCTURE WORKS 2017  
 Title: LV DISTRIBUTION UPGRADE SEVENTH FLOOR STRIP OUT WORKS  
 Drawing No: 18080-DB-07-00  
 Revision: T1



REF. NO.	DESCRIPTION
1	Strip out isolator for Lift 1 and associated containment.
2	Strip out isolator for Lift 2, and associated containment.
3	Strip out isolating switch from LV switch room
4	Strip out isolator for Lift 5 busbar chamber and associated containment.
5	Strip out isolator for Lift 3 busbar chamber and associated containment.
6	Strip out isolator for Lift 4 busbar chamber and associated containment.
7	Strip out control fuse switch, busbar chamber and associated containment.
8	Strip out isolator for Lift 6 and associated containment.
9	Strip out isolator for Lift 7 and associated containment.



REF. NO.	DESCRIPTION
8	Strip out isolator for Lift 6 and associated containment.
9	Strip out isolator for Lift 7 and associated containment.

NOTES

- DO NOT SCALE THIS DRAWING. ALL DIMENSIONS TO BE TAKEN FROM THIS DRAWING.
- THIS DRAWING SHOULD BE READY FOR CONSTRUCTION WITH THE SPECIFICATION AND ANY REFERENCES OR DISCREPANCIES MUST BE CLARIFIED BY THE CLIENT.
- EXISTING SUBMITTALS MUST BE REVIEWED AND RE-USED WHERE APPROPRIATE.
- ALL NEW DISTRIBUTION EQUIPMENT TO BE INSTALLED WITHIN THE EXISTING CONTAINMENT SHALL BE INSTALLED WITHIN THE EXISTING CONTAINMENT.
- ALL NEW WORK SHALL BE INSTALLED WITHIN THE EXISTING CONTAINMENT.
- ALL REMOVED WORK SHALL BE RECONNECTED TO NEW WORK.
- ALL DISTRIBUTION WORK SHALL BE PROVIDED WITH A PROTECTIVE COVER.
- ALL DISTRIBUTION WORK SHALL BE PROVIDED WITH A PROTECTIVE COVER.
- THE EXISTING INSTALLATIONS BEFORE WORKS COMMENCE.
- ALL WORK SHALL BE SUBJECT TO FINAL DESIGN APPROVAL BY THE CLIENT.
- ALL WORK SHALL BE SUBJECT TO FINAL DESIGN APPROVAL BY THE CLIENT.

**PROJECT**  
 ELECTRICAL INFRASTRUCTURE WORKS  
 2017

**CLIENT**  
 DEPARTMENT FOR TRANSPORT

**ARCHITECT**  
 FATHULLAH + COULD

**PROJECT NO.** 18080  
**DATE** JUNE 17  
**SCALE** A3

**DESIGNER** JAC  
**DATE** JUNE 17  
**SCALE** A3

**PROJECT NO.** 18080-DB-08-00  
**DATE** JUNE 17  
**SCALE** A3

**PROJECT**  
 ELECTRICAL INFRASTRUCTURE WORKS  
 2017

**CLIENT**  
 DEPARTMENT FOR TRANSPORT

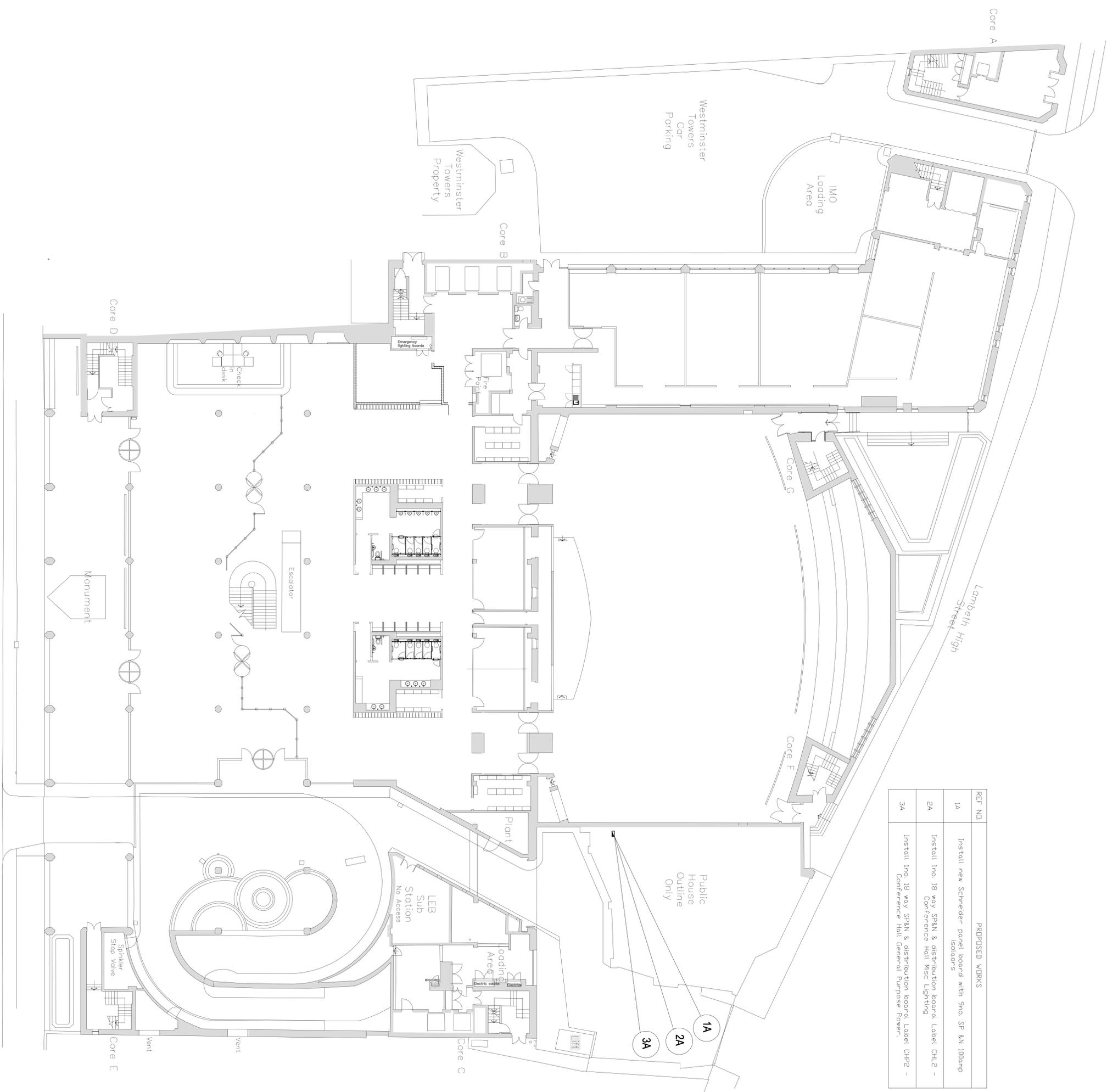
**ARCHITECT**  
 FATHULLAH + COULD

**PROJECT NO.** 18080  
**DATE** JUNE 17  
**SCALE** A3

**DESIGNER** JAC  
**DATE** JUNE 17  
**SCALE** A3

**PROJECT NO.** 18080-DB-08-00  
**DATE** JUNE 17  
**SCALE** A3





REF. NO.	PROPOSED WORKS
1A	Install new Schneider panel board with 9no. SP & 100amp Isolators
2A	Install 1no. 18 way SP&N & distribution board. Label CHL2 - Conference Hall Misc Lighting
3A	Install 1no. 18 way SP&N & distribution board. Label CHP2 - Conference Hall General Purpose Power.

- NOTES**
1. DO NOT SCALE THIS DRAWING. ALL DIMENSIONS TO BE CHECKED ON SITE BEFORE COMMENCEMENT OF WORKS.
  2. ALL WORKS TO BE COMPLETED IN ACCORDANCE WITH THE SPECIFICATION. ANY DEVIATIONS OR DISCREPANCIES MUST BE REFERRED TO THE SERVICES ENGINEER.
  3. ALL NEW DISTRIBUTION BOARDS TO BE INSTALLED WITH APPROPRIATE LOCAL SOLAINTERS TO SUIT NEW SIZE BY CONTRACTORS.
  4. EXACT LOCATIONS OF ALL NEW SERVICES AND EQUIPMENT TO BE DETERMINED BY THE SERVICES ENGINEER.
  5. PASSINGS OF ALL WORKS TO BE AGREED UPON BEFORE WORKS COMMENCE.
  6. DISTRIBUTIONS AND PROVIDED WITH THE APPROPRIATE RATED MAINS TYPE.
  7. THE CONTRACTOR SHALL FURNISH AND INSTALL ALL MAINS AND SERVICES TO BE CONNECTED TO NEW WORKS.
  8. SELECTION OF MAINS ON SP&N WMS.
  9. THE CONTRACTOR SHALL FURNISH AND INSTALL ALL MAINS AND SERVICES TO BE CONNECTED TO NEW WORKS AND SELECTIONS TO BE AGREED WITH THE SERVICES ENGINEER.

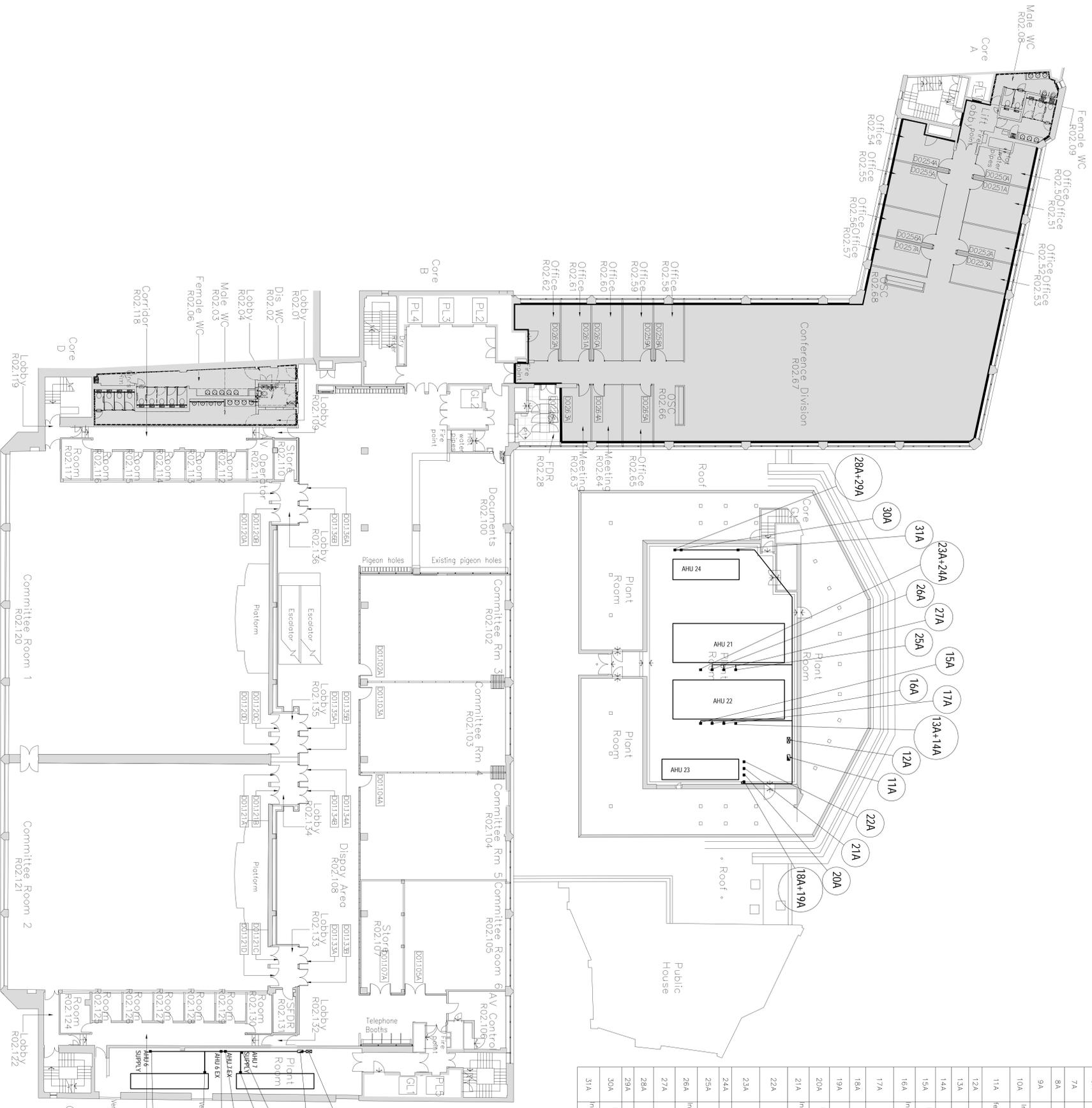
Rev	Date	Description	Rev	Check	Date

**TRICUP**  
**ST WATERS**  
**+ ANDERS**  
 182 Cambridge Street  
 1. +61 (0)3 9201 1000  
 e. info@tricup.com.au  
 www.tricup.com.au

Project: **ELECTRICAL INFRASTRUCTURE WORKS 2017**  
 Client: **DEPARTMENT FOR TRANSPORT**  
 Address: **Faithful + Gould**  
 Project No: **2017**  
 Drawn By: **SW**  
 Date: **17/01/17**  
 Checked: **MS**  
 Scale: **AS1**  
 Author: **MS**  
 Revision: **T1**

**18080-DB-G-01**





REF. NO.	PROPOSED WORKS
1A	Install 1no. Schneider Electric panel board with a 100amp isolator feeding on 12 Way TP&N Spnose Actvg Isolator Type B Distribution Board Label 2C1P2
2A	Install 2.5mm 2Core SWA cable from 2C1P2 to Control Panel 4.
3A	Install 1.5mm 2Core SWA cable from 2C1P2 feeding AHU 7 Light Switch.
4A	AHU 7 - Replace Light switch with IP65 rated light switch.
5A	Install 4mm 4Core SWA cable from 2C1P2 feeding AHU 7 Supply Fan Isolator.
6A	Install 4mm 4Core SWA cable from 2C1P2 feeding AHU 7 Extract Fan Isolator.
7A	Install 1.5mm 2Core SWA cable from 2C1P2 feeding AHU 6 Light Switch.
8A	AHU 6 - Replace Light switch with IP65 rated light switch.
9A	Install 4mm 4Core SWA cable from 2C1P2 feeding AHU 6 Supply Fan Isolator.
10A	Install 4mm 4Core SWA cable from 2C1P2 feeding AHU 6 Extract Fan Isolator.
11A	Install 1no. Schneider Electric panel board with a 200amp isolator feeding on 24 Way TP&N Spnose Actvg Isolator Type B Distribution Board Label 2C1P2
12A	Install 2.5mm 2Core SWA cable from GH1P2 to Control Panel 9.
13A	Install 1.5mm 2Core SWA cable from GH1P2 feeding AHU 22 Light Switch.
14A	AHU 22 - Replace Light Switch with IP65 rated light switch.
15A	Install 4mm 4Core SWA cable from GH1P2 feeding AHU 22 Supply Fan Isolator.
16A	Install 4mm 4Core SWA cable from GH1P2 feeding AHU 22 Extract Fan Isolator.
17A	Install 4mm 4Core SWA cable from GH1P2 feeding AHU 22 Heat recovery Pump Isolator.
18A	Install 1.5mm 2Core SWA cable from GH1P2 feeding AHU 23 Light Switch.
19A	AHU 23 - Replace Light Switch with IP65 rated light switch.
20A	Install 4mm 4Core SWA cable from GH1P2 feeding AHU 23 Supply Fan Isolator.
21A	Install 4mm 4Core SWA cable from GH1P2 feeding AHU 23 Extract Fan Isolator.
22A	Install 4mm 4Core SWA cable from GH1P2 feeding AHU 23 Heat recovery Pump Isolator.
23A	Install 1.5mm 2Core SWA cable from GH1P2 feeding AHU 21 Light Switch.
24A	AHU 21 - Replace Light Switch with IP65 rated light switch.
25A	Install 4mm 4Core SWA cable from GH1P2 feeding AHU 21 Supply Fan Isolator.
26A	Install 4mm 4Core SWA cable from GH1P2 feeding AHU 21 Extract Fan Isolator.
27A	Install 4mm 4Core SWA cable from GH1P2 feeding AHU 21 Heat recovery Pump Isolator.
28A	Install 1.5mm 2Core SWA cable from GH1P2 feeding AHU 24 Light Switch.
29A	AHU 24 - Replace Light Switch with IP65 rated light switch.
30A	Install 4mm 4Core SWA cable from GH1P2 feeding AHU 24 Supply Fan Isolator.
31A	Install 4mm 4Core SWA cable from GH1P2 feeding AHU 24 Extract Fan Isolator.

- NOTES**
- DO NOT SCALE THIS DRAWING. ALL DIMENSIONS TO BE TAKEN FROM THE DRAWING.
  - THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH THE SPECIFICATION AND ANY OTHER DOCUMENTS REFERENCED THEREIN.
  - EXISTING SERVICES AND EQUIPMENT TO BE REMOVED AND RE-USED SHALL BE FULLY COORDINATED ON SITE.
  - ALL NEW SERVICES AND EQUIPMENT TO BE INSTALLED SHALL BE FULLY COORDINATED ON SITE.
  - ALL DISTRIBUTION BOARDS ARE TO BE PROVIDED WITH A MAIN SWITCH AND REMOVED ON SITE.
  - ALL REMOVED EQUIPMENT ARE TO BE CONNECTED TO NEW DISTRIBUTION BOARDS AND PROVIDED WITH THE APPROPRIATE ISOLATION.
  - ALL DISTRIBUTION BOARDS ARE TO BE PROVIDED WITH A MAIN SWITCH AND REMOVED ON SITE.
  - ALL REMOVED EQUIPMENT ARE TO BE CONNECTED TO NEW DISTRIBUTION BOARDS AND PROVIDED WITH THE APPROPRIATE ISOLATION.
  - ALL REMOVED EQUIPMENT ARE TO BE CONNECTED TO NEW DISTRIBUTION BOARDS AND PROVIDED WITH THE APPROPRIATE ISOLATION.
  - ALL REMOVED EQUIPMENT ARE TO BE CONNECTED TO NEW DISTRIBUTION BOARDS AND PROVIDED WITH THE APPROPRIATE ISOLATION.

**PROJECT INFORMATION**

Project: ELECTRICAL INFRASTRUCTURE WORKS 2017

Client: DEPARTMENT FOR TRANSPORT

Architect: FAITHFUL + GUILD

Project No: 18080

Drawn By: SM

Date: JUNE 17

Checked: JC

Scale: NIS

Acad: MMS

Revision: 11

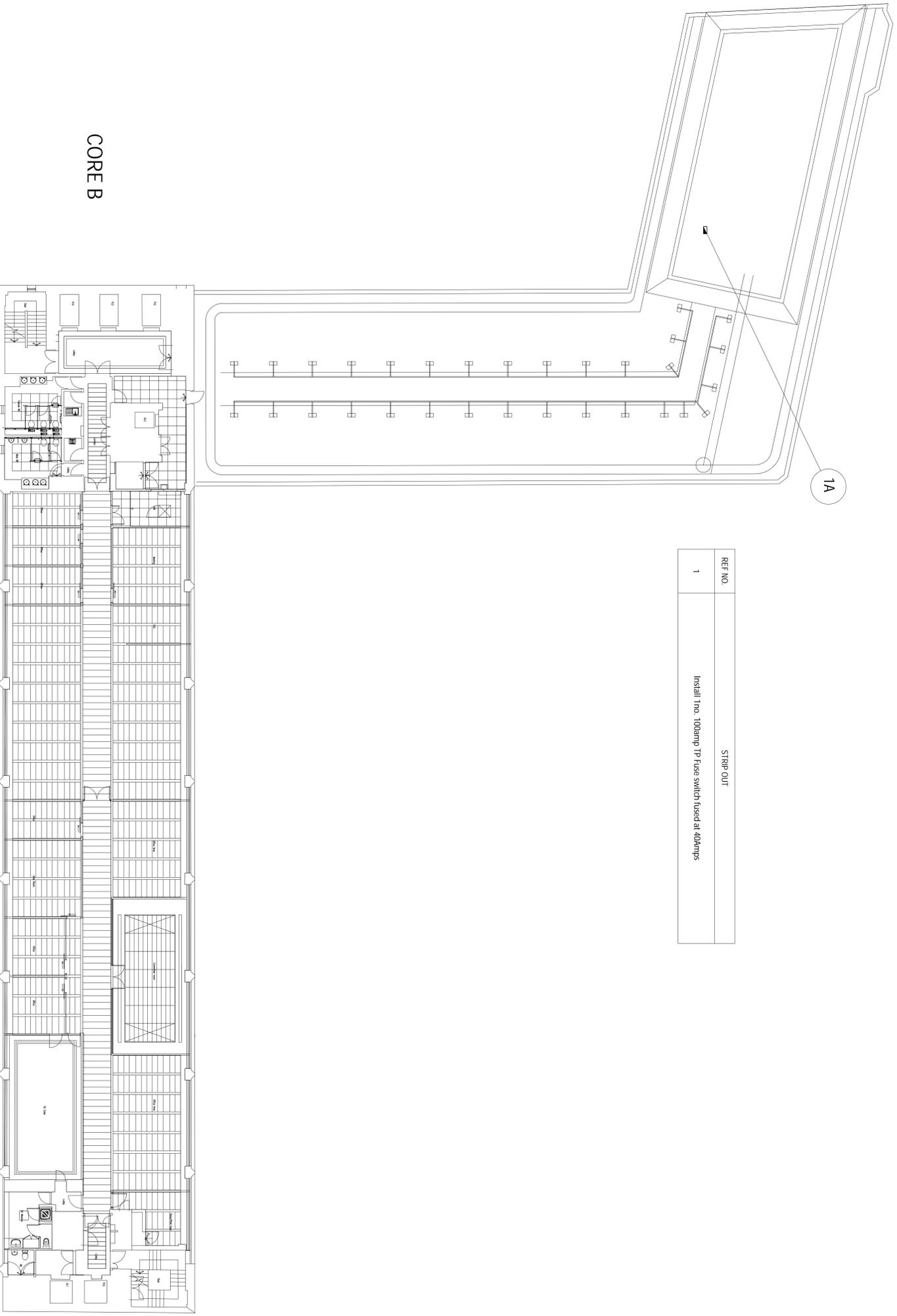
18080-DB-02-01

**TRIO LP**  
**BYWATERS**  
**+ ANDERS**

Approved Authority: V&E  
 101 Parkside Drive  
 London W11 1BB  
 T: +44 (0)20 7092 1000  
 F: +44 (0)20 7092 1001  
 W: www.triolp.com



CORE A



REF NO.	DESCRIPTION
1	STRIP OUT Install 1no. 100amp TP Fuse switch fused at 40amps

- NOTES**
- DO NOT SCALE THIS DRAWING. ALL DIMENSIONS TO BE TAKEN FROM THE DRAWING.
  - THIS DRAWING SHOULD BE READY FOR CONSTRUCTION WITH THE SPECIFICATION. ANY DIFFERENCES OR DISCREPANCIES MUST BE CLARIFIED BEFORE COMMENCEMENT OF WORK.
  - EXISTING SUB MAIN CABLES TO BE REMOVED AND RE-USED WHERE APPROPRIATE.
  - ALL NEW DISTRIBUTION EQUIPMENT TO BE INSTALLED WITHIN THE EXISTING SUB MAIN CABLES TO BE REMOVED AND RE-USED WHERE APPROPRIATE.
  - CABLES BETWEEN NETWORKS AND/OR TO BE INSTALLED BY CONTRACTORS.
  - SELECTION OF ALL NEW SERVICES AND EQUIPMENT SHALL BE FULLY COORDINATED ON SITE.
  - PARALLEL OF ALL WORKS IS TO BE AGREED UPON BEFORE COMMENCEMENT OF WORK.
  - ALL REMOVED EQUIPMENT ARE TO BE CONNECTED TO NEW DISTRIBUTION AND PROVIDED WITH THE APPROPRIATELY SIZED CABLES.
  - ALL DISTRIBUTION BOARDS ARE TO BE PROVIDED WITH A SELECTION OF MAINS ON SPARE MAINS.
  - THE EXISTING INSTALLATIONS BEFORE WORKS COMMENCEMENT AND WORKS TO BE COMPLETED SHALL BE SUBJECT TO FINAL DESIGN REVIEW AND APPROVAL BY THE ENGINEER.
  - THIS DRAWING IS TO BE USED ONLY FOR THE SERVICES ENGINEER.

CORE B

CORE C

THE LV DISTRIBUTION UPGRADE SEVENTH FLOOR PROPOSED WORKS

**PROJECT**  
ELECTRICAL INFRASTRUCTURE WORKS  
2017

**CLIENT**  
DEPARTMENT FOR TRANSPORTATION

**ARCHITECT**  
FATHULLAH + GOULD

Project No.	Drawn By	Date	Checked	Scale
18080	SMR	JUNE 17	JC	NIS

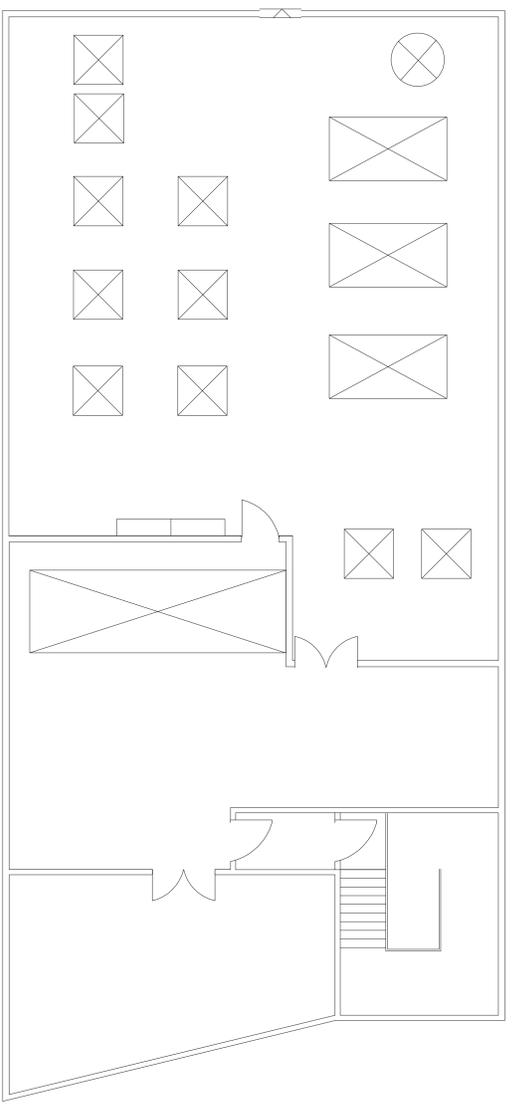
**ARCHITECT'S NAME**  
FATHULLAH + GOULD

**DRAWING NO.**  
18080-DB-07-01

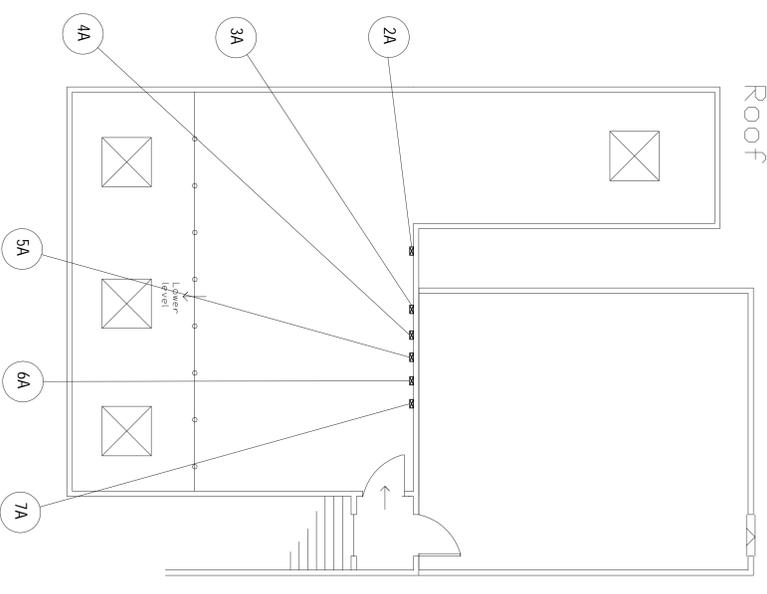
**REVISION**  
T1

**COMPANY**  
TROLUP  
BYWATERS  
+ ANDERS  
Architects Partnership Ltd  
147 Finchley Road  
London NW11 3BU  
T: +44 (0)20 7092 1000  
F: +44 (0)20 7092 1001  
www.fathullah.com

Core  
A  
Roof

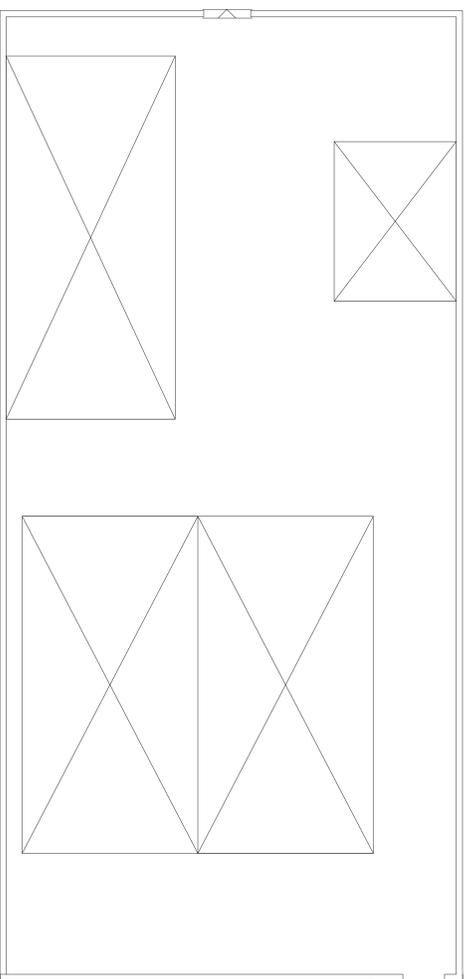


Core  
B  
Roof

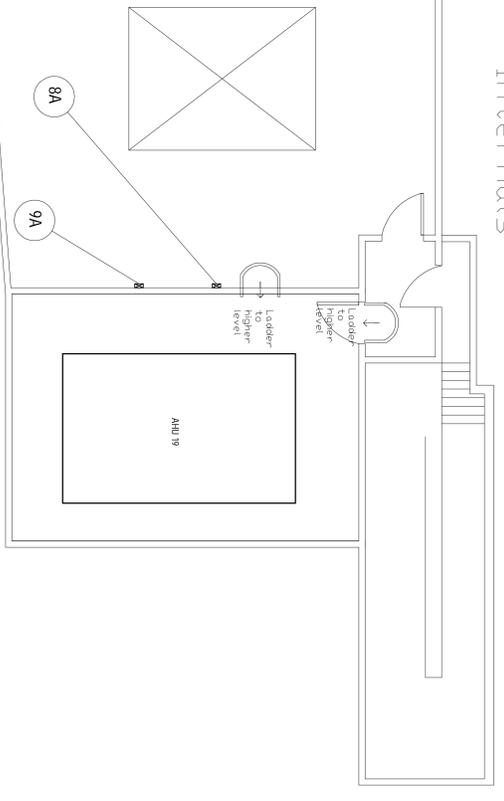


REF. NO.	PROPOSED WORKS
1A	Install 1no. 100amp fused switch TR&N Fused at 40amps.
2A	Install 1no. 100amp fused switch TR&N Fused at 100amps.
3A	Install new 300amp TP Isolating switch.
4A	Install 1no. 100amp fused switch TR&N Fused at 100amps.
5A	Install 1no. 100amp fused switch TR&N Fused at 100amps.
6A	Install 1no. 100amp fused switch TR&N Fused at 100amps.
7A	Install 1no. 100amp fused switch TR&N Fused at 63 amps.
8A	Install 1no. 100amp fused switch TR&N Fused at 40amps.
9A	Install 1no. 60amp fused switch TR&N Fused at 16 amps.

Core  
C  
Roof



Core  
C  
Roof  
Internals



- NOTES**
- DO NOT SCALE THIS DRAWING. ALL DIMENSIONS TO BE CHECKED ON SITE BEFORE COMMENCEMENT OF WORKS. THE CONTRACTOR SHALL FURNISH THESE DIMENSIONS WITH SPECIFICATION. ANY DIFFERENCES OR DISCREPANCIES MUST BE REFERRED TO THE SERVICES ENGINEER IMMEDIATELY.
  - ALL NEW DISTRIBUTION BOARDS TO BE INSTALLED WITH APPROPRIATE LOCAL SOLAIDERS TO SUIT SERVING SIZE BY CONTRACTOR.
  - EXACT LOCATIONS OF ALL NEW SERVICES AND EQUIPMENT TO BE DETERMINED BY THE CONTRACTOR AND PROVIDED WITH THE APPROPRIATE WORKS COMMENCE.
  - ALL NEW SERVICES ARE TO BE CONNECTED TO NEW DISTRIBUTION BOARDS AND PROVIDED WITH THE APPROPRIATE RATED OVER CURRENT DEVICES.
  - THE CONTRACTOR SHALL FURNISH THESE DIMENSIONS WITH SPECIFICATION. ANY DIFFERENCES OR DISCREPANCIES MUST BE REFERRED TO THE SERVICES ENGINEER IMMEDIATELY.
  - ALL NEW DISTRIBUTION BOARDS TO BE INSTALLED WITH APPROPRIATE LOCAL SOLAIDERS TO SUIT SERVING SIZE BY CONTRACTOR.
  - EXACT LOCATIONS OF ALL NEW SERVICES AND EQUIPMENT TO BE DETERMINED BY THE CONTRACTOR AND PROVIDED WITH THE APPROPRIATE WORKS COMMENCE.
  - ALL NEW SERVICES ARE TO BE CONNECTED TO NEW DISTRIBUTION BOARDS AND PROVIDED WITH THE APPROPRIATE RATED OVER CURRENT DEVICES.
  - THE CONTRACTOR SHALL FURNISH THESE DIMENSIONS WITH SPECIFICATION. ANY DIFFERENCES OR DISCREPANCIES MUST BE REFERRED TO THE SERVICES ENGINEER IMMEDIATELY.
  - ALL NEW DISTRIBUTION BOARDS TO BE INSTALLED WITH APPROPRIATE LOCAL SOLAIDERS TO SUIT SERVING SIZE BY CONTRACTOR.

**TRCUP**  
**BY WATERS**  
**+ ANDREWS**

183 Campbell Street  
Level 1  
Sydney NSW 2000  
Australia  
T: +61 (0)2 9291 1000  
E: sales@trcup.com.au  
W: www.trcup.com.au

**Project:**  
ELECTRICAL INFRASTRUCTURE WORKS  
2017

**Client:**  
DEPARTMENT FOR TRANSPORT  
FAITHFUL + GOULD

**Drawn By:** SWM  
**Checked:** MTS  
**Date:** 2017

**Revision:**  
18080-DB-08-01  
T1

---

## A2.2 - Distribution Board Schedules

# Distribution Board Schedule

Project: IMO LV and Control panel Replacement

Job No: 18080

Dist Board Ref: SBTP1

Engineer: S.I.M

Location: Basement Core B - Plant Room 3

Date: 08/05/2017

Board Size & Phase: Schneider Electric 12 Way 3 Phase

Checked: \_\_\_\_\_

Circuit			Circuit Description	Cable	Circuit Load (Watts)		
No.	Phase	MCB			L1	L2	L3
1	L1	<b>32A Type C</b>	<b>AHU 20 Supply Fan</b>	<b>4mm SWA</b>			
	L2	<b>32A Type C</b>	<b>AHU 20 Supply Fan</b>	<b>4mm SWA</b>			
	L3	<b>32A Type C</b>	<b>AHU 20 Supply Fan</b>	<b>4mm SWA</b>			
2	L1	<i>63A Type C</i>	<i>Mains Cold Water Booster Set</i>	<i>10mm SWA</i>			
	L2	<i>63A Type C</i>	<i>Mains Cold Water Booster Set</i>	<i>10mm SWA</i>			
	L3	<i>63A Type C</i>	<i>Mains Cold Water Booster Set</i>	<i>10mm SWA</i>			
3	L1	<b>16A Type C</b>	<b>AHU 20 Extract</b>	<b>4mm SWA</b>			
	L2	<b>16A Type C</b>	<b>AHU 20 Extract</b>	<b>4mm SWA</b>			
	L3	<b>16A Type C</b>	<b>AHU 20 Extract</b>	<b>4mm SWA</b>			
4	L1	<b>10A Type B</b>	<b>AHU 20 Lighting</b>	<b>2.5mm SWA</b>			
	L2	N/A	Spare Way	N/A			
	L3	N/A	Spare Way	N/A			
5	L1	<b>16A Type C</b>	<b>AHU 20 Heat Recovery Pump</b>	<b>4mm SWA</b>			
	L2	<b>16A Type C</b>	<b>AHU 20 Heat Recovery Pump</b>	<b>4mm SWA</b>			
	L3	<b>16A Type C</b>	<b>AHU 20 Heat Recovery Pump</b>	<b>4mm SWA</b>			
6	L1	<b>16A Type C</b>	<b>Fan Coil Unit 19 &amp; 20 Located in the Paper Store</b>	<b>4mm SWA</b>			
	L2	N/A	Spare Way	N/A			
	L3	N/A	Spare Way	N/A			
7	L1	<b>16A Type C</b>	<b>CP8 Outstation</b>	<b>2.5mm SWA</b>			
	L2	N/A	Spare Way	N/A			
	L3	N/A	Spare Way	N/A			
8	L1	<b>20A Type B</b>	<b>Lights Lamp Posts Lambert Street</b>	<b>2.5mm SWA</b>			
	L2	N/A	Spare Way	N/A			
	L3	N/A	Spare Way	N/A			
9	L1	N/A	Spare Way	N/A			
	L2	N/A	Spare Way	N/A			
	L3	N/A	Spare Way	N/A			
10	L1	N/A	Spare Way	N/A			
	L2	N/A	Spare Way	N/A			
	L3	N/A	Spare Way	N/A			
11	L1	N/A	Spare Way	N/A			
	L2	N/A	Spare Way	N/A			
	L3	N/A	Spare Way	N/A			
12	L1	N/A	Spare Way	N/A			
	L2	N/A	Spare Way	N/A			
	L3	N/A	Spare Way	N/A			

**Legend**

*Italics* Re-use existing circuits

**Bold** New wiring

Standard Not identified

	Total Load per phase		
	L1	L2	L3
<b>Watts</b>			
<b>Diversity %</b>			
<b>Power Factor</b>			
<b>Total Demand per phase</b>			

Brought Forward (Watts)		

Circuit			Circuit Description	Cable	Circuit Load (Watts)		
No.	Phase	MCB			L1	L2	L3
13	L1						
	L2						
	L3						
14	L1						
	L2						
	L3						
15	L1						
	L2						
	L3						
16	L1						
	L2						
	L3						
17	L1						
	L2						
	L3						
18	L1						
	L2						
	L3						
19	L1						
	L2						
	L3						
20	L1						
	L2						
	L3						
21	L1						
	L2						
	L3						
22	L1						
	L2						
	L3						
23	L1						
	L2						
	L3						
24	L1						
	L2						
	L3						

Total Load per phase			
	L1	L2	L3
<b>Watts</b>			
<b>Diversity %</b>			
<b>Power Factor</b>			
<b>Total Demand per phase</b>			

**Legend**

*Italics* Re-use existing circuits

**Bold** New wiring

Standard Not identified

# Distribution Board Schedule

Project: IMO LV and Control panel Replacement

Job No: 18080

Dist Board Ref: DB MSBL1 - MSBP1

Engineer: S.I.M

Location: Basement Core A - Plant Room 2 Generator Room

Date: 08/05/2017

Board Size & Phase Schneider Electric 18 Way 3 Phase

Checked: \_\_\_\_\_

Circuit			Circuit Description	Cable	Circuit Load (Watts)		
No.	Phase	MCB			L1	L2	L3
1	L1	<b>32A Type C</b>	<b>Sump Pump (Cold Water Storage Tank Room)</b>	<b>2.5mm SWA</b>			
	L2	<b>32A Type C</b>	<b>Sump Pump (Cold Water Storage Tank Room)</b>	<b>2.5mm SWA</b>			
	L3	<b>32A Type C</b>	<b>Sump Pump (Cold Water Storage Tank Room)</b>	<b>2.5mm SWA</b>			
2	L1	<b>32A Type C</b>	<b>Fan Supply Generator Room</b>	<b>6mm SWA</b>			
	L2	<b>32A Type C</b>	<b>Fan Supply Generator Room</b>	<b>6mm SWA</b>			
	L3	<b>32A Type C</b>	<b>Fan Supply Generator Room</b>	<b>6mm SWA</b>			
3	L1	N/A	Spare Way	N/A			
	L2	N/A	Spare Way	N/A			
	L3	N/A	Spare Way	N/A			
4	L1	<i>16A Type C</i>	<i>Sump Pump Smith Well (External)</i>	<i>2.5mm SWA</i>			
	L2	N/A	Spare Way	N/A			
	L3	N/A	Spare Way	N/A			
5	L1	<b>32A Type C</b>	<b>Cleaners Socket-Outlets in the Basement Area</b>	<b>2.5mm SWA</b>			
	L2	N/A	Spare Way	N/A			
	L3	N/A	Spare Way	N/A			
6	L1	<b>32A Type C</b>	<b>Cleaners Socket-Outlets in the Basement Area</b>	<b>2.5mm SWA</b>			
	L2	N/A	Spare Way	N/A			
	L3	N/A	Spare Way	N/A			
7	L1	<b>20A Type B</b>	<b>13A socket outlet in Water Tank Room</b>	<b>2.5mm SWA</b>			
	L2	N/A	Spare Way	N/A			
	L3	N/A	Spare Way	N/A			
8	L1	<b>20A Type B</b>	<b>13A socket outlet in Water Tank Room</b>	<b>2.5mm SWA</b>			
	L2	N/A	Spare Way	N/A			
	L3	N/A	Spare Way	N/A			
9	L1	N/A	Spare Way	N/A			
	L2	N/A	Spare Way	N/A			
	L3	N/A	Spare Way	N/A			
10	L1	N/A	Spare Way	N/A			
	L2	N/A	Spare Way	N/A			
	L3	N/A	Spare Way	N/A			
11	L1	N/A	Spare Way	N/A			
	L2	N/A	Spare Way	N/A			
	L3	N/A	Spare Way	N/A			
12	L1	N/A	Spare Way	N/A			
	L2	N/A	Spare Way	N/A			
	L3	N/A	Spare Way	N/A			

**Legend**

*Italics* Re-use existing circuits

**Bold** New wiring

Standard Not identified

Total Load per phase			
	L1	L2	L3
<b>Watts</b>			
<b>Diversity %</b>			
<b>Power Factor</b>			
<b>Total Demand per phase</b>			

Brought Forward (Watts)		

Circuit			Circuit Description	Cable	Circuit Load (Watts)		
No.	Phase	MCB			L1	L2	L3
13	L1	N/A	Spare Way	N/A			
	L2	N/A	Spare Way	N/A			
	L3	N/A	Spare Way	N/A			
14	L1	N/A	Spare Way	N/A			
	L2	N/A	Spare Way	N/A			
	L3	N/A	Spare Way	N/A			
15	L1	N/A	Spare Way	N/A			
	L2	N/A	Spare Way	N/A			
	L3	N/A	Spare Way	N/A			
16	L1	N/A	Spare Way	N/A			
	L2	N/A	Spare Way	N/A			
	L3	N/A	Spare Way	N/A			
17	L1	N/A	Spare Way	N/A			
	L2	N/A	Spare Way	N/A			
	L3	N/A	Spare Way	N/A			
18	L1	N/A	Spare Way	N/A			
	L2	N/A	Spare Way	N/A			
	L3	N/A	Spare Way	N/A			
19	L1						
	L2						
	L3						
20	L1						
	L2						
	L3						
21	L1						
	L2						
	L3						
22	L1						
	L2						
	L3						
23	L1						
	L2						
	L3						
24	L1						
	L2						
	L3						

**Legend**  
*Italics* Re-use existing circuits  
**Bold** New wiring  
Standard Not identified

	Total Load per phase		
	L1	L2	L3
<b>Watts</b>			
<b>Diversity %</b>			
<b>Power Factor</b>			
<b>Total Demand per phase</b>			

# Distribution Board Schedule

Project: IMO LV and Control panel Replacement  
 Dist Board Ref: DB MBBTP1  
 Location: Basement Core B LV Switch Room  
 Board Size & Phase Schneider Electric 18 Way 3 Phase

Job No: 18080  
 Engineer: S.I.M  
 Date: 08/05/2017  
 Checked: \_\_\_\_\_

Circuit			Circuit Description	Cable	Circuit Load (Watts)		
No.	Phase	MCB			L1	L2	L3
1	L1	N/A	Spare Way	N/A			
	L2	N/A	Spare Way	N/A			
	L3	N/A	Spare Way	N/A			
2	L1	N/A	Spare Way	N/A			
	L2	N/A	Spare Way	N/A			
	L3	N/A	Spare Way	N/A			
3	L1	<b>32A Type C</b>	<b>Car Park Sump Pump</b>	<b>4mm SWA</b>			
	L2	<b>32A Type C</b>	<b>Car Park Sump Pump</b>	<b>4mm SWA</b>			
	L3	<b>32A Type C</b>	<b>Car Park Sump Pump</b>	<b>4mm SWA</b>			
4	L1	<b>32A Type C</b>	<b>Car Park Extract Fan No.1</b>	<b>4mm SWA</b>			
	L2	<b>32A Type C</b>	<b>Car Park Extract Fan No.1</b>	<b>4mm SWA</b>			
	L3	<b>32A Type C</b>	<b>Car Park Extract Fan No.1</b>	<b>4mm SWA</b>			
5	L1	<b>32A Type C</b>	<b>Car Park Extract Fan No.2</b>	<b>4mm SWA</b>			
	L2	<b>32A Type C</b>	<b>Car Park Extract Fan No.2</b>	<b>4mm SWA</b>			
	L3	<b>32A Type C</b>	<b>Car Park Extract Fan No.2</b>	<b>4mm SWA</b>			
6	L1	N/A	Spare Way	N/A			
	L2	N/A	Spare Way	N/A			
	L3	N/A	Spare Way	N/A			
7	L1	N/A	Spare Way	N/A			
	L2	N/A	Spare Way	N/A			
	L3	N/A	Spare Way	N/A			
8	L1	N/A	Spare Way	N/A			
	L2	N/A	Spare Way	N/A			
	L3	N/A	Spare Way	N/A			
9	L1	N/A	Spare Way	N/A			
	L2	N/A	Spare Way	N/A			
	L3	N/A	Spare Way	N/A			
10	L1	<i>16A Type C</i>	<i>Chemical Store Extract Fan</i>	<i>2.5mm SWA</i>			
	L2	<i>16A Type C</i>	<i>Chemical Store Extract Fan</i>	<i>2.5mm SWA</i>			
	L3	<i>16A Type C</i>	<i>Chemical Store Extract Fan</i>	<i>2.5mm SWA</i>			
11	L1	<b>32A Type C</b>	<b>Sump Pump Ring Final Circuit. 4no Control Pan</b>	<b>4mm SWA</b>			
	L2	N/A	Spare Way	N/A			
	L3	<i>16A Type C</i>	<i>Core D Ground Floor Twin Fan</i>	<i>2.5mm SWA</i>			
12	L1	<b>32A Type C</b>	<b>Switch Room Corridor Sump Pump No.11</b>	<b>4mm SWA</b>			
	L2	N/A	Spare Way	N/A			
	L3	N/A	Spare Way	N/A			

**Legend**  
*Italics* Re-use existing circuits  
**Bold** New wiring  
 Standard Not identified

	Total Load per phase		
	L1	L2	L3
<b>Watts</b>			
<b>Diversity %</b>			
<b>Power Factor</b>			
<b>Total Demand per phase</b>			

Brought Forward (Watts)		

Circuit			Circuit Description	Cable	Circuit Load (Watts)		
No.	Phase	MCB			L1	L2	L3
13	L1	32	<i>Basement Sump Pump</i>	4mm			
	L2	32	<i>Basement Sump Pump</i>	4mm			
	L3	32	<i>Basement Sump Pump</i>	4mm			
14	L1	N/A	Spare Way	N/A			
	L2	TBC	To be confirmed by contractor	TBC			
	L3	N/A	Spare Way	N/A			
15	L1	N/A	Spare Way	N/A			
	L2	N/A	Spare Way	N/A			
	L3	N/A	Spare Way	N/A			
16	L1	N/A	Spare Way	N/A			
	L2	N/A	Spare Way	N/A			
	L3	N/A	Spare Way	N/A			
17	L1	N/A	Spare Way	N/A			
	L2	N/A	Spare Way	N/A			
	L3	N/A	Spare Way	N/A			
18	L1	N/A	Spare Way	N/A			
	L2	N/A	Spare Way	N/A			
	L3	N/A	Spare Way	N/A			
19	L1						
	L2						
	L3						
20	L1						
	L2						
	L3						
21	L1						
	L2						
	L3						
22	L1						
	L2						
	L3						
23	L1						
	L2						
	L3						
24	L1						
	L2						
	L3						

**Legend**  
*Italics* Re-use existing circuits  
**Bold** New wiring  
Standard Not identified

	Total Load per phase		
	L1	L2	L3
<b>Watts</b>			
<b>Diversity %</b>			
<b>Power Factor</b>			
<b>Total Demand per phase</b>			

# Distribution Board Schedule

Project: IMO LV and Control panel Replacement  
 Dist Board Ref: LV Panel Board - BBTP1  
 Location: Basement Core C - Chilled Water Plant Room  
 Board Size & Phase Schneider Electric 12 Way 3 Phase Panel

Job No: 18080  
 Engineer: S.I.M  
 Date: 08/05/2017  
 Checked: \_\_\_\_\_

Circuit			Circuit Description	Cable	Circuit Load (Watts)		
No.	Phase	MCB			L1	L2	L3
1	L1	100A	Chilled Water Pump 8	10mm SWA			
	L2	100A	Chilled Water Pump 8	10mm SWA			
	L3	100A	Chilled Water Pump 8	10mm SWA			
2	L1	100A	Chilled Water Pump 7	10mm SWA			
	L2	100A	Chilled Water Pump 7	10mm SWA			
	L3	100A	Chilled Water Pump 7	10mm SWA			
3	L1	100A	AHU Chilled Water Pump 3	10mm SWA			
	L2	100A	AHU Chilled Water Pump 3	10mm SWA			
	L3	100A	AHU Chilled Water Pump 3	10mm SWA			
4	L1	100A	AHU Chilled Water Pump 4	10mm SWA			
	L2	100A	AHU Chilled Water Pump 4	10mm SWA			
	L3	100A	AHU Chilled Water Pump 4	10mm SWA			
5	L1	160A	Chiller Control Panel	16mm SWA			
	L2	160A	Chiller Control Panel	16mm SWA			
	L3	160A	Chiller Control Panel	16mm SWA			
6	L1	N/A	Spare Way	N/A			
	L2	N/A	Spare Way	N/A			
	L3	N/A	Spare Way	N/A			
7	L1	250A	Distribution Boards BBTP1/1 & BBTP1/2	95mm SWA			
	L2	250A	Distribution Boards BBTP1/1 & BBTP1/2	95mm SWA			
	L3	250A	Distribution Boards BBTP1/1 & BBTP1/2	95mm SWA			
8	L1	N/A	Spare Way	N/A			
	L2	N/A	Spare Way	N/A			
	L3	N/A	Spare Way	N/A			
9	L1	N/A	Spare Way	N/A			
	L2	N/A	Spare Way	N/A			
	L3	N/A	Spare Way	N/A			
10	L1	N/A	Spare Way	N/A			
	L2	N/A	Spare Way	N/A			
	L3	N/A	Spare Way	N/A			
11	L1	N/A	Spare Way	N/A			
	L2	N/A	Spare Way	N/A			
	L3	N/A	Spare Way	N/A			
12	L1	N/A	Spare Way	N/A			
	L2	N/A	Spare Way	N/A			
	L3	N/A	Spare Way	N/A			

**Legend**  
*Italics* Re-use existing circuits  
**Bold** New wiring  
 Standarc Not identified

	Total Load per phase		
	L1	L2	L3
<b>Watts</b>			
<b>Diversity %</b>			
<b>Power Factor</b>			
<b>Total Demand per phase</b>			

Brought Forward (Watts)		

Circuit			Circuit Description	Cable	Circuit Load (Watts)		
No.	Phase	MCB			L1	L2	L3
13	L1						
	L2						
	L3						
14	L1						
	L2						
	L3						
15	L1						
	L2						
	L3						
16	L1						
	L2						
	L3						
17	L1						
	L2						
	L3						
18	L1						
	L2						
	L3						
19	L1						
	L2						
	L3						
20	L1						
	L2						
	L3						
21	L1						
	L2						
	L3						
22	L1						
	L2						
	L3						
23	L1						
	L2						
	L3						
24	L1						
	L2						
	L3						

**Legend**  
*Italics* Re-use existing circuits  
**Bold** New wiring  
 Standarc Not identified

	Total Load per phase		
	L1	L2	L3
<b>Watts</b>			
<b>Diversity %</b>			
<b>Power Factor</b>			
<b>Total Demand per phase</b>			

# Distribution Board Schedule

Project: **IMO LV and Control panel Replacement**  
 Dist Board Ref: **DB BBTP1-1&2**  
 Location: **Basement Core C - Chilled Water Plant Room**  
 Board Size & Phase: **Schneider Electric Distribution Panel**

Job No: 18080  
 Engineer: S.I.M  
 Date: 08/05/2017  
 Checked:

Circuit			Circuit Description	Cable	Circuit Load (Watts)		
No.	Phase	MCB			L1	L2	L3
1	L1	32A Type C	AHU 25 Supply Fan	4mm SWA			
	L2	32A Type C	AHU 25 Supply Fan	4mm SWA			
	L3	32A Type C	AHU 25 Supply Fan	4mm SWA			
2	L1	32A Type C	AHU 25 Extract Fan	4mm SWA			
	L2	32A Type C	AHU 25 Extract Fan	4mm SWA			
	L3	32A Type C	AHU 25 Supply Fan	4mm SWA			
3	L1	16A Type C	CP1 Outstation	2.5mm SWA			
	L2	16A Type C	AFP01 Outstation	2.5mm SWA			
	L3	N/A	Spare Way	N/A			
4	L1	16A Type C	Pump 5 Entrance Hall Chilled Water Pump	10mm SWA			
	L2	16A Type C	Pump 5 Entrance Hall Chilled Water Pump	10mm SWA			
	L3	16A Type C	Pump 5 Entrance Hall Chilled Water Pump	10mm SWA			
5	L1	16A Type C	Pump 6 Entrance Hall Chilled Water Pump	10mm SWA			
	L2	16A Type C	Pump 6 Entrance Hall Chilled Water Pump	10mm SWA			
	L3	16A Type C	Pump 6 Entrance Hall Chilled Water Pump	10mm SWA			
6	L1	10A Type C	HWS Pump 1	4mm SWA			
	L2	10A Type C	HWS Pump 1	4mm SWA			
	L3	10A Type C	HWS Pump 1	4mm SWA			
7	L1	10A Type C	HWS Pump 2	4mm SWA			
	L2	10A Type C	HWS Pump 2	4mm SWA			
	L3	10A Type C	HWS Pump 2	4mm SWA			
8	L1	32A Type C	Calorifier Panel 1	2.5mm			
	L2	N/A	Spare Way	N/A			
	L3	N/A	Spare Way	N/A			
9	L1	32A Type C	Calorifier Panel 2	2.5mm			
	L2	N/A	Spare Way	N/A			
	L3	N/A	Spare Way	N/A			
10	L1	20A Type C	De-Aerator	4mm SWA			
	L2	N/A	Spare Way	N/A			
	L3	N/A	Spare Way	N/A			
11	L1	20A Type C	Trace Heating	2.5mm SWA			
	L2	N/A	Spare Way	N/A			
	L3	N/A	Spare Way	N/A			
12	L1	N/A	Spare Way	N/A			
	L2	N/A	Spare Way	N/A			
	L3	N/A	Spare Way	N/A			

**Legend**

*Italics* Re-use existing circuits  
**Bold** New wiring  
 Standard Not identified

	Total Load per phase		
	L1	L2	L3
Watts			
Diversity %			
Power Factor			
Total Demand per phase			

Brought Forward (Watts)		

Circuit			Circuit Description	Cable	Circuit Load (Watts)		
No.	Phase	MCB			L1	L2	L3
13	L1						
	L2						
	L3						
14	L1						
	L2						
	L3						
15	L1						
	L2						
	L3						
16	L1						
	L2						
	L3						
17	L1						
	L2						
	L3						
18	L1						
	L2						
	L3						
19	L1						
	L2						
	L3						
20	L1						
	L2						
	L3						
21	L1						
	L2						
	L3						
22	L1						
	L2						
	L3						
23	L1						
	L2						
	L3						
24	L1						
	L2						
	L3						

**Legend**

*Italics* Re-use existing circuits

**Bold** New wiring

Standard Not identified

Total Load per phase			
	L1	L2	L3
<b>Watts</b>			
<b>Diversity %</b>			
<b>Power Factor</b>			
<b>Total Demand per phase</b>			

# Distribution Board Schedule

Project: IMO LV and Control panel Replacement  
 Dist Board Ref: DB MBBTP2  
 Location: Baement Core C - LV Switch Room  
 Board Size & Phase Schneider Electric 12 Way 3 Phase

Job No: 18080  
 Engineer: S.I.M  
 Date: 08/05/2017  
 Checked: \_\_\_\_\_

Circuit			Circuit Description	Cable	Circuit Load (Watts)		
No.	Phase	MCB			L1	L2	L3
1	L1	32A Type C	<i>E.B. Ground Floor Rear Access Gates.</i>	6mm			
	L2	32A Type C	<i>E.B. Ground Floor Rear Access Gates.</i>				
	L3	32A Type C	<i>E.B. Ground Floor Rear Access Gates.</i>				
2	L1	32A Type C	<i>E.B. Ground Floor Front Access Gates.</i>	6mm			
	L2	32A Type C	<i>E.B. Ground Floor Front Access Gates.</i>				
	L3	32A Type C	<i>E.B. Ground Floor Front Access Gates.</i>				
3	L1	16A Type C	<i>E.B. Ground Floor Loading Bay Shutter Motor.</i>	4mm			
	L2	16A Type C	<i>E.B. Ground Floor Loading Bay Shutter Motor.</i>				
	L3	16A Type C	<i>E.B. Ground Floor Loading Bay Shutter Motor.</i>				
4	L1	10A Type C	<i>E.B. Basement Car Park Supply Fan No.1.</i>	4mm			
	L2	10A Type C	<i>E.B. Basement Car Park Supply Fan No.1.</i>				
	L3	10A Type C	<i>E.B. Basement Car Park Supply Fan No.1.</i>				
5	L1	10A Type C	<i>E.B. Basement Car Park Supply Fan No.2.</i>	4mm			
	L2	10A Type C	<i>E.B. Basement Car Park Supply Fan No.2.</i>				
	L3	10A Type C	<i>E.B. Basement Car Park Supply Fan No.2.</i>				
6	L1	32A Type C	<i>Sump Pump Ring Final Circuit. 6no Control Panels</i>	4mm			
	L2	N/A	Spare Way	N/A			
	L3	N/A	Spare Way	N/A			
7	L1	N/A	Spare Way	N/A			
	L2	N/A	Spare Way	N/A			
	L3	N/A	Spare Way	N/A			
8	L1	TBC	<i>Waste Compactor</i>	TBC			
	L2	TBC	<i>Waste Compactor</i>	TBC			
	L3	TBC	<i>Waste Compactor</i>	TBC			
9	L1	N/A	Spare Way	N/A			
	L2	N/A	Spare Way	N/A			
	L3	N/A	Spare Way	N/A			
10	L1	N/A	Spare Way	N/A			
	L2	N/A	Spare Way	N/A			
	L3	N/A	Spare Way	N/A			
11	L1	N/A	Spare Way	N/A			
	L2	N/A	Spare Way	N/A			
	L3	N/A	Spare Way	N/A			
12	L1	N/A	Spare Way	N/A			
	L2	N/A	Spare Way	N/A			
	L3	N/A	Spare Way	N/A			

**Legend**  
*Italics* Re-use existing circuits  
**Bold** New wiring  
 Standarc Not identified

	Total Load per phase		
	L1	L2	L3
<b>Watts</b>			
<b>Diversity %</b>			
<b>Power Factor</b>			
<b>Total Demand per phase</b>			

Brought Forward (Watts)		

Circuit			Circuit Description	Cable	Circuit Load (Watts)		
No.	Phase	MCB			L1	L2	L3
13	L1						
	L2						
	L3						
14	L1						
	L2						
	L3						
15	L1						
	L2						
	L3						
16	L1						
	L2						
	L3						
17	L1						
	L2						
	L3						
18	L1						
	L2						
	L3						
19	L1						
	L2						
	L3						
20	L1						
	L2						
	L3						
21	L1						
	L2						
	L3						
22	L1						
	L2						
	L3						
23	L1						
	L2						
	L3						
24	L1						
	L2						
	L3						

**Legend**  
*Italics* Re-use existing circuits  
**Bold** New wiring  
 Standarc Not identified

	Total Load per phase		
	L1	L2	L3
<b>Watts</b>			
<b>Diversity %</b>			
<b>Power Factor</b>			
<b>Total Demand per phase</b>			

# Distribution Board Schedule

Project: IMO LV and Control panel Replacement  
 Dist Board Ref: LV Panel Board-Conference Hall  
 Location: Ground Floor Conference Hall  
 Board Size & Phase Schneider Electric Distribution Panel

Job No: 18080  
 Engineer: S.I.M  
 Date: 08/05/2017  
 Checked: \_\_\_\_\_

Circuit			Circuit Description	Cable	Circuit Load (Watts)		
No.	Phase	MCB			L1	L2	L3
1	L1	100A	Interpreters Booths	50mm			
	L2						
	L3						
2	L1	100A	Dimmer Rack ER-3	50mm			
	L2						
	L3						
3	L1	100A	Dimmer Rack ER-5	50mm			
	L2						
	L3						
4	L1	100A	Dimmer Rack CHL8	50mm			
	L2						
	L3						
5	L1	100A	Dimmer Rack ER-1	50mm			
	L2						
	L3						
6	L1	100A	Dimmer Rack ER-2	50mm			
	L2						
	L3						
7	L1	100A	Dimmer Rack ER-4	50mm			
	L2						
	L3						
8	L1	100	Distribution Board CHP2	50mm			
	L2						
	L3						
9	L1	100	Distribution Board CHL2	50mm			
	L2						
	L3						
10	L1						
	L2						
	L3						
11	L1						
	L2						
	L3						
12	L1						
	L2						
	L3						

**Legend**  
*Italics* Re-use existing circuits  
**Bold** New wiring  
 Standarc Not identified

	Total Load per phase		
	L1	L2	L3
<b>Watts</b>			
<b>Diversity %</b>			
<b>Power Factor</b>			
<b>Total Demand per phase</b>			

Brought Forward (Watts)		

Circuit			Circuit Description	Cable	Circuit Load (Watts)		
No.	Phase	MCB			L1	L2	L3
13	L1						
	L2						
	L3						
14	L1						
	L2						
	L3						
15	L1						
	L2						
	L3						
16	L1						
	L2						
	L3						
17	L1						
	L2						
	L3						
18	L1						
	L2						
	L3						
19	L1						
	L2						
	L3						
20	L1						
	L2						
	L3						
21	L1						
	L2						
	L3						
22	L1						
	L2						
	L3						
23	L1						
	L2						
	L3						
24	L1						
	L2						
	L3						

**Legend**  
*Italics* Re-use existing circuits  
**Bold** New wiring  
 Standarc Not identified

	Total Load per phase		
	L1	L2	L3
<b>Watts</b>			
<b>Diversity %</b>			
<b>Power Factor</b>			
<b>Total Demand per phase</b>			

# Distribution Board Schedule

Project: IMO LV and Control panel Replacement  
 Dist Board Ref: DB 1BTP1  
 Location: First Floor Core B - Plant Room 8  
 Board Size & Phase Schneider Electric 12 Way 3 Phase

Job No: 18080  
 Engineer: S.I.M  
 Date: 08/05/2017  
 Checked: \_\_\_\_\_

Circuit			Circuit Description	Cable	Circuit Load (Watts)		
No.	Phase	MCB			L1	L2	L3
1	L1	<b>16A Type C</b>	Toilet Extract Fan A	4mm SWA			
	L2	<b>16A Type C</b>	Toilet Extract Fan A	4mm SWA			
	L3	<b>16A Type C</b>	Toilet Extract Fan A	4mm SWA			
2	L1	<b>16A Type C</b>	Toilet Extract Fan B	4mm SWA			
	L2	<b>16A Type C</b>	Toilet Extract Fan B	4mm SWA			
	L3	<b>16A Type C</b>	Toilet Extract Fan B	4mm SWA			
3	L1	<b>16A Type C</b>	AHU 1 Supply Fan	4mm SWA			
	L2	<b>16A Type C</b>	AHU 1 Supply Fan	4mm SWA			
	L3	<b>16A Type C</b>	AHU 1 Supply Fan	4mm SWA			
4	L1	N/A	Spare	N/A			
	L2	N/A	Spare	N/A			
	L3	N/A	Spare	N/A			
5	L1	<i>16A Type C</i>	<i>Kitchen Hood F38</i>	<i>2.5mm SWA</i>			
	L2	<i>16A Type C</i>	<i>Kitchen Hood F38</i>	<i>2.5mm SWA</i>			
	L3	<i>16A Type C</i>	<i>Kitchen Hood F38</i>	<i>2.5mm SWA</i>			
6	L1	<b>16A Type C</b>	AHU 1 Extract Fan	4mm SWA			
	L2	<b>16A Type C</b>	AHU 1 Extract Fan	4mm SWA			
	L3	<b>16A Type C</b>	AHU 1 Extract Fan	4mm SWA			
7	L1	TBC	To be confirmed by contractor	TBC			
	L2	<b>16A Type C</b>	<b>CP2 Outstation</b>	<b>2.5mm SWA</b>			
	L3	TBC	To be confirmed by contractor	TBC			
8	L1	<b>10A Type B</b>	<b>AHU 1 Lights</b>	<b>2.5mm</b>			
	L2	N/A	Spare Way	N/A			
	L3	<i>10A Type B</i>	<i>Plant Room Lighting</i>	<i>1.5mm</i>			
9	L1	<b>16A Type C</b>	<b>AHU 2 Supply Fan</b>	<b>4mm SWA</b>			
	L2	<b>16A Type C</b>	<b>AHU 2 Supply Fan</b>	<b>4mm SWA</b>			
	L3	<b>16A Type C</b>	<b>AHU 2 Supply Fan</b>	<b>4mm SWA</b>			
10	L1	N/A	Spare Way	N/A			
	L2	N/A	Spare Way	N/A			
	L3	<i>20A Type B</i>	<i>Plant Room Socket-Outlets</i>	<i>2.5mm</i>			
11	L1	N/A	Spare Way	N/A			
	L2	N/A	Spare Way	N/A			
	L3	N/A	Spare Way	N/A			
12	L1	N/A	Spare Way	N/A			
	L2	N/A	Spare Way	N/A			
	L3	N/A	Spare Way	N/A			

**Legend**  
*Italics* Re-use existing circuits  
**Bold** New wiring  
 Standard Not identified

	Total Load per phase		
	L1	L2	L3
<b>Watts</b>			
<b>Diversity %</b>			
<b>Power Factor</b>			
<b>Total Demand per phase</b>			

Brought Forward (Watts)		

Circuit			Circuit Description	Cable	Circuit Load (Watts)		
No.	Phase	MCB			L1	L2	L3
13	L1						
	L2						
	L3						
14	L1						
	L2						
	L3						
15	L1						
	L2						
	L3						
16	L1						
	L2						
	L3						
17	L1						
	L2						
	L3						
18	L1						
	L2						
	L3						
19	L1						
	L2						
	L3						
20	L1						
	L2						
	L3						
21	L1						
	L2						
	L3						
22	L1						
	L2						
	L3						
23	L1						
	L2						
	L3						
24	L1						
	L2						
	L3						

**Legend**  
*Italics* Re-use existing circuits  
**Bold** New wiring  
Standard Not identified

Total Load per phase			
	L1	L2	L3
<b>Watts</b>			
<b>Diversity %</b>			
<b>Power Factor</b>			
<b>Total Demand per phase</b>			

# Distribution Board Schedule

Project: IMO LV and Control Panel Replacement  
 Dist Board Ref: DB 1CTP1-1&2  
 Location: First Floor Core C - Plant Room 9  
 Board Size & Phase Schneider Electric 24 Way 3 Phase Acti9 Type B

Job No: 18080  
 Engineer: S.I.M  
 Date: 08/05/2017  
 Checked: \_\_\_\_\_

Circuit			Circuit Description	Cable	Circuit Load (Watts)		
No.	Phase	MCB			L1	L2	L3
1	L1	10A Type B	AHU Lights	1.5mm SWA			
	L2	16A Type C	CP3 Outstation	2.5mm SWA			
	L3	10A Type B	Plantroom Lighting	2.5mm SWA			
2	L1	16A Type C	AHU No.4 Supply Fan	4mm SWA			
	L2	16A Type C	AHU No.4 Supply Fan	4mm SWA			
	L3	16A Type C	AHU No.4 Supply Fan	4mm SWA			
3	L1	16A Type C	AHU No.4 Extract fan	4mm SWA			
	L2	16A Type C	AHU No.4 Extract fan	4mm SWA			
	L3	16A Type C	AHU No.4 Extract Fan	4mm SWA			
4	L1	16A Type C	AHU 3 Supply Fan	4mm SWA			
	L2	16A Type C	AHU 3 Supply Fan	4mm SWA			
	L3	16A Type C	AHU 3 Supply Fan	4mm SWA			
5	L1	N/A	Spare Way	N/A			
	L2	N/A	Spare Way	N/A			
	L3	N/A	Spare Way	N/A			
6	L1	16A Type C	Fan 3 Meeting Room 3	2.5mm SWA			
	L2	16A Type C	Fan 3 Meeting Room 3	2.5mm SWA			
	L3	16A Type C	Fan 3 Meeting Room 3	2.5mm SWA			
7	L1	N/A	Spare Way	N/A			
	L2	N/A	Spare Way	N/A			
	L3	N/A	Spare Way	N/A			
8	L1	16A Type C	AHU 5 Supply Fan	4mm SWA			
	L2	16A Type C	AHU 5 Supply Fan	4mm SWA			
	L3	16A Type C	AHU 5 Supply Fan	4mm SWA			
9	L1	16A Type C	Kitchen Preparation Fan	4mm SWA			
	L2	16A Type C	Kitchen Preparation Fan	4mm SWA			
	L3	16A Type C	Kitchen Preparation Fan	4mm SWA			
10	L1	16A Type C	Toilet Extract Fan Duty	4mm SWA			
	L2	16A Type C	Toilet Extract Fan Duty	4mm SWA			
	L3	16A Type C	Toilet Extract Fan Duty	4mm SWA			
11	L1	16A Type C	Toilet Extract Fan Standby	4mm SWA			
	L2	16A Type C	Toilet Extract Fan Standby	4mm SWA			
	L3	16A Type C	Toilet Extract Fan Standby	4mm SWA			
12	L1	20A Type B	Plant Room Socket Outlets	4mm SWA			
	L2	N/A	Spare Way	N/A			
	L3	N/A	Spare Way	N/A			

**Legend**  
*Italics* Re-use existing circuits  
**Bold** New wiring  
 Standarc Not identified

	Total Load per phase		
	L1	L2	L3
Watts			
Diversity %			
Power Factor			
Total Demand per phase			

Brought Forward (Watts)		

Circuit			Circuit Description	Cable	Circuit Load (Watts)		
No.	Phase	MCB			L1	L2	L3
13	L1		Spare Way				
	L2		Spare Way				
	L3		Spare Way				
14	L1		Spare Way				
	L2		Spare Way				
	L3		Spare Way				
15	L1		Spare Way				
	L2		Spare Way				
	L3		Spare Way				
16	L1		Spare Way				
	L2		Spare Way				
	L3		Spare Way				
17	L1		Spare Way				
	L2		Spare Way				
	L3		Spare Way				
18	L1		Spare Way				
	L2		Spare Way				
	L3		Spare Way				
19	L1		Spare Way				
	L2		Spare Way				
	L3		Spare Way				
20	L1		Spare Way				
	L2		Spare Way				
	L3		Spare Way				
21	L1		Spare Way				
	L2		Spare Way				
	L3		Spare Way				
22	L1		Spare Way				
	L2		Spare Way				
	L3		Spare Way				
23	L1		Spare Way				
	L2		Spare Way				
	L3		Spare Way				
24	L1		Spare Way				
	L2		Spare Way				
	L3		Spare Way				

**Legend**  
*Italics* Re-use existing circuits  
**Bold** New wiring  
 Standarc Not identified

	Total Load per phase		
	L1	L2	L3
<b>Watts</b>			
<b>Diversity %</b>			
<b>Power Factor</b>			
<b>Total Demand per phase</b>			

# Distribution Board Schedule

Project: IMO LV and Control panel Replacement  
 Dist Board Ref: DB 1CTP1-1&2  
 Location: Second Floor Core C - Plant Room 10  
 Board Size & Phase Schneider Electric 12 Way 3 Phase

Job No: 18080  
 Engineer: S.I.M  
 Date: 08/05/2017  
 Checked: \_\_\_\_\_

Circuit			Circuit Description	Cable	Circuit Load (Watts)		
No.	Phase	MCB			L1	L2	L3
1	L1	<b>16A Type C</b>	AHU 6 Supply Fan	4mm SWA			
	L2	<b>16A Type C</b>	AHU 6 Supply Fan	4mm SWA			
	L3	<b>16A Type C</b>	AHU 6 Supply Fan	4mm SWA			
2	L1	<i>10A Type B</i>	<i>Plant Room Lights</i>	<i>1.5mm</i>			
	L2	N/A	Spare Way	N/A			
	L3	N/A	Spare Way	N/A			
3	L1	<i>20A Type B</i>	<i>Plant Room Radial Socket-Outlets</i>	<i>4mm</i>			
	L2	N/A	Spare Way	N/A			
	L3	N/A	Spare Way	N/A			
4	L1	<b>16A Type C</b>	AHU 6 Extract Fan	4mm SWA			
	L2	<b>16A Type C</b>	AHU 6 Extract Fan	4mm SWA			
	L3	<b>16A Type C</b>	AHU 6 Extract Fan	4mm SWA			
5	L1	<b>16A Type C</b>	AHU 7 Supply Fan	4mm SWA			
	L2	<b>16A Type C</b>	AHU 7 Supply Fan	4mm SWA			
	L3	<b>16A Type C</b>	AHU 7 Supply Fan	4mm SWA			
6	L1	<i>20A Type B</i>	<i>Plant Room Radial Sockets</i>	<i>4mm SWA</i>			
	L2	N/A	Spare Way	N/A			
	L3	N/A	Spare Way	N/A			
7	L1	N/A	Spare Way	N/A			
	L2	N/A	Spare Way	N/A			
	L3	N/A	Spare Way	N/A			
8	L1	<b>16A Type C</b>	AHU 7 Extract Fan	4mm SWA			
	L2	<b>16A Type C</b>	AHU 7 Extract Fan	4mm SWA			
	L3	<b>16A Type C</b>	AHU 7 Extract Fan	4mm SWA			
9	L1	<b>16A Type C</b>	CP4 Outstation	2.5mm SWA			
	L2	N/A	Spare Way	N/A			
	L3	N/A	Spare Way	N/A			
10	L1	<b>10A Type B</b>	AHU 6 Lights	1.5mm SWA			
	L2	N/A	Spare Way	N/A			
	L3	N/A	Spare Way	N/A			
11	L1	<i>10A Type B</i>	<i>AHU 7 Lights</i>	<i>1.5mm SWA</i>			
	L2	N/A	Spare Way	N/A			
	L3	N/A	Spare Way	N/A			
12	L1	N/A	Spare Way	N/A			
	L2	N/A	Spare Way	N/A			
	L3	N/A	Spare Way	N/A			

**Legend**  
*Italics* Re-use existing circuits  
**Bold** New wiring  
 Standarc Not identified

	Total Load per phase		
	L1	L2	L3
<b>Watts</b>			
<b>Diversity %</b>			
<b>Power Factor</b>			
<b>Total Demand per phase</b>			

Brought Forward (Watts)		

Circuit			Circuit Description	Cable	Circuit Load (Watts)		
No.	Phase	MCB			L1	L2	L3
13	L1						
	L2						
	L3						
14	L1						
	L2						
	L3						
15	L1						
	L2						
	L3						
16	L1						
	L2						
	L3						
17	L1						
	L2						
	L3						
18	L1						
	L2						
	L3						
19	L1						
	L2						
	L3						
20	L1						
	L2						
	L3						
21	L1						
	L2						
	L3						
22	L1						
	L2						
	L3						
23	L1						
	L2						
	L3						
24	L1						
	L2						
	L3						

**Legend**  
*Italics* Re-use existing circuits  
**Bold** New wiring  
 Standarc Not identified

	Total Load per phase		
	L1	L2	L3
<b>Watts</b>			
<b>Diversity %</b>			
<b>Power Factor</b>			
<b>Total Demand per phase</b>			

# Distribution Board Schedule

Project: IMO LV and Control panel Replacement  
 Dist Board Ref: DB CHTP2-1&2  
 Location: Second Floor (Mezzanine) - Plant Room 15  
 Board Size & Phase: Schneider Electric 24 Way 3 Phase

Job No: 18080  
 Engineer: S.I.M  
 Date: 08/05/2017  
 Checked: \_\_\_\_\_

Circuit			Circuit Description	Cable	Circuit Load (Watts)		
No.	Phase	MCB			L1	L2	L3
1	L1	16A Type C	AHU 24 Supply Fan	4mm SWA			
	L2	16A Type C	AHU 24 Supply Fan	4mm SWA			
	L3	16A Type C	AHU 24 Supply Fan	4mm SWA			
2	L1	10A Type B	AHU 21 Lights	1.5mm SWA			
	L2	10A Type B	AHU 24 Lights	1.5mm SWA			
	L3	N/A	Spare Way	N/A			
3	L1	16A Type C	AHU 24 Extract Fan	4mm SWA			
	L2	16A Type C	AHU 24 Extract Fan	4mm SWA			
	L3	16A Type C	AHU 24 Extract Fan	4mm SWA			
4	L1	20A Type C	Roof Hoist	6mm SWA			
	L2	20A Type C	Roof Hoist	6mm SWA			
	L3	20A Type C	Roof Hoist	6mm SWA			
5	L1	40A Type C	AHU 21 Supply Fan	6mm SWA			
	L2	40A Type C	AHU 21 Supply Fan	6mm SWA			
	L3	40A Type C	AHU 21 Supply Fan	6mm SWA			
6	L1	N/A	Spare Way	N/A			
	L2	N/A	Spare Way	N/A			
	L3	10A Type B	Staircase Lighting	1.5mm			
7	L1	N/A	Spare Way	N/A			
	L2	TBC	Drainage Pump (Near AHU 21)	1.5mm			
	L3	N/A	Spare Way	N/A			
8	L1	40A Type C	AHU 21 Extract Fan	6mm SWA			
	L2	40A Type C	AHU 21 Extract Fan	6mm SWA			
	L3	40A Type C	AHU 21 Extract Fan	6mm SWA			
9	L1	16A Type C	AHU 21 Heat Recovery pump	4mm SWA			
	L2	16A Type C	AHU 21 Heat Recovery pump	4mm SWA			
	L3	16A Type C	AHU 21 Heat Recovery pump	4mm SWA			
10	L1	N/A	Spare Way	N/A			
	L2	N/A	Spare Way	N/A			
	L3	10A Type B	Staircase F Lighting	1.5mm			
11	L1	N/A	Spare Way	N/A			
	L2	N/A	Spare Way	N/A			
	L3	10A Type B	Plant Room Small Power	1.5mm			
12	L1	N/A	Spare Way	N/A			
	L2	N/A	Spare Way	N/A			
	L3	10A Type B	Plant Room Lighting	1.5mm			

**Legend**

*Italics* Re-use existing circuits  
**Bold** New wiring  
 Standard Not identified

	Total Load per phase		
	L1	L2	L3
<b>Watts</b>			
<b>Diversity %</b>			
<b>Power Factor</b>			
<b>Total Demand per phase</b>			

Brought Forward (Watts)		

Circuit			Circuit Description	Cable	Circuit Load (Watts)		
No.	Phase	MCB			L1	L2	L3
13	L1	16A Type C	AHU 22 Supply Fan	4mm SWA			
	L2	16A Type C	AHU 22 Supply Fan	4mm SWA			
	L3	16A Type C	AHU 22 Supply Fan	4mm SWA			
14	L1	N/A	Spare Way	N/A			
	L2	N/A	Spare Way	N/A			
	L3	N/A	Spare Way	N/A			
15	L1	N/A	Spare Way	N/A			
	L2	16A Type C	CP9 Outstation	2.5mm SWA			
	L3	N/A	Spare Way	N/A			
16	L1	16A Type C	AHU 22 Extract Fan	4mm SWA			
	L2	16A Type C	AHU 22 Extract Fan	4mm SWA			
	L3	16A Type C	AHU 22 Extract Fan	4mm SWA			
17	L1	16A Type C	AHU 22 Heat Recovery Pump	4mm SWA			
	L2	16A Type C	AHU 22 Heat Recovery Pump	4mm SWA			
	L3	16A Type C	AHU 22 Heat Recovery Pump	4mm SWA			
18	L1	16A Type C	AHU 23 Supply Fan	6mm SWA			
	L2	16A Type C	AHU 23 Supply Fan	6mm SWA			
	L3	16A Type C	AHU 23 Supply Fan	6mm SWA			
19	L1	N/A	Spare Way	N/A			
	L2	N/A	Spare Way	N/A			
	L3	N/A	Spare Way	N/A			
20	L1	N/A	Spare Way	N/A			
	L2	N/A	Spare Way	N/A			
	L3	N/A	Spare Way	N/A			
21	L1	16A Type C	AHU 23 Extract Fan	4mm SWA			
	L2	16A Type C	AHU 23 Extract Fan	4mm SWA			
	L3	16A Type C	AHU 23 Extract Fan	4mm SWA			
22	L1	16A Type C	AHU 23 Heat Recovery Pump	2.5mm SWA			
	L2	16A Type C	AHU 23 Heat Recovery Pump	2.5mm SWA			
	L3	16A Type C	AHU 23 Heat Recovery Pump	2.5mm SWA			
23	L1	10A Type B	AHU 22 Lights	1.5mm SWA			
	L2	10A Type B	AHU 23 Lights	1.5mm SWA			
	L3	N/A	Spare Way	N/A			
24	L1	N/A	Spare Way	N/A			
	L2	N/A	Spare Way	N/A			
	L3	N/A	Spare Way	N/A			

**Legend**

*Italics* Re-use existing circuits

**Bold** New wiring

Standard Not identified

	Total Load per phase		
	L1	L2	L3
<b>Watts</b>			
<b>Diversity %</b>			
<b>Power Factor</b>			
<b>Total Demand per phase</b>			

# Distribution Board Schedule

Project: IMO LV and Control panel Replacement  
 Dist Board Ref: DB 3CTP2-1&2  
 Location: Third Floor Core C - Plant Room 12  
 Board Size & Phase Schneider Electric 18 Way 3 Phase

Job No: 18080  
 Engineer: S.I.M  
 Date: 08/05/2017  
 Checked: \_\_\_\_\_

Circuit			Circuit Description	Cable	Circuit Load (Watts)		
No.	Phase	MCB			L1	L2	L3
1	L1	<b>10 A Type C</b>	AHU 11 Light	1.5mm SWA			
	L2	<b>16A Type C</b>	CP6 Outstation	2.5mm SWA			
	L3	<i>10A Type B</i>	<i>Plant Room Lighting</i>	<i>2.5mm</i>			
2	L1	<b>16A Type C</b>	AHU 11 Supply Fan	4mm SWA			
	L2	<b>16A Type C</b>	AHU 11 Supply Fan	4mm SWA			
	L3	<b>16A Type C</b>	AHU 11 Supply Fan	4mm SWA			
3	L1	<b>16A Type C</b>	AHU 11 Extract Fan	4mm SWA			
	L2	<b>16A Type C</b>	AHU 11 Extract Fan	4mm SWA			
	L3	<b>16A Type C</b>	AHU 11 Extract Fan	4mm SWA			
4	L1	<b>16A Type C</b>	AHU 12 Supply Fan	4mm SWA			
	L2	<b>16A Type C</b>	AHU 12 Supply Fan	4mm SWA			
	L3	<b>16A Type C</b>	AHU 12 Supply Fan	4mm SWA			
5	L1	<b>16A Type C</b>	AHU 12 Extract Fan	4mm SWA			
	L2	<b>16A Type C</b>	AHU 12 Extract Fan	4mm SWA			
	L3	<b>16A Type C</b>	AHU 12 Extract Fan	4mm SWA			
6	L1	<b>16A Type C</b>	AHU 13 Supply Fan	4mm SWA			
	L2	<b>16A Type C</b>	AHU 13 Supply Fan	4mm SWA			
	L3	<b>16A Type C</b>	AHU 13 Supply Fan	4mm SWA			
7	L1	<b>16A Type C</b>	AHU 13 Extract Fan	4mm SWA			
	L2	<b>16A Type C</b>	AHU 13 Extract Fan	4mm SWA			
	L3	<b>16A Type C</b>	AHU 13 Extract Fan	4mm SWA			
8	L1	<b>10A Type C</b>	AHU 12 & 13 Lights	1.5mm SWA			
	L2	<i>20A Type B</i>	<i>Plant Room Radial Socket-Outlets</i>	<i>4mm SWA</i>			
	L3	N/A	Spare Way	N/A			
9	L1	<b>16A Type C</b>	AHU 11 Heat Recovery Pump	4mm SWA			
	L2	<b>16A Type C</b>	AHU 11 Heat Recovery Pump	4mm SWA			
	L3	<b>16A Type C</b>	AHU 11 Heat Recovery Pump	4mm SWA			
10	L1	N/A	Spare Way	N/A			
	L2	N/A	Spare Way	N/A			
	L3	N/A	Spare Way	N/A			
11	L1	N/A	Spare Way	N/A			
	L2	N/A	Spare Way	N/A			
	L3	N/A	Spare Way	N/A			
12	L1	N/A	Spare Way	N/A			
	L2	N/A	Spare Way	N/A			
	L3	N/A	Spare Way	N/A			

**Legend**

*Italics* Re-use existing circuits

**Bold** New wiring

Standard Not identified

	Total Load per phase		
	L1	L2	L3
<b>Watts</b>			
<b>Diversity %</b>			
<b>Power Factor</b>			
<b>Total Demand per phase</b>			

Brought Forward (Watts)		

Circuit			Circuit Description	Cable	Circuit Load (Watts)		
No.	Phase	MCB			L1	L2	L3
13	L1	N/A	Spare Way	N/A			
	L2	N/A	Spare Way	N/A			
	L3	N/A	Spare Way	N/A			
14	L1	N/A	Spare Way	N/A			
	L2	N/A	Spare Way	N/A			
	L3	N/A	Spare Way	N/A			
15	L1	N/A	Spare Way	N/A			
	L2	N/A	Spare Way	N/A			
	L3	N/A	Spare Way	N/A			
16	L1	N/A	Spare Way	N/A			
	L2	N/A	Spare Way	N/A			
	L3	N/A	Spare Way	N/A			
17	L1	N/A	Spare Way	N/A			
	L2	N/A	Spare Way	N/A			
	L3	N/A	Spare Way	N/A			
18	L1	N/A	Spare Way	N/A			
	L2	N/A	Spare Way	N/A			
	L3	N/A	Spare Way	N/A			
19	L1						
	L2						
	L3						
20	L1						
	L2						
	L3						
21	L1						
	L2						
	L3						
22	L1						
	L2						
	L3						
23	L1						
	L2						
	L3						
24	L1						
	L2						
	L3						

**Legend**  
*Italics* Re-use existing circuits  
**Bold** New wiring  
 Standarc Not identified

	Total Load per phase		
	L1	L2	L3
<b>Watts</b>			
<b>Diversity %</b>			
<b>Power Factor</b>			
<b>Total Demand per phase</b>			

# Distribution Board Schedule

Project: IMO LV and Control panel Replacement  
 Dist Board Ref: DB 3BTP1-1&2  
 Location: 3rd Floor Core B - Plant Room 11  
 Board Size & Phase Schneider Electric 18 Way 3 Phase

Job No: 18080  
 Engineer: S.I.M  
 Date: 08/05/2017  
 Checked:

Circuit			Circuit Description	Cable	Circuit Load (Watts)		
No.	Phase	MCB			L1	L2	L3
1	L1	16A Type C	AHU 10 Toilet Extract Fan	4mm SWA			
	L2	16A Type C	AHU 10 Toilet Extract Fan	4mm SWA			
	L3	16A Type C	AHU 10 Toilet Extract Fan	4mm SWA			
2	L1	16A Type C	AHU 10 Supply Fan	4mm SWA			
	L2	16A Type C	AHU 10 Supply Fan	4mm SWA			
	L3	16A Type C	AHU 10 Supply Fan	4mm SWA			
3	L1	16A Type C	AHU 8 Supply Fan	4mm SWA			
	L2	16A Type C	AHU 8 Supply Fan	4mm SWA			
	L3	16A Type C	AHU 8 Supply Fan	4mm SWA			
4	L1	16A Type C	AHU 27 Supply Fan	2.5mm SWA			
	L2	16A Type C	AHU 27 Supply Fan	2.5mm SWA			
	L3	16A Type C	AHU 27 Supply Fan	2.5mm SWA			
5	L1	16A Type C	AHU 8 Toilet Extract Fan Standby	4mm SWA			
	L2	16A Type C	AHU 8 Toilet Extract Fan Standby	4mm SWA			
	L3	16A Type C	AHU 8 Toilet Extract Fan Standby	4mm SWA			
6	L1	16A Type C	AHU 8 Extract Fan	4mm SWA			
	L2	16A Type C	AHU 8 Extract Fan	4mm SWA			
	L3	16A Type C	AHU 8 Extract Fan	4mm SWA			
7	L1	16A Type C	AHU 9 Supply and Extract Starter Panel	4mm SWA			
	L2	16A Type C	AHU 9 Supply and Extract Starter Panel	4mm SWA			
	L3	16A Type C	AHU 9 Supply and Extract Starter Panel	4mm SWA			
8	L1	16A Type C	AHU 27 Extract Fan	4mm SWA			
	L2	16A Type C	AHU 27 Extract Fan	4mm SWA			
	L3	16A Type C	AHU 27 Extract Fan	4mm SWA			
9	L1	10A Type C	AHU 8 Light	1.5mm SWA			
	L2	N/A	Spare Way	N/A			
	L3	N/A	Spare Way	N/A			
10	L1	32A Type C	Roof Hoist	6mm SWA			
	L2	32A Type C	Roof Hoist	6mm SWA			
	L3	32A Type C	Roof Hoist	6mm SWA			
11	L1	10A Type C	AHU 9 Light	1.5mm SWA			
	L2	32A Type C	Roof Pond Filter	2x2.5mm			
	L3	10A Type C	Plant Room Lighting	1.5mm SWA			
12	L1	16A Type C	AHU 8 Heat Recovery Pump	4mm SWA			
	L2	16A Type C	AHU 8 Heat Recovery Pump	4mm SWA			
	L3	16A Type C	AHU 8 Heat Recovery Pump	4mm SWA			

**Legend**  
*Italics* Re-use existing circuits  
**Bold** New wiring  
 Standarc Not identified

	Total Load per phase		
	L1	L2	L3
Watts			
Diversity %			
Power Factor			
Total Demand per phase			

Brought Forward (Watts)		

Circuit			Circuit Description	Cable	Circuit Load (Watts)		
No.	Phase	MCB			L1	L2	L3
13	L1	<i>Unknown</i>	<i>Unknown</i>	2.5mm			
	L2	<b>16A Type B</b>	<b>CP5 Outstation</b>	<b>2.5mm SWA</b>			
	L3	N/A	Spare Way	N/A			
14	L1	N/A	Spare Way	N/A			
	L2	N/A	Spare Way	N/A			
	L3	N/A	Spare Way	N/A			
15	L1	N/A	Spare Way	N/A			
	L2	N/A	Spare Way	N/A			
	L3	N/A	Spare Way	N/A			
16	L1	N/A	Spare Way	N/A			
	L2	N/A	Spare Way	N/A			
	L3	<b>20A Type B</b>	<i>Socket Outlet Below Distribution Board</i>	4mm			
17	L1	N/A	Spare Way	N/A			
	L2	N/A	Spare Way	N/A			
	L3	N/A	Spare Way	N/A			
18	L1	N/A	Spare Way	N/A			
	L2	N/A	Spare Way	N/A			
	L3	N/A	Spare Way	N/A			
19	L1						
	L2						
	L3						
20	L1						
	L2						
	L3						
21	L1						
	L2						
	L3						
22	L1						
	L2						
	L3						
23	L1						
	L2						
	L3						
24	L1						
	L2						
	L3						

**Legend**  
*Italics* Re-use existing circuits  
**Bold** New wiring  
 Standarc Not identified

	Total Load per phase		
	L1	L2	L3
<b>Watts</b>			
<b>Diversity %</b>			
<b>Power Factor</b>			
<b>Total Demand per phase</b>			

# Lift Isolator Schedule

Project: IMO LV and Control panel Replacement

Job No: 18080

Dist Board Ref: Lift Isolators

Engineer S.I.M

Location: Various

Date: 08/05/2017

Board Size & Phase:

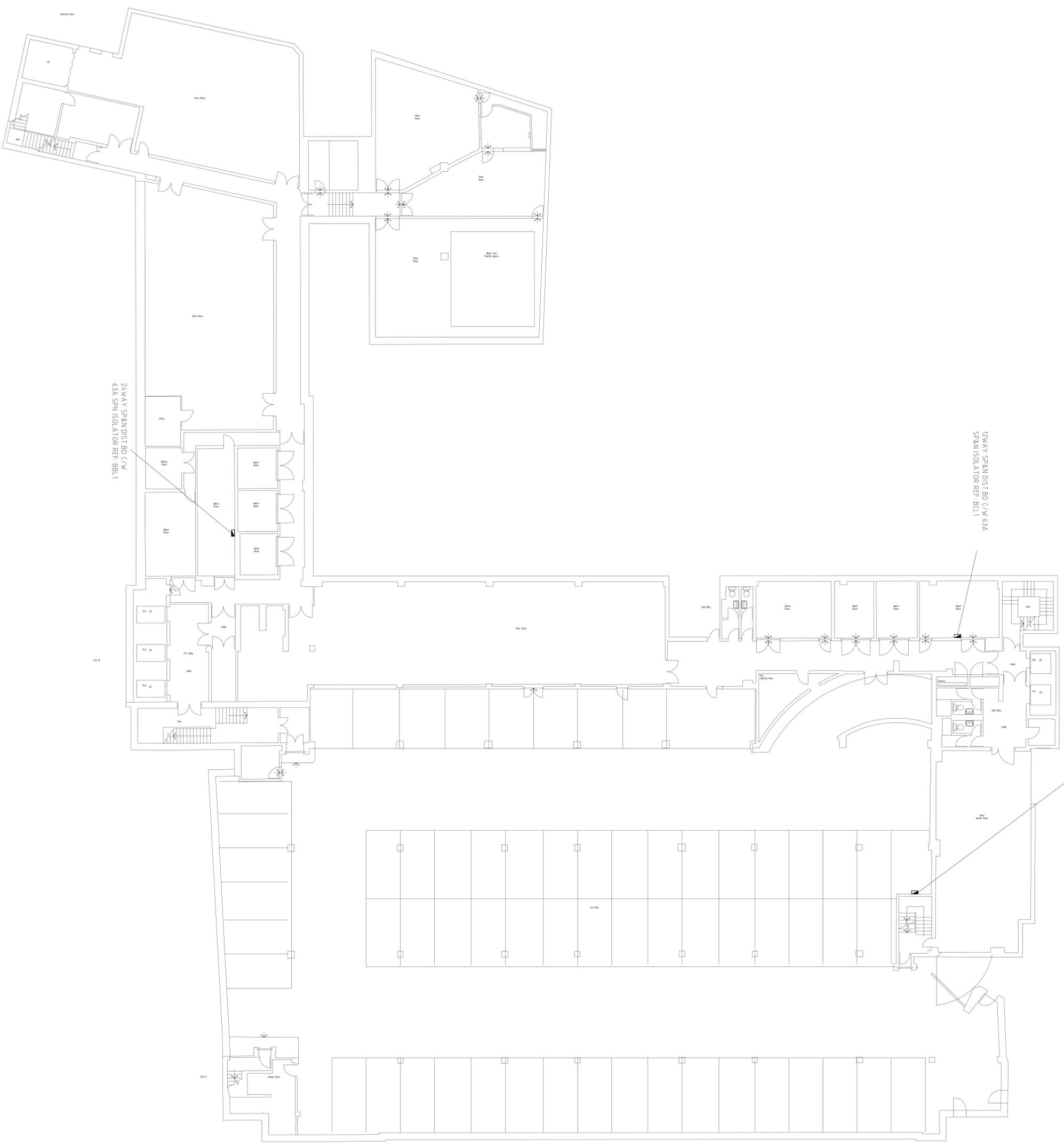
Checked:

Lift Description			Isolator Description	Cable	Fused Rating
Floor.	Core	Lift no.			
B	B	8	Hydraulic Lift, 200A F/Switch	TBC	160A
7	A	1	100A F/Switch	TBC	40A
N/A	B	N/A	300amp T.P Isolating Switch	TBC	N/A
9	B	N/A	Lift Controls DB, 100A F/Switch	TBC	63A
9	B	2	100A F/Switch	TBC	100A
9	B	3	100A F/Switch	TBC	100A
9	B	4	100A F/Switch	TBC	100A
9	B	5	100A F/Switch	TBC	100A
9	C	6	100A F/Switch	TBC	40A
9	C	7	60A F/Switch	TBC	16A

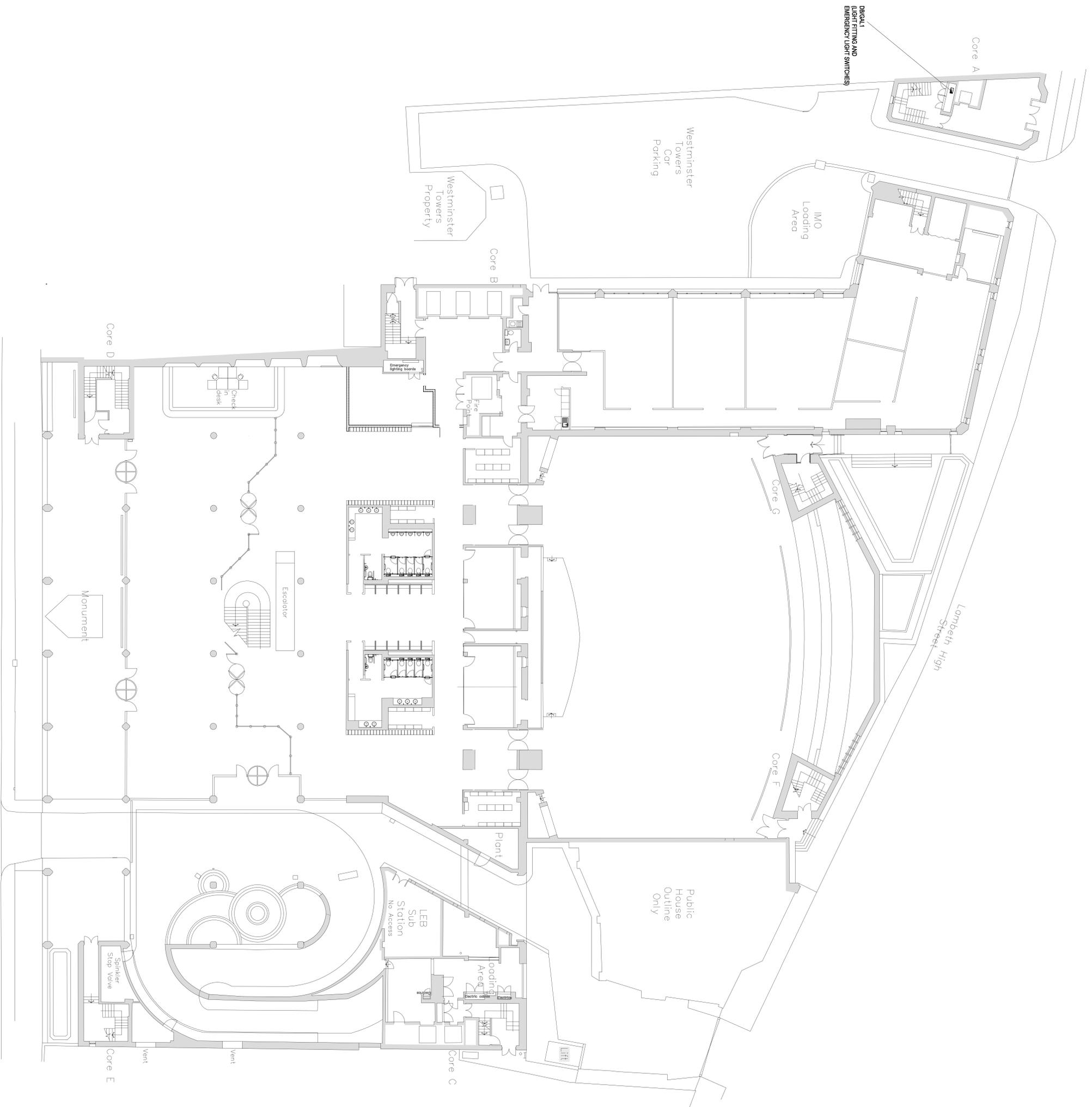
---

## Appendix Three- Emergency Lighting Works

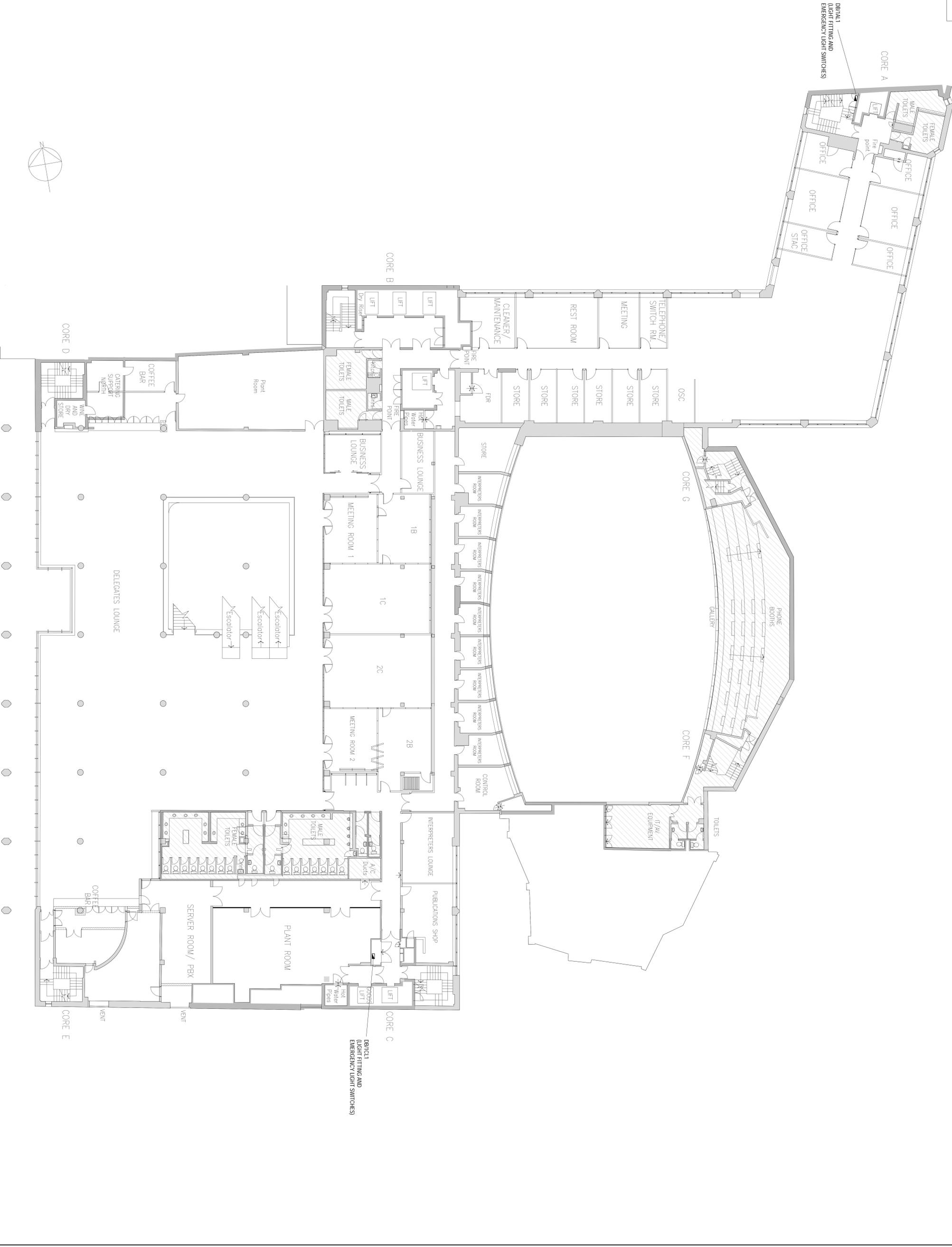
### A.3.1 - Drawings



<p>Client: DEPARTMENT FOR TRANSPORT</p> <p>Approved: FAITHFUL + GUILD</p> <p>Project No: 18080</p> <p>Drawn By: SWP</p> <p>Date: 18/08/17</p> <p>Checked: JCS</p> <p>Scale: NTS</p> <p>Author: MDD</p> <p>Revision: T1</p>		<p>18080-EL-B-01</p>		
<p><b>TRICUP</b> BY WATERS + ANDERS</p> <p>83 Ferndale Street 1 - 444 1000 1054, 1450 * 1482 Spencer Street * 1482 Spencer Street</p>				
<p>Project: ELECTRICAL INFRASTRUCTURE WORK 2017</p> <p>Title: EMERGENCY LIGHT UPGRADES GROUND FLOOR PROPOSED WORKS</p>				
Rev	Date	Description	Rev	Date



<p><b>TRCUP</b>  <b>ST WATERS</b>  <b>+ ANDERS</b>          183 Crayke Street          1. +44 (0)20 7091 1000          e. info@trcup.com          www.trcup.com</p>			
<p><b>Client:</b> DEPARTMENT FOR TRANSPORT  <b>Address:</b> FAITHFUL + GOULD  <b>Project No.:</b> SWP  <b>Drawn By:</b> JUNE 17  <b>Checkd:</b> JCS  <b>Scale:</b> N/A  <b>Acad Model:</b> Revision</p>			
<p><b>Project:</b> 2017  <b>EMERGENCY LIGHT UPGRADES          GROUND FLOOR          PROPOSED WORKS</b></p>			
<p><b>Project:</b> ELECTRICAL INFRASTRUCTURE WORKS</p>			
<p>Rev / Desc</p>	<p>Rev / Desc</p>	<p>Date</p>	<p>Date</p>
<p>Drawing No. 18080-EL-G-01</p>			
			<p>T1</p>



REV	DATE	DESCRIPTION	BY	CHECKED	DATE

**TROUP BYWATERS**  
*Bringing Buildings to Life Since 1958*  
 445 Empire Street  
 London, WV 26040  
 T: 202.724.4400  
 F: 202.724.4401  
 E: info@troupany.com  
 I: www.troupany.com

**PROJECT:**  
 EMERGENCY LIGHT UPGRADES  
 FIRST FLOOR  
 PROPOSED WORKS

**CLIENT:**  
 DEPARTMENT FOR TRANSPORT  
 FAITHFUL + GULD

**DATE:**  
 2017

**DRAWING NO.:**  
 18080-EL-01-01

**SCALE:**  
 AS SHOWN

**DATE:**  
 11/17/17

**BY:**  
 JAC

**CHECKED:**  
 JAC

**DATE:**  
 11/17/17

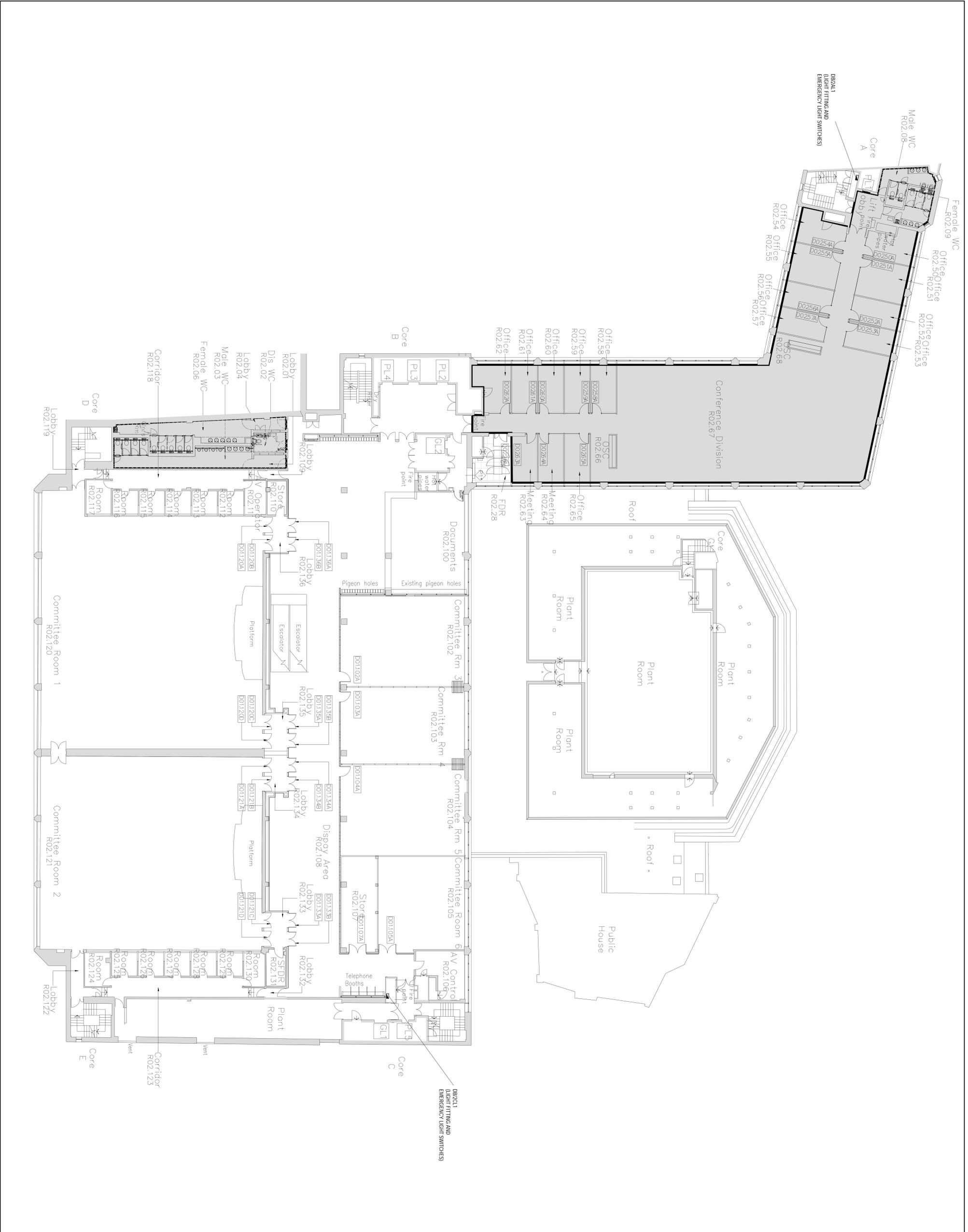
**SCALE:**  
 AS SHOWN

**DATE:**  
 11/17/17

**BY:**  
 JAC

**CHECKED:**  
 JAC

**DATE:**  
 11/17/17



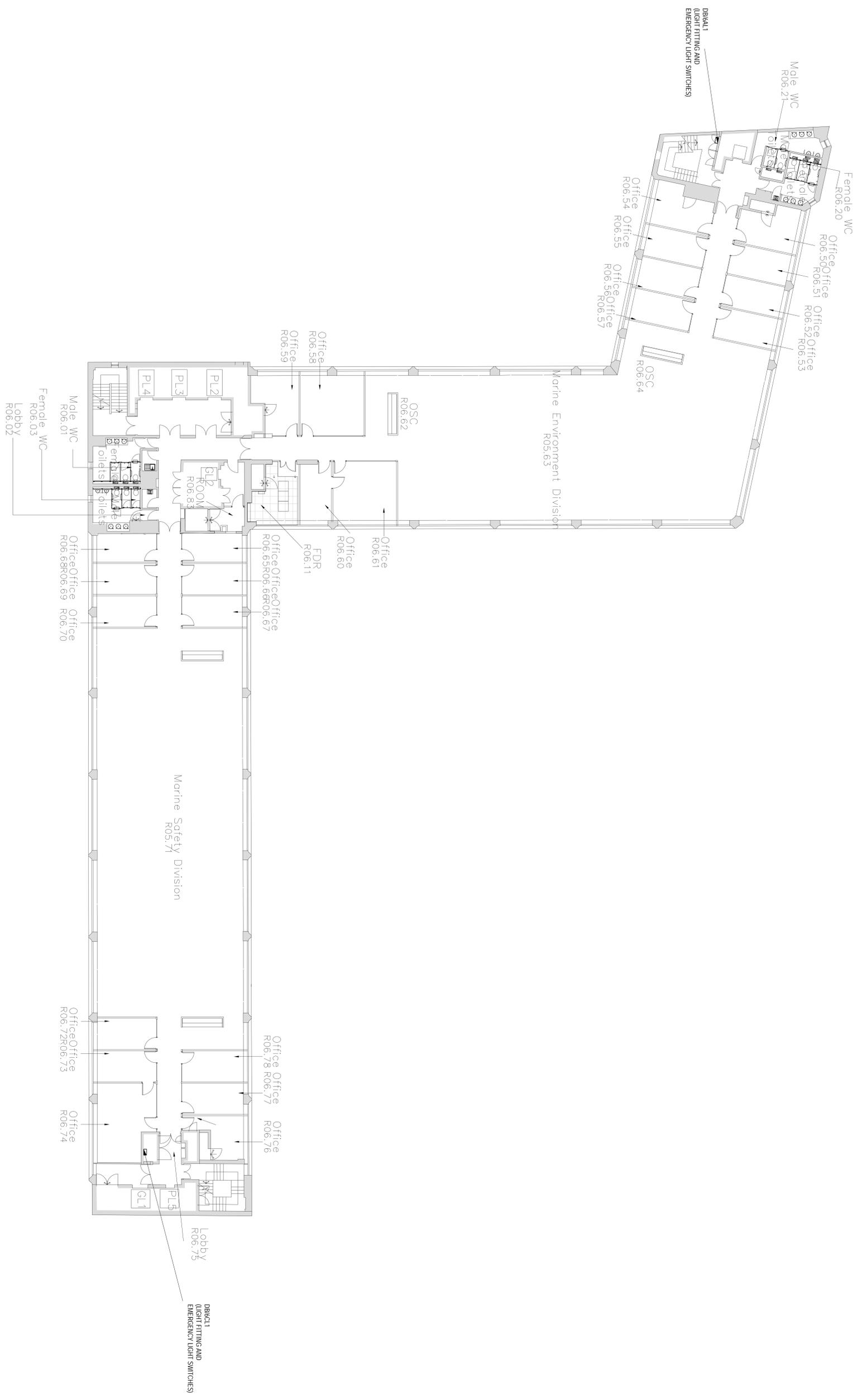
<p><b>TRICUP</b>  <b>BY WATERS</b>  <b>+ ANDERS</b>          182 Campbell Street          Sydney NSW 2000          t +61 (0)2 9291 1800          e info@tricup.com.au          www.tricup.com.au</p>	
<p><b>Project:</b>          ELECTRICAL INFRASTRUCTURE WORKS          2017</p>	
<p><b>The:</b>          EMERGENCY LIGHT UPGRADES          FIRST FLOOR          PROPOSED WORKS</p>	
<p><b>Client:</b>          DEPARTMENT FOR TRANSPORT          FAITHFUL + GOULD</p>	
<p><b>Project No:</b>          18080-EL-02-01</p>	<p><b>Revision:</b>          T1</p>





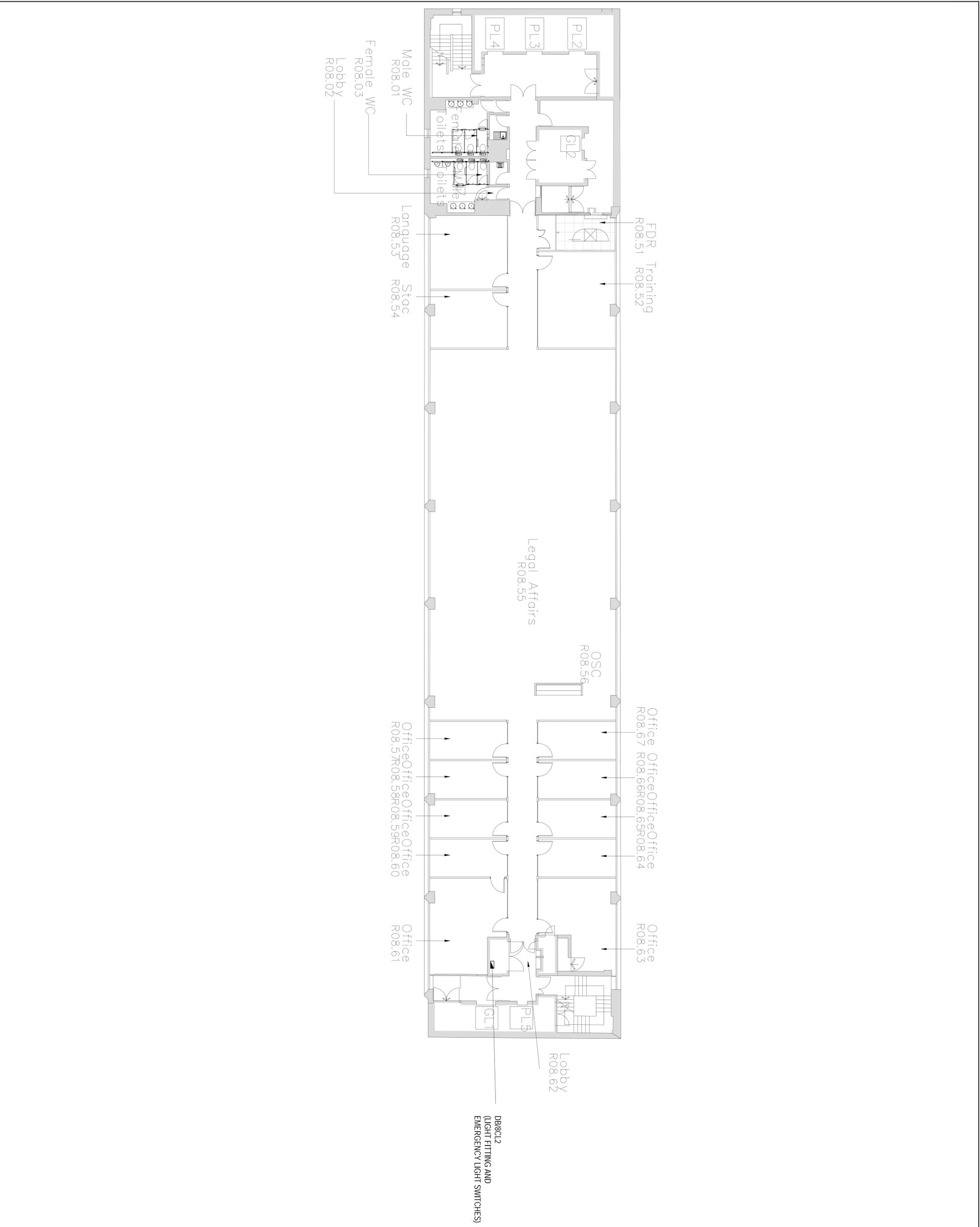






<p><b>TRCUP</b>  <b>BY WATERS</b>  <b>+ ANDERS</b>          183 Campbell Street          Sydney NSW 2000          t +61 (0)2 9291 1800          e info@trcup.com.au          www.trcup.com.au</p>			
<p>Client: DEPARTMENT FOR TRANSPORT</p>	<p>Project: 2017</p>	<p>Project No: 18090-EL-06-01</p>	<p>Revision: T1</p>
<p>Author: FAITHFUL + GOULD</p>	<p>Design By: JAMES TAYLOR</p>	<p>Checked: JAMES TAYLOR</p>	<p>Scale: N/A</p>
<p>Date: 2017</p>	<p>Drawn By: JAMES TAYLOR</p>	<p>Project No: 18090-EL-06-01</p>	<p>Revision: T1</p>
<p>Project: THE DEPARTMENT FOR TRANSPORT SIXTH FLOOR PROPOSED WORKS</p>	<p>Project No: 18090-EL-06-01</p>	<p>Revision: T1</p>	<p>Revision: T1</p>





Client	TRANSPORT FOR LONDON
Address	FALTHFUL + GOULD
Project No.	2017
Drawn By	SW
Checkd	MS
Scale	
Revision	T1
Drawing No.	18080-EL-08-01

Rev	Date	Description	Rev	Date	Date

<p><b>TRCUP</b>  <b>BY WATERS</b>  <b>+ ANDERS</b></p> <p><small>Architectural Practice Ltd</small>          183 City Road          London EC3N 7TE          T: +44 (0)20 7294 1000          E: info@trcup.com          www.trcup.com</p>	
---	--

<p>Project  <b>ELECTRICAL INFRASTRUCTURE WORKS</b>          2017</p>	<p>The  <b>EMERGENCY LIGHT UPGRADES</b>  <b>EIGHTH FLOOR</b>  <b>PROPOSED WORKS</b></p>
--	---

---

## A.3.2 - Manufacturers Literature



An LED based, IP65 rated, emergency luminaire range comprising two models, a bulkhead and exit sign, both offering low maintenance

- Suitable for escape route and anti-panic (open area) lighting applications
- Long life LED solution
- 3 hour maintained and non maintained LED bulkhead
- 3 hour maintained exit sign features an integrated door illumination panel
- Bulkhead of durable polycarbonate construction
- Bulkheads supplied with an adhesive ISO legend kit and exit sign supplied with down arrow ISO legend

### Applications

- Corridor/staircases
- Warehouse/Storage
- Kitchen
- Loading bay
- Meeting rooms
- Utility areas
- Offices
- Toilets
- Lecture Theatre
- Open areas

### Emergency legends



### Spacing data

2m escape route

Minimum illuminance (lux)	Mounting height (m)	Maximum Spacing (m)			
		Centre to End		Between Centres	
		Trans	Axial	Trans	Axial
1.0	2.5	2.50	2.40	6.85	6.55
	3	2.45	2.30	7.05	6.75

Open area

Minimum illuminance (lux)	Mounting height (m)	Maximum Spacing (m)			
		Centre to End		Between Centres	
		Trans	Axial	Trans	Axial
0.5	2.5	2.40	2.40	7.75	7.65
	3	2.50	2.45	8.25	8.20
	3.5	2.50	2.50	8.65	8.65

Light source - LED  
DLOR - 99.0% LOR - 100%

## Standards

CE EN 60598 IP65 850°C

IP20

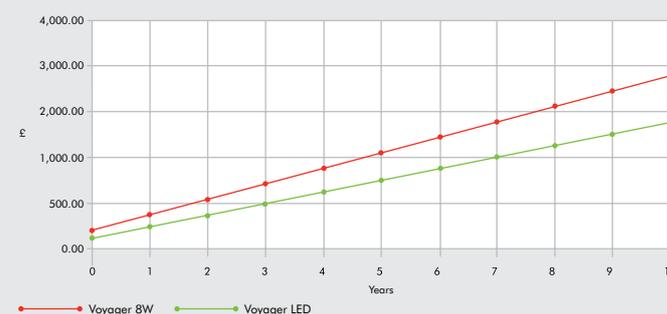
## Lamps



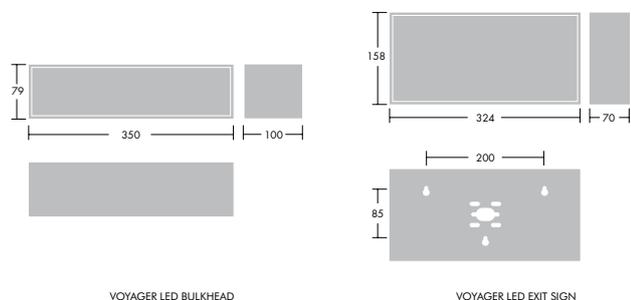
### Case Study for comparing a LED emergency bulkhead Vs a 8W T16 emergency bulkhead

The application is a new installation, a 30 metre corridor in an industrial location. Due to the improved spacing for the LED bulkhead then only four fittings are required compared to seven for the 8W versions. As there is a reduction in the number of fittings that require regular test and inspection then over the first year there is a small saving when selecting LED over 8W T16 if this was over a 10 year period, there would be a saving of over £1100.

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
LED	£213.33	£373.33	£533.33	£693.33	£886.67	£1,046.67	£1,206.67	£1,366.67	£1,526.67	£1,686.67
8W	£247.33	£527.33	£807.33	£1,087.33	£1,410.67	£1,690.67	£1,970.67	£2,250.67	£2,530.67	£2,810.67
Savings	£34.00	£154.00	£274.00	£394.00	£524.00	£644.00	£764.00	£884.00	£1,004.00	£1,124.00



## Overview



VOYAGER LED BULKHEAD

VOYAGER LED EXIT SIGN

## Ordering Guide

Supplied complete with LEDs

Description	Weights (kg)	SAP Code	Cat No.
VOYAGER E LED BULKHEAD E3NM	0.89	96241056	EVBLE3NM
VOYAGER E LED BULKHEAD E3M	0.89	96241057	EVBLE3M
VOYAGER E LED EXIT SIGN BOX*	1.78	96241058	EVELED3M

## Legends

VOYAGER LEG EURO UP	96233875	EVBEUU
VOYAGER LEG EURO DOWN	96233876	EVBEUD
VOYAGER LEG EURO LEFT	96233877	EVBEUL
VOYAGER LEG EURO RIGHT	96233878	EVBEUR
VOYAGER LEG ISO UP	96236785	EVBISOU
VOYAGER LEG ISO DOWN	96236786	EVBISOD
VOYAGER LEG ISO LEFT	96236787	EVBISOL
VOYAGER LEG ISO RIGHT	96236788	EVBISOR

\* Voyager Exit Sign Box contains the ISO down legend.

## Materials/Finish

Bulkhead  
Body: white polycarbonate.  
Diffuser: opal polycarbonate.  
Gear tray: polycarbonate.

Exit sign  
Body/gear tray: white painted steel.  
Panel: polycarbonate

## Installation/Mounting

Bulkhead  
Surface with Ø20mm cable entry each end and rear. Drill points for mounting on recessed ceiling or wall boxes including BESA. 3/4 way terminal block 2x1.5mm<sup>2</sup> or 1x4mm<sup>2</sup> capacity.

Exit sign  
Wall mounting with Ø20mm cable entry top and rear. Screw fixings (3) on rear. 3/4 way terminal block 2x1.5mm<sup>2</sup> or 1x4mm<sup>2</sup> capacity.

## Specification

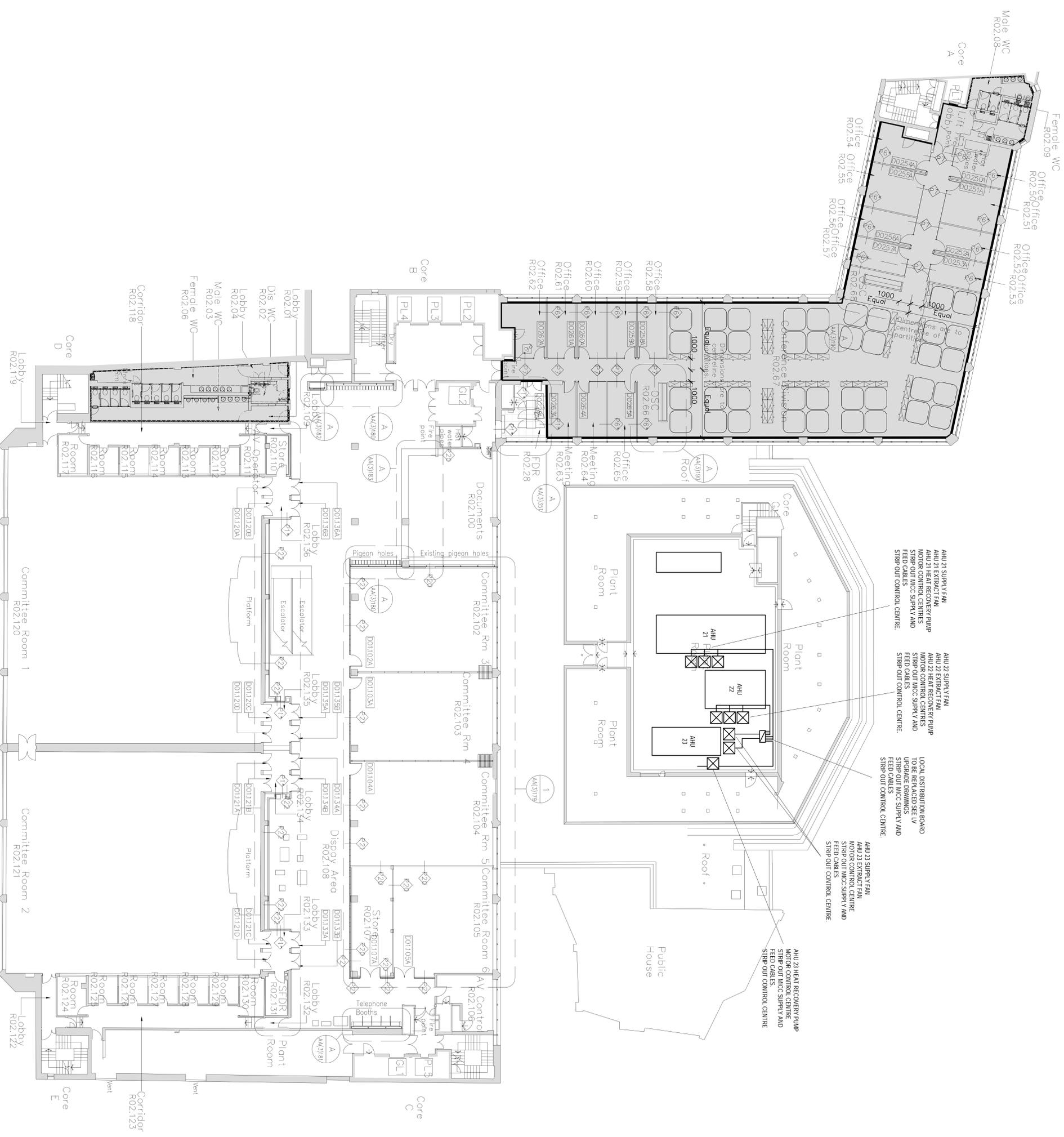
To specify state: Economical self-contained surface IP65 emergency bulkhead for maintained/non-maintained emergency lighting of 3 hour duration, with LED lamp and self adhesive legends.  
As Thorn Voyager E Bulkhead LED

To specify state: Economical wall mounted maintained/maintained 3 hour duration emergency exit sign IP20 with LED lamp, door illumination panel, down arrow ISO legend and epoxy coated mild steel construction.  
As Thorn Voyager E Exit Sign LED

---

## Appendix Four - Control Panel Replacement Works

### A4.1 - Drawings



NOTES

1. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH THE SPECIFICATION SCOPE OF WORKS PLUS ALL OTHER SERVICES.
2. ALL WORK SHALL BE IN ACCORDANCE WITH THE REQUIREMENTS OF THE SPECIFICATION AND THE EXISTING SITE DRAWINGS FROM THE MANAGEMENT OF WORKS.
3. EXACT LOCATION OF SERVICES SHALL BE FULLY CO-ORDINATED ON SITE BY THE CONTRACTOR SCALED AND ONLY WHAT IS ON THE DRAWING SHALL BE CONSIDERED.
4. THE SERVICES WORKS ARE TO BE CO-ORDINATED AND PROGRAMME WITH ALL MAINTENANCE SERVICES LINE TO THE BUILDING MANAGER (BIRMINGHAM WORKING HOURS).
5. ALL WORK SHALL BE COMPLETED WITHIN THE SPECIFIED TIME FRAME. DELAYS SHALL BE REPORTED TO THE BIRMINGHAM WORKING HOURS.
6. RISK VISUAL, STATEMENTS AND INFORMATION PROVIDED BY THE CONTRACTOR SHALL BE ACCEPTED ON THE ASSUMPTION OF THE INFORMATION PROVIDED BY OTHERS.

Project  
ELECTRICAL INFRASTRUCTURE WORKS  
2017

Client  
DEPARTMENT FOR TRANSPORT

Address  
FAITHFUL + GUILD

Project No  
18080-CP-2-00

Drawn By  
DATE 17/11/17

Checked  
DATE 17/11/17

Scale  
AS SHOWN

Author  
DATE 17/11/17

Rev	Date	Description	Rev	Check	Date

TRICUP  
BY WATERS  
+ ANDERS

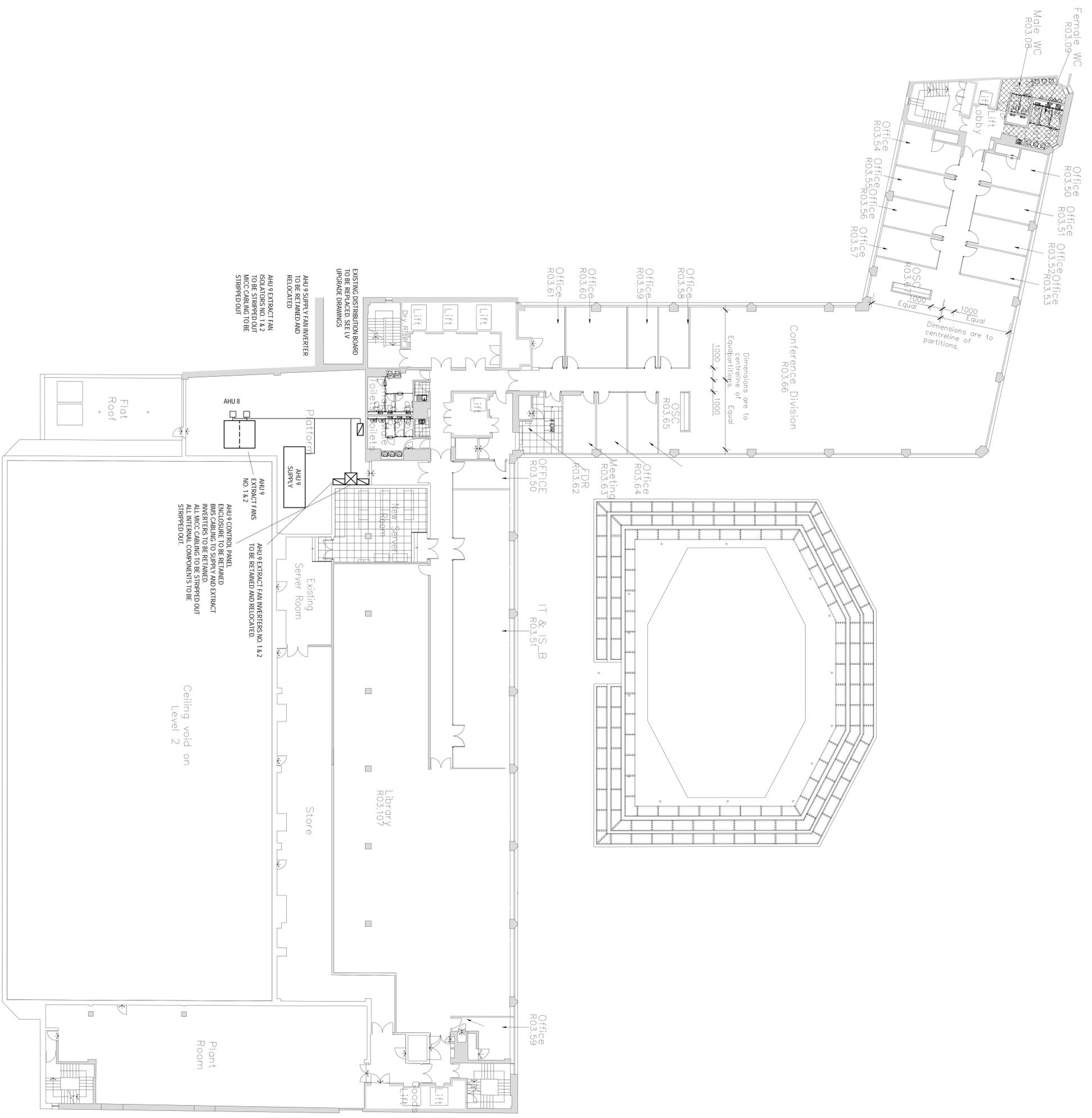
182, Cambridge Street  
London, EC4A 3DF  
T: +44 (0)20 7091 1000  
E: info@tricap.co.uk  
W: www.tricap.co.uk

Contract No  
18080-CP-2-00

Drawing No  
T1

---

## A4.2 - Variable Speed Drive Schedules

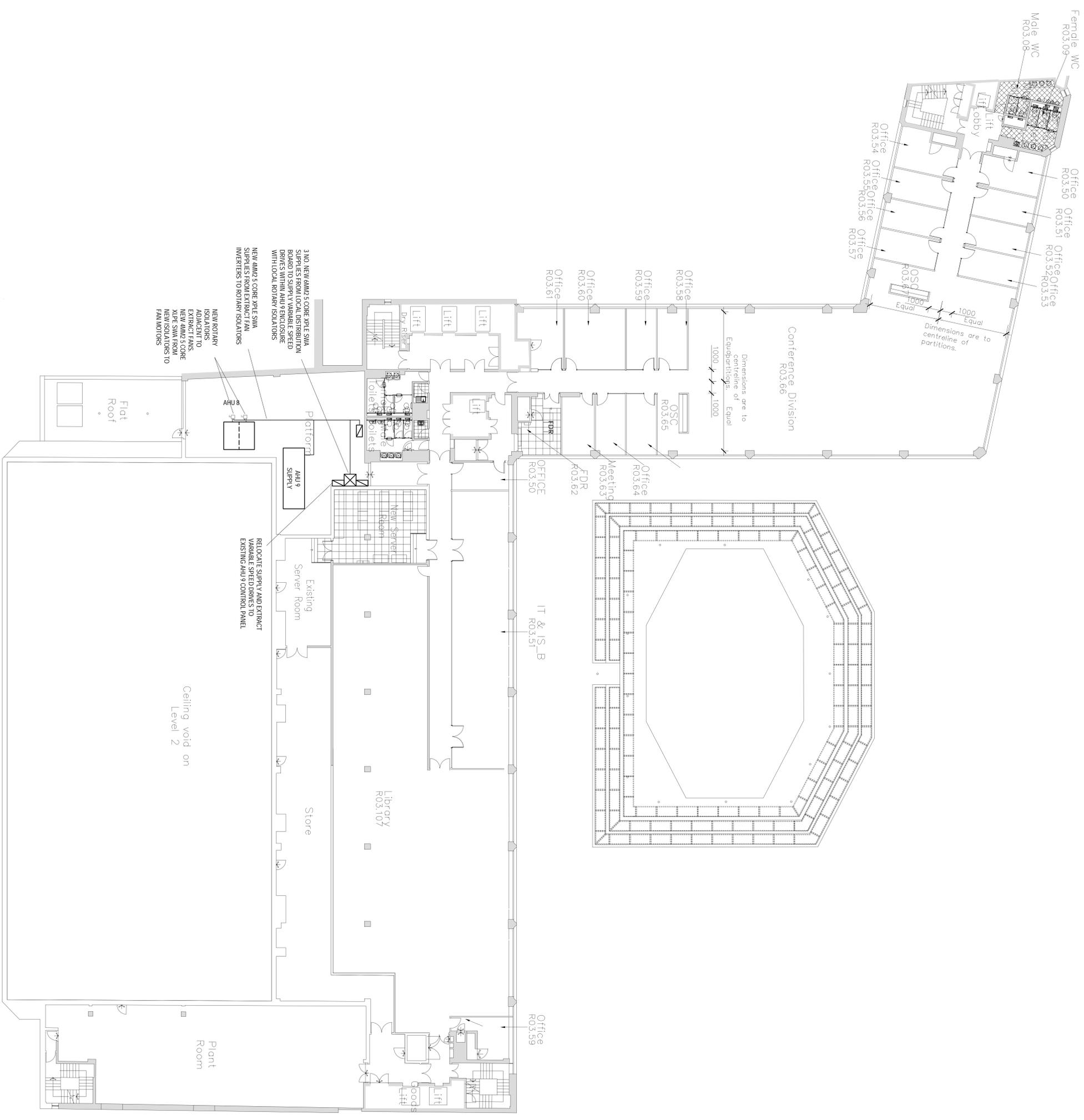


- NOTES**
1. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH THE SPECIFICATION SCOPE OF WORKS PLUS ALL OTHER SERVICES.
  2. CONTRIBUTIONS SHALL FOLLOW THE REQUIREMENTS WITH THE EXISTING SITE DATA FROM THE COMMENCEMENT OF WORKS.
  3. EXACT LOCATION OF SERVICES SHALL BE FULLY CO-ORDINATED ON SITE BY THE CONTRACTOR SCALED AND ONLY WHAT IS FOR CALCULATED DIMENSIONS USED.
  4. THE SERVICES WORKS ARE TO BE CO-ORDINATED AND PROGRAMME WITH ALL MAINTENANCE SERVICES LINE TO THE BUILDING PARKING TOWER WORKING HOURS.
  5. REMAINING SERVICES SHALL BE IDENTIFIED BY THE BUILDING VISUAL SURVEYS AND INFORMATION PROVIDED BY OTHERS. NO RESPONSIBILITY SHALL BE ACCEPTED ON THE ACCOUNT OF THE INFORMATION PROVIDED BY OTHERS.

Rev	Date	Description	Rev	Check	Date
<p><b>TRICUP</b>  <b>BY WATERS</b>  <b>+ ANDERS</b></p> <p>182 Cambridge Street              Level 11              Sydney NSW 2000              Australia              T: +61 (0)2 9291 1400              F: +61 (0)2 9291 1401              E: info@tricap.com.au              W: www.tricap.com.au</p>					
<p>Client: DEPARTMENT FOR TRANSPORTATION              Address: FAITHFUL + GUILD              Project No: 18080-CP-03-00              Drawn By: JAC              Date: 17/06/17              Checked: KTS              Scale: Revision              Acad Model              Drawing No: 18080-CP-03-00              T1</p>					
<p>Project: ELECTRICAL INFRASTRUCTURE WORKS              2017              THE CONTROL PANEL UPGRADE              THIRD FLOOR              STRIP OUT WORKS</p>					







- NOTES**
1. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH THE SPECIFICATION SCOPE OF WORKS PLUS ALL OTHER SERVICES CONTRIBUTIONS SHALL FURNISH THE NECESSARY DETAILS WITH THE EXISTING SITE DRAWINGS FROM TO COMPLEMENT OR WORKS EXACT LOCATION OF SERVICES SHALL BE FULLY CO-ORDINATED ON SITE BY THE CONTRACTOR SCALED AND ONE WORK FOR EACH CALCULATED DIMENSIONS USED
  2. THE SERVICES WORKS ARE TO BE CO-ORDINATED AND PROGRAMME WITH ALL MAINTENANCE SERVICES LINE TO THE BUILDING PLANNING DEPARTMENT WORKING HOURS FROM VISUAL SURVEYS AND INFORMATION PROVIDED BY OTHERS, NOT RESPONSIBILITY SHALL BE ACCEPTED ON THE MOTOR SIZES ASSIGNED VIA VISUAL SURVEY ONLY.
  3. CONTRACTOR TO VERIFY MOTOR SIZES AND INVERTER FOR INVERTER SELECTION REFER TO SCHEDULES WITHIN SPECIFICATION AND SET OUTING TO BE ALIGNED TO EXISTING DRAS WIRING TO BE RETAINED AND CONNECTED TO NEW INVERTERS TO BE INSTALLED AND COMMISSION ACCORDANCE WITH MANUFACTURERS INSTRUCTIONS.
  - 4.
  - 5.
  - 6.
  - 7.
  - 8.
  - 9.
  - 10.
  - 11.

Rev	Date	Description	Rev	Check	Date
<p><b>TRICUP</b>  <b>BY WATERS</b>  <b>+ ANDERS</b>          183 Cavendish Street          Level 11          Auckland 1010          T: +64 (0) 9 704 1000          F: +64 (0) 9 704 1001          E: info@tricup.co.nz          W: www.tricup.co.nz</p>					
<p>Client: DEPARTMENT FOR TRANSPORTATION          Address: FAITHFUL + GOULD          Project No: 18080-CP-03-01          Drawn By: DATE: 17/06/17          Checked: DATE: 17/06/17          Scale: A3          Author: MMS          Revision: T1</p>					
<p>Project: ELECTRICAL INFRASTRUCTURE WORKS          2017          THE CONTROL PANEL UPGRADE          THIRD FLOOR          PROPOSED WORKS</p>					



















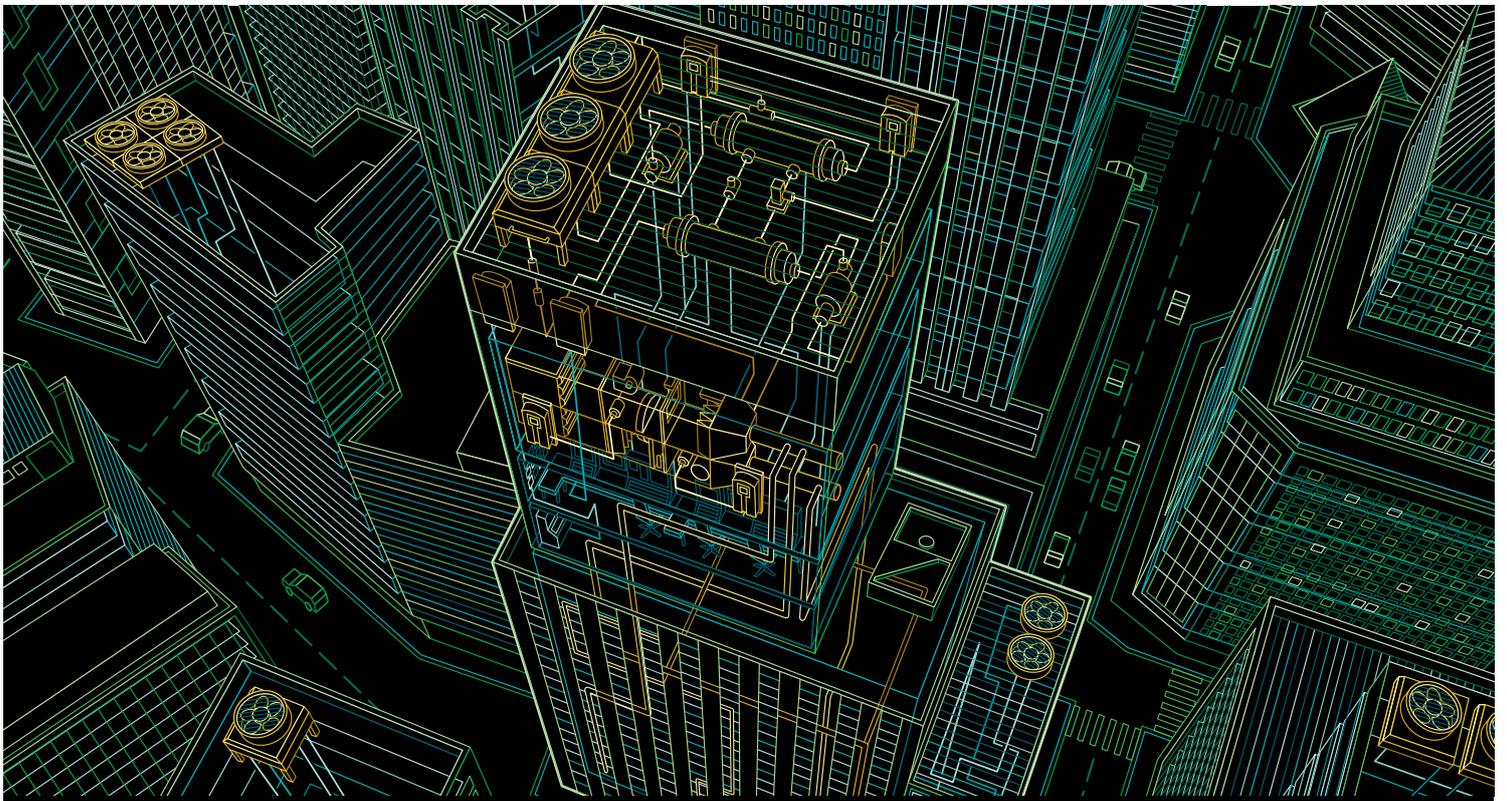






---

## A4.3 - Manufacturers Literature



Low voltage AC drives

# ABB drives for HVAC

## Committed to your comfort zone

# Peace of mind as standard



## Design engineer

“We specify ABB drives and have them running in more than 3,000 buildings. Their simplicity and reliability allow me to concentrate on my job without having to worry about the HVAC installation.”

“When I call ABB, I know I get the right answer.”

“With ABB’s energy saving tools, I can prove that the money saved helps justify the investment. Some people like the general idea of saving energy, some people want to go into the smallest detail. Either is possible with the ABB drive for HVAC.”

“I don’t have to look for external components like timers and PID controllers and then worry about their compatibility.”

“The ABB drive for HVAC does precisely what it is engineered to do - when the building gets hot the drive delivers air flow to suit.”

“The documentation for the ABB drive for HVAC is simple and clear to understand. For the first time in a long while I never get calls from our personnel on site.”

“Once the ABB drive for HVAC is installed, that’s the last time I hear about it.”

“Override is an invaluable function that minimizes the number of components and facilitates my job.”

## Keeps you out of trouble

- EMC filters for building sector, class C2 (1<sup>st</sup> environment).
- Meets mandatory harmonic current standard EN 61000-3-12.
- Coated electronic boards improve reliability and extend the life-time of the drive.
- Ambient temperature up to 50 °C.

## Override

Override can be used, for example, during a fire for extracting fumes rapidly and efficiently from a building. When override is activated the drive operates in a pre-defined direction at a preset speed while ignoring the drive’s other control commands and internal protective functions.

## Real-time clock and calendar

The built-in real-time clock and calendar function provides true time and date stamps to drive events and enables the use of timers. Information is displayed clearly on the control panel. Further, daylight saving times can be easily selected according to different time zones.

## Built-in timers

External timer circuits are no longer needed. Built-in timers - utilizing the real-time clock - allow starting and stopping the drive or changing the speed, according to the time of day or night. Relay outputs can be operated with timers to control any auxiliary equipment on site.

## BACnet MS/TP, N2, FLN and Modbus RTU embedded

Commonly used HVAC communication protocols are embedded into the drive, ensuring that they are always there if you need them. ABB has supplied, to building automation, tens of thousands of drives utilizing serial communications, including more than 30,000 BACnet installations.



### Makes your life comfortable

- Multilingual control panel with HELP button
- 14 HVAC application macros are preprogrammed and selectable without programming.
- A printed user's manual is delivered with each drive.
- Miniature circuit breakers can be used instead of fuses.

### Swinging choke - up to 25% less harmonics

ABB's swinging choke lets the drive for HVAC deliver up to 25% less harmonics at partial loads, compared to a conventional choke of equal size.

### Main switch as option for local safety

Integrated drive specific disconnect solution for

- easy installation
- easy serviceability
- space savings



### Interactive startup assistants

Startup assistants help to commission the drive. Easy step-by-step assistants show how to use the PID controllers, timer functions and serial communications settings.

### Tailor-made HVAC software

The ABB drive for HVAC delivers a complete solution with a tailor-made configuration that will save you time and money. For example, actual process values like differential pressure signals can be converted inside the drive and displayed in engineering units like bar, l/s and °C.



### Contractor

"A great feature is the startup assistant. It guides me through the startup routine of the drive, very quickly and easily, enabling me to put a less experienced person on the job."

"The ABB drive for HVAC speaks my language - even in full sentences! I save time and money."

"Thanks to smart design, control and power cables are extremely easy to connect."

"The ABB drive for HVAC has all the functionality I need, built-in. So I don't have to check for the order handling to see if all add-ons have been included. One less thing to worry about."

"With the timer function I can leave out building management system (BMS) automation completely on smaller jobs."

"ABB's no-quibble warranty means just that - no questions are asked, so paperwork is kept to a minimum."

# Intelligent and intuitive AC drives for improved energy efficiency

**ABB drives for HVAC make maintaining a building's comfort zone easy, quick and energy efficient. The drives control the speed of pump, fan and compressor motors used in air handling units, cooling towers, chillers and other heating, ventilation and air conditioning (HVAC) applications. They help reduce the HVAC system's energy consumption by up to 70 percent, and quite often have payback times of less than a year. With more than 600,000 drives for HVAC installed globally, these highly reliable drives with built-in BACnet easily integrate into building management systems. The drives are stocked globally for quick delivery.**

The user interface, designed with the simplicity and intuitiveness of a mobile phone, helps make drive startup quick and easy. Configuring the drive to control HVAC applications takes only seconds using the drive's built-in application macros, that come as standard with the drive. The drive's seamless connectivity to building management systems through embedded communication protocols along with the drive's wide range of inputs and outputs make integration into HVAC systems cost efficient and easily adaptable to future upgrades.

The drive is programmed with several HVAC applications, including supply and return fans, cooling tower fans, booster pumps and condensers. The intelligence within the HVAC control panel means that the user is given direct and understandable instructions in clear text at all times.

Harmonics and RFI emissions are major concerns within many HVAC installations. The ABB drive for HVAC fulfils demanding requirements for electromagnetic compatibility. A swinging choke cuts harmonics emissions by up to 25 percent.

## **Smaller carbon footprint through improved energy efficiency**

One of the biggest benefits of using ABB drives for HVAC applications is the energy saving opportunity over fixed speed motors or conventional flow control methods. Rather than have an electric motor running continuously at full speed, an AC drive allows the user to steplessly control the motor speed, depending on the demand.

In HVAC applications, the most of which being pumps and fans, AC drives can cut energy bill as much as 70 percent. As such ABB is a world leader in assessing the energy saving potential within the HVAC sector.

ABB offers energy appraisals coupled with a series of energy saving tools and calculators built-in within drives. Energy appraisals can rapidly determine just where and how much energy can be saved. By reducing the motor speed by 20 percent, power required can be lowered by up to 50 percent. In addition, ABB drives for HVAC offer a return on investment usually within months on the basis of energy savings alone.

For over 45 years ABB has delivered millions of AC drives worldwide. In 2013 these drives cut electricity consumption by 400 TWh (400 000 000 000 kWh). This is equivalent to the average annual consumption of electricity of more than 100 million European households. This corresponds to an average CO<sub>2</sub> emission reduction of 340 million tonne.

## **A clean standard against dirty electricity - IEC/EN 61000-3-12**

The ABB drive for HVAC fulfils IEC/EN 61000-3-12 and carries manufacturer's written statement of compliance. This means security and simplicity for specifying engineers and facility managers.

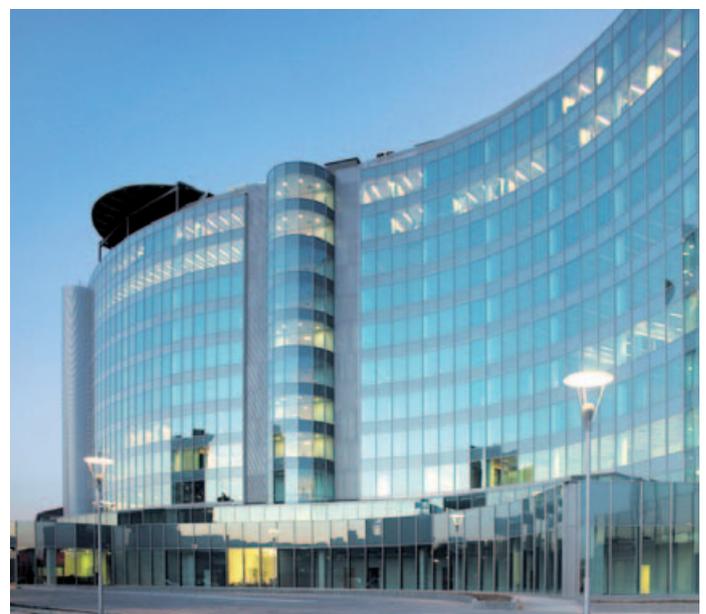
This European standard sets strict limits for harmonic currents produced by products connected to the electrical network.

Harmonic currents are forms of pollution on the electrical network. The harmonics can cause several undesired effects - flickering lights, failing computers and overheating of electrical equipment.

## **Ambient temperature up to 50 °C in 24/7/365**

Ambient temperatures affect the output performance of each drive. The hotter it is outside - or inside the cabinet in which the drive is installed - the less current the drive can deliver. This means that the designer has to select the drive according to the peak temperature.

To make the selection easier, the identical output current values for both IP21 and IP54 units are available at different ambient temperatures.





### Facility managers

“The energy saving capability of the ABB drive for HVAC means it pays back in less than two years. After that the drive provides profit straight to my bottom line. Using ABB’s remote access and diagnostics tools gives me real-time proof on the energy savings”

“With the swinging choke taking care of harmonics, I only pay for the electricity that works for me and not for the electricity that just causes losses.”

“My system delivers the output I require, when I need it, and especially when it is hot outside.”

“Reaction to load change is fast and I only pay for the peak capacity when it is needed.”

“I love the HELP button. I call it my panic button - it is always there to guide me.”

“The silence of the ABB drive for HVAC is music to my ears.”

“In case of an alarm or fault situation, the diagnostic assistant automatically tells me in clear language what to do.”

“With built-in and snap-on fieldbusses I’m flexible for all future automation needs.”

“The maintenance assistant is another great feature of the ABB drive for HVAC. I simply do not have to worry about when to service the equipment. The drive tells me when it is time to send people to do maintenance.”

“ABB will be here in 10 years time and beyond. That is the biggest guarantee you can give me.”

### Interactive maintenance assistant

Maintenance scheduling no longer requires guesswork. The drive alerts you when maintenance is required based on your individual requirements.

### Interactive diagnostic assistant

Should a fault occur, the diagnostic assistant displays in plain language possible causes and potential solutions.

### Fault logger

The fault logger of the ABB drive for HVAC is especially useful in tracking down drive failures through its use of the real-time clock.

In addition to recording both time and date, the fault logger also takes a snapshot of 7 diagnostic values - like motor speed and output current. You know what happened and when.

### Tools for

- calculating energy savings and payback times
- commissioning
- remote access and diagnostics

### Noise smoothing

Software function to reduce the audible noise.



### Tailor-made control panel for HVAC applications

- Interactive assistants advise on the use of PID (incl. air flow calculation), timers, fieldbus and facilitate commissioning
- HELP button always available
- Up- and downloading of parameters from one drive to another
- Easily detachable by hand (both IP21 and IP54)
- Built-in real-time clock
- 18 languages available in one single panel, including Russian, Turkish, Czech, Polish and Chinese

### Energy efficiency

- Advanced motor control features, such as flux optimization, help lower energy use. With flux optimization, the magnitude of the flux is controlled according to the actual load. This results in reduced energy consumption and lower noise.
- Built-in calculators monitor energy used and saved in kilowatt-hours and megawatt-hours, as well as show the saving as a monetary value in local currency and as reduced carbon dioxide (CO<sub>2</sub>) emissions.

### Flange mounting

The drive can be flange-mounted to the side of an air duct or integrated with an air handling unit (AHU). By placing the heat sink of the drive in the air flow, additional cooling is achieved efficiently.

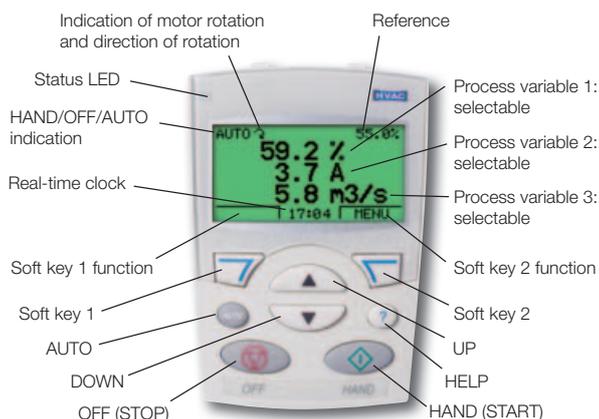
### Two PID controllers as standard

The ABB drive for HVAC has two independent PID controllers built in. As an example: one PID controller works with the drive to maintain the duct static pressure. Simultaneously, the other PID controller can be used to control a separate external device, eg, a chilled water valve. All of this can, of course, be monitored and controlled through serial communications.

### Mounting side by side

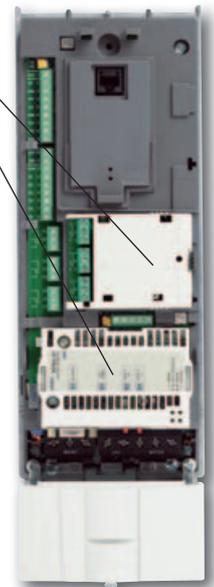
The ABB drive for HVAC is optimized for installing into cabinets: no space is needed between the units, whether IP21 or IP54, even with the covers on.

### Motor protection with PTC or PT 100.



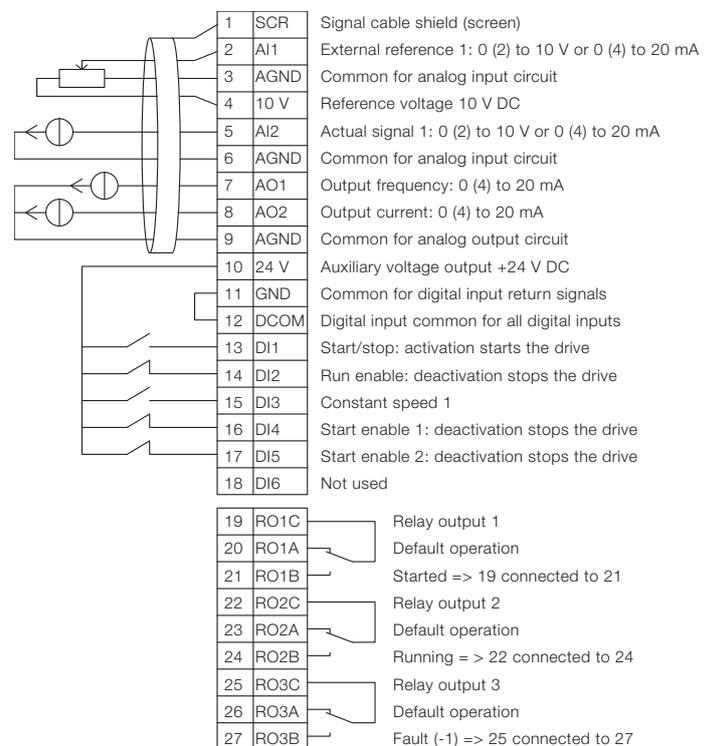
### Options

- Relay extension module for three additional outputs (module fits under the cover of the drive)
- BACnet/IP router, LonWorks adapter (LonMark approved) or other option module. Modules fit under the cover of the drive
- Control panel mounting kit for cabinet door mounting
- Output filters, please contact ABB
- External module for remote access and diagnostics



### Inputs and outputs

The diagram below shows the inputs and outputs of the ABB drive for HVAC. The sample connections are suitable for a number of HVAC applications like supply and return fans, condensers and booster pumps.



- All inputs and outputs are short-circuit protected.
- All connectors are individually numbered, reducing possible causes of misunderstandings and errors

# Technical data

Supply connection	
Voltage and power range	3-phase, 380 to 480 V, +10/-15% (0.75 to 355 kW) 3-phase, 208 to 240 V, +10/-15% (0.75 to 75 kW) 1-phase, 208 to 240 V, +10/-15% (50% derating) auto-identification of input line
Frequency	48 to 63 Hz
Power factor	0.98
Efficiency at rated power	
	98%
Motor connection	
Voltage	3-phase, from 0 to $U_N$
Frequency	0 to 500 Hz
Rated currents (apply to both IP21 and IP54)	Current at ambient temperature of -15 to +40 °C: rated output current ( $I_{2N}$ ), no derating needed Current at ambient temperature of +40 to +50 °C: derating of 1%/°C above 40 °C
Switching frequency	Selectable 0.75 to 37 kW: 1 kHz, 4 kHz, 8 kHz or 12 kHz 45 to 110 kW: 1 kHz, 4 kHz or 8 kHz 132 to 355 kW: 1 kHz or 4 kHz
Environmental limits	
Ambient temperature	-40 to 70 °C
Transportation and storage	
Operation	-15 to 50 °C (no frost allowed)
Altitude	
Output current	Rated current available at 0 to 1000 m reduced by 1% per 100 m over 1000 to 2000 m 2000 to 4000 m, please consult ABB
Relative humidity	Lower than 95% (without condensation)
Protection classes	IP21 or IP54 IP21 for wall mounted and free standing units IP54 for wall mounted units
Inputs and outputs	
2 analog inputs	Selectable both for current and voltage
Voltage signal	0 (2) to 10 V, $R_{in} > 312 \text{ k}\Omega$ single-ended
Current signal	0 (4) to 20 mA, $R_{in} = 100 \Omega$ single-ended
Potentiometer reference value	10 V $\pm 2\%$ max. 10 mA, $R < 10 \text{ k}\Omega$
2 analog outputs	0 (4) to 20 mA, load $< 500 \Omega$
Internal auxiliary voltage	24 V DC $\pm 10\%$ , max. 250 mA
6 digital inputs	12 to 24 V DC, 24 V AC. Internal 24 V DC supply
3 relay outputs	Maximum switching voltage 250 V AC/30 V DC Maximum continuous current 2 A rms
PTC and PT 100	Any of the 6 digital inputs or analog inputs can be configured for PTC. Both analog outputs can be used to feed the PT 100 sensor.
Communication	Protocols as standard (EIA-485): BACnet MS/TP, Modbus RTU, N2 and FLN Available as plug-in options: BACnet/IP router, LonWorks, Ethernet etc. Available as an external option: Ethernet adapter for remote monitoring
Protection functions	
	Overvoltage controller Undervoltage controller Earth-leakage supervision Motor short-circuit protection Output and input switch supervision Overcurrent protection Phase-loss detection (both motor and line) Underload supervision - can be used also for belt-loss detection Overload supervision Stall protection
Product compliance	
Harmonics	IEC/EN 61000-3-12
Standards and directives	Low Voltage Directive 2006/95/EC EMC Directive 2004/108/EC Quality assurance system ISO 9001 and Environmental system ISO 14001 CE, UL, cUL, and EAC approvals Galvanic isolation according to PELV RoHS (Restriction of Hazardous Substances)
EMC (according to EN61800-3)	Class C2 (1 <sup>st</sup> environment restricted distribution) as standard

## Types and ratings

$P_N$ kW	$I_{2N}$ A	Frame size	Type designation (order code)
$U_N = 380 \text{ to } 480 \text{ V (380, 400, 415, 440, 460, 480 V)}$ HVAC control panel and EMC filter are included.			
0.75	2.4	R1	ACH550-01-02A4-4 <sup>1)</sup>
1.1	3.3	R1	ACH550-01-03A3-4 <sup>1)</sup>
1.5	4.1	R1	ACH550-01-04A1-4 <sup>1)</sup>
2.2	5.4	R1	ACH550-01-05A4-4 <sup>1)</sup>
3	6.9	R1	ACH550-01-06A9-4 <sup>1)</sup>
4	8.8	R1	ACH550-01-08A8-4 <sup>1)</sup>
5.5	11.9	R1	ACH550-01-012A-4 <sup>1)</sup>
7.5	15.4	R2	ACH550-01-015A-4 <sup>1)</sup>
11	23	R2	ACH550-01-023A-4 <sup>1)</sup>
15	31	R3	ACH550-01-031A-4 <sup>1)</sup>
18.5	38	R3	ACH550-01-038A-4 <sup>1)</sup>
22	45	R3	ACH550-01-045A-4 <sup>1)</sup>
30	59	R4	ACH550-01-059A-4 <sup>1)</sup>
37	72	R4	ACH550-01-072A-4 <sup>1)</sup>
45	87	R4	ACH550-01-087A-4 <sup>1)</sup>
55	125	R5	ACH550-01-125A-4 <sup>1)</sup>
75	157	R6	ACH550-01-157A-4 <sup>1)</sup>
90	180	R6	ACH550-01-180A-4 <sup>1)</sup>
110	205	R6	ACH550-01-195A-4 <sup>1)</sup>
132	246	R6*	ACH550-01-246A-4 <sup>1)</sup>
160	290	R6*	ACH550-01-290A-4 <sup>1)</sup>
200	368	R8	ACH550-02-368A-4
250	486	R8	ACH550-02-486A-4
280	526	R8	ACH550-02-526A-4
315	602	R8	ACH550-02-602A-4
355	645	R8	ACH550-02-645A-4

<sup>1)</sup> This type code is valid for the IP21 unit. For the IP54 unit, add +B055 at the end of the code.

$I_{2N}$  = Nominal output current, 1,1 x  $I_{2N}$  overload is allowed for 1 minute every 10 minutes through the entire speed range.

$P_N$  = Typical motor power. The ABB drive for HVAC can deliver  $P_N$  continuously at an ambient temperature of 50 °C.

$U_N$  = Nominal supply voltage

## Dimensions

### Wall mounted units

Frame size	Dimensions and weights									
	IP21 / UL type 1					IP54 / UL type 12				
	H1	H2	W	D	Weight	H	W	D	Weight	
	mm	mm	mm	mm	kg	mm	mm	mm	kg	
R1	369	330	125	212	6,5	449	213	234	8,2	
R2	469	430	125	222	9	549	213	245	11,2	
R3	583	490	203	231	16	611	257	253	18,5	
R4	689	596	203	262	24	742	257	284	26,5	
R5	739	602	265	286	34	776	369	309	38,5	
R6	880	700	302	400	69	924	410	423	80	
R6*	986	700	302	400	73	1119	410	423	84	

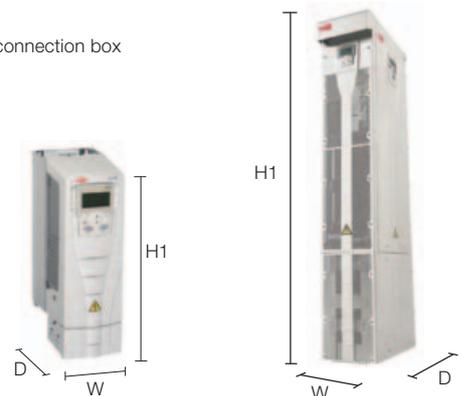
### Free standing units

Frame size	Dimensions and weights			
	H1	W	D	Weight
	mm	mm	mm	kg
R8	2024	347	617	230

H1 = Height with cable connection box

W = Width

D = Depth



# Contact us

For more information please contact your local ABB representative or visit:

[www.abb.com/drives](http://www.abb.com/drives)

[www.abb.com/drivespartners](http://www.abb.com/drivespartners)

© Copyright 2015 ABB. All rights reserved.  
Specifications subject to change without notice.

3AFE66295378 REV L EN 15.4.2015

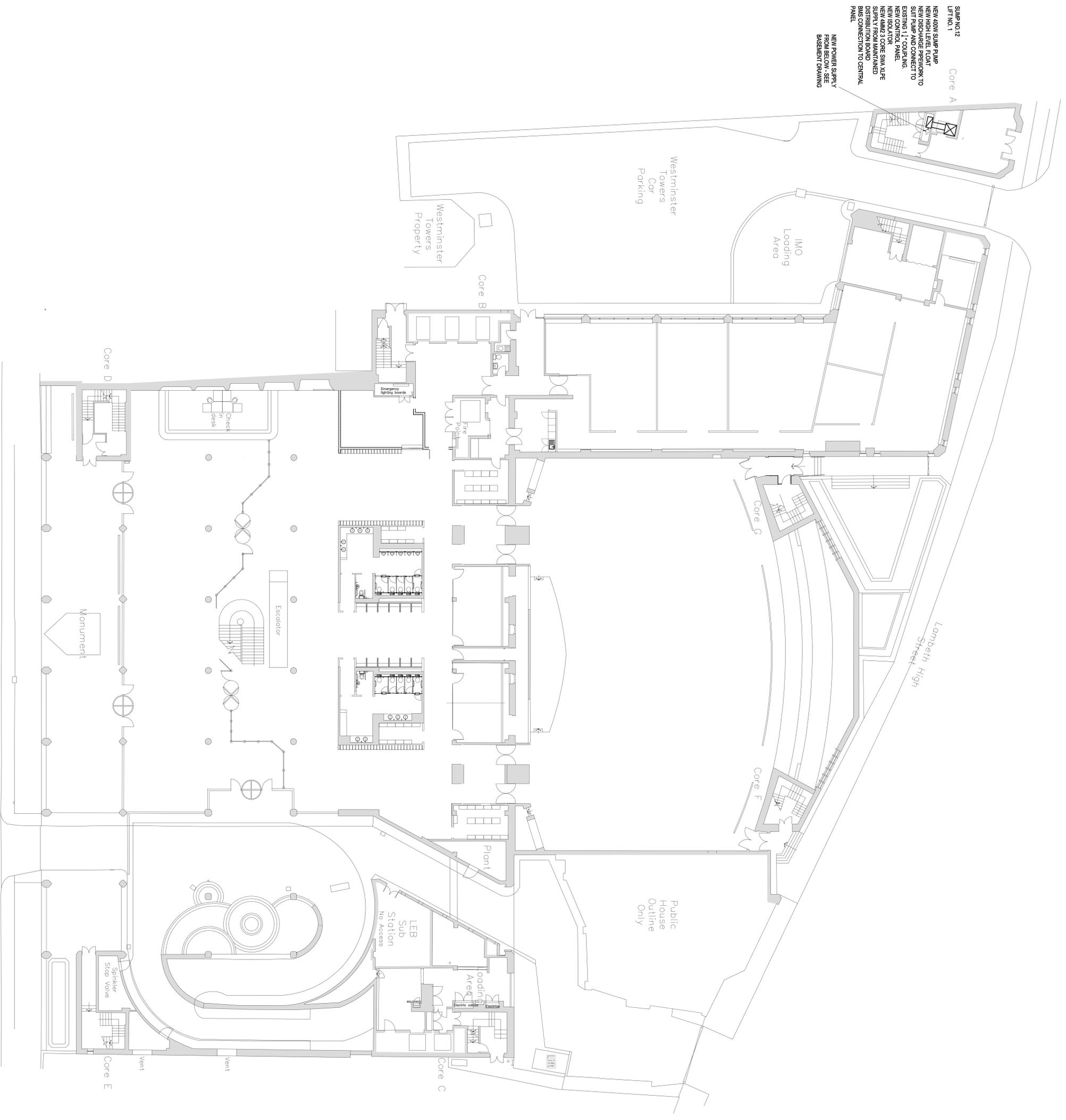
---

## Appendix Five - Sump Pump Replacement Works

### A5.1 - Drawings







SWAMP NO.12  
 LIFT NO.1  
 Core A  
 NEW 400V SWAMP PUMP  
 NEW HIGH LEVEL FLOAT  
 NEW DISCHARGE PIPING TO  
 SPLIT PUMP AND CONNECT TO  
 EXISTING 1.1 COUPLING  
 NEW CONTROL PANEL  
 NEW ISOLATION SW. X1 BE  
 NEW DISCHARGE PIPING  
 SUPPLY FROM MAINTAINED  
 DISTRIBUTION BOARD  
 BMS CONNECTION TO CENTRAL  
 PANEL  
 NEW POWER SUPPLY  
 FROM BELOW, SEE  
 BASEMENT DRAWING

NOTES

1. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH THE SPECIFICATION SCOPE OF WORKS PLUS ALL OTHER SERVICES
2. CONTRACTORS SHALL FAMILIARISE THEMSELVES WITH THE EXISTING SITE BEFORE PROCEEDING WITH THE WORKS. EXACT LOCATION OF SERVICES SHALL BE FULLY CO-ORDINATED ON SITE BY THE CONTRACTOR SCALD AND ONE WRITTEN FOR CALCULATED DIMENSIONS USED
3. THE SERVICES WORKS ARE TO BE CO-ORDINATED AND PROGRAMME WITH ALL MAINTENANCE SERVICES (SEE THE BUILDING MAINTENANCE WORKING PAPERS)
4. ALL WORK SHALL BE COMPLETED WITHIN THE SPECIFIED TIME FRAME. VISUAL SURVEYS AND INFORMATION PROVIDED BY OTHERS, NO RESPONSIBILITY SHALL BE ACCEPTED ON THE PART OF THE CONTRACTOR FOR ANY DISCREPANCIES WITHIN THE DRAWING AS PER SPECIMENS WITHIN SPECIFICATION
5. TO BE CHECKED AND CONFIRMED BY CONTRACTOR INSTALLER
6. ALL WORK SHALL BE COMPLETED WITHIN THE SPECIFIED TIME FRAME
7. PUMP POWER SUPPLIES TO BE FITTED WITH QUICK RELEASE COMPLETERS TO BE WATERPROOF AND SUITABLE FOR ENVIRONMENT
8. ALL WORK SHALL BE COMPLETED WITHIN THE SPECIFIED TIME FRAME
9. RECOMMENDATIONS OF THE SUPPLIER, TNS AND COUPLER
10. BMS CONNECTIONS AT LOCAL CONTROL PANELS TO BE CONNECTED TO NEW CENTRAL LABOUR AND BMS PANEL (SEE DRAWING)
11. NEW SERVO MOTOR CONTROLLER WITHIN THE REAR WALL TO BE CONNECTED TO NETWORK
12. ALL WORK SHALL BE COMPLETED WITHIN THE SPECIFIED TIME FRAME
13. ALL RETAINED PIPING TO BE CLEANED AND WASHED OUT AND LEFT DRY
14. ALL WORK SHALL BE COMPLETED WITHIN THE SPECIFIED TIME FRAME
15. PUMP WELL
16. CONTROL PANEL

Rev	Date	Description	Rev	Check	Date

**TRICUP**  
**ST WATERS**  
**+ ANDERS**  
 182 Cambridge Street  
 London, EC2A 4PU  
 T: +44 (0)20 7291 1000  
 E: info@tricup.co.uk  
 W: www.tricup.co.uk

Project: **ELECTRICAL INFRASTRUCTURE WORKS 2017**  
 Client: **DEPARTMENT FOR TRANSPORT**  
 Address: **FATHFUL + GOULD**  
 Project No: **18080-SP-00-01**  
 Drawn By: **AKS**  
 Date: **1/11/17**  
 Checked: **AKS**  
 Scale: **N/S**  
 Author: **AKS**  
 Revision: **T1**



---

## A5.2 - Sump Pump Schedules































---

## A5.3 - Manufacturers Literature

# Pumps, Pumping Systems and Ancillaries

## NEWTON CP250, CP400 & CP750

### A Range of High Quality Clean Water Pumps



Rev 2.1 - 09 December 2016

PRODUCT CODE - P27 to P33

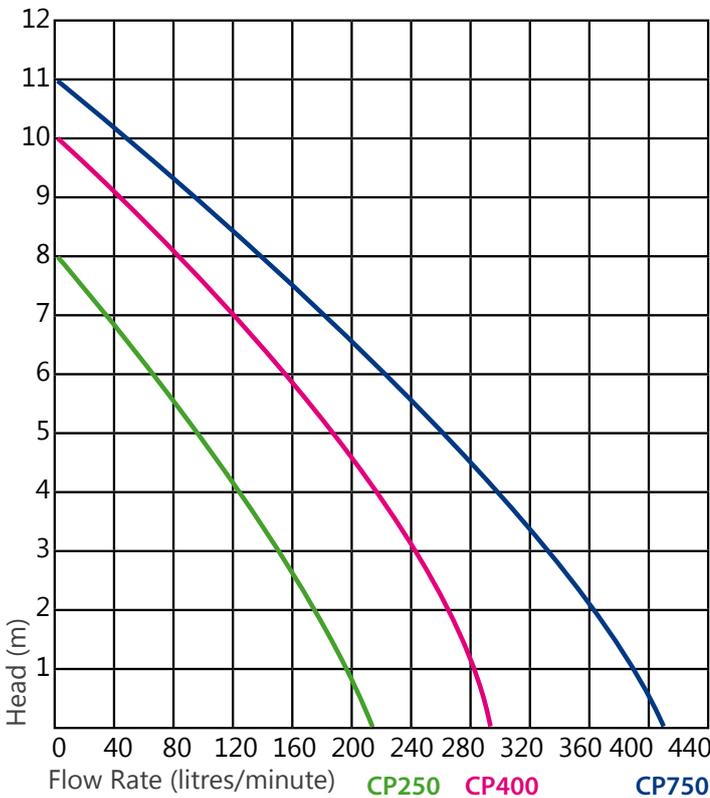
### INTRODUCTION

The Newton [CP250](#), [CP400](#) and [CP750](#) are a range of high quality clean water pumps ideally suited for the removal of ground water from basements and cellars. The unique vertical operation float switch ensures that the pumps operate within their footprint, removing the possibility of the float snagging during operation and allowing the pumps to be used within smaller sumps. The vertical float switch is also very flexible, allowing the pump switching height to be adjusted both in terms of the height between the 'on' and 'off' positions, as well as the height relative to the pump.

The Newton CP Pumps are suitable for use with [Newton Victron Power Inverters](#) to give continual pumping even during power outage.

Newton CP Pumps are supplied with a 1-year manufacturers warranty or a 3-year back-to-base warranty if the pumps are serviced by a Newton approved service engineer.

The Newton CP series pumps are sold in both manual and automatic versions and can be purchased as pumps only, or as a key component in our [Titan-Pro White](#) and [Titan-2](#) packaged pumping systems.



### KEY BENEFITS

- 3-year warranty - see page page 2
- Thermal overload protection against motor burnout
- Non-clogging vortex impeller
- Protection against motor burnouts due to a locked impeller
- Double mechanical seals ensure increased durability against particle abrasion and wear
- Anti-airlock impellor housing ensures that the pump is able to remove trapped air even when the sump was previously dry
- High performance and efficiency even with a low current
- Unique vertical float allows complete adjustment of the start and stop heights
- Continued pumping even during power cuts when used with Newton Power Converters - see page 3.

### TYPICAL APPLICATIONS

Primarily designed to be used with Newton sump systems for the removal of ground water collected by [Newton System 500](#) basement waterproofing system, Newton CP pumps can also be used for the removal of water from:

- Flooded basements and cellars
- Light-wells
- Surface drainage collection vessels
- Reservoirs and water holding vessels

# NEWTON CP250, CP400 & CP750

A Range of High Quality Clean Water Pumps

## TECHNICAL DATA

Features	CP250	CP400	CP750	Units
Purchase Code - Manual Version	P31	P32	P33	
Purchase Code	P29	P28	P27	
Pump Design	Vortex			
Outlet	40	50	80	mm
Max Soft Solids Handling	5	10	15	mm
Recommended Discharge Pipe	50	50 / 63	63	mm
Max Pumping Head	8.0	10.0	11.0	m
Max Flow Rate	210	290	410	litres/minute
Flow Rate at 4m Head	120	220	295	litres/minute
Pump Switching	Automatic by pump float			
Float Switch	Fully adjustable vertical operation			
Pump Start Level	Fully adjustable			
Lowest or Stop Water Level	80	80	127	mm
Length	190	215	260	mm
Width	140	155	160	mm
Height - Handle/Gland	366/374	385/395	419/434	mm
Weight	11.0	12.0	15.0	kg
Clean Water Pumping	Yes			
Effluent Pumping	No			
Sewage Pumping	No			
Fluid Temperature Range	0 to 40			°C
Power Supply	Single Phase			W
Motor Output	250	400	750	W
Amps (Starting)	7.4	10.5	15.8	
Amps (Running)	2.4	2.1	3.4	
Body Material	Stainless Steel (304)			
Shaft Material	Stainless Steel (410)			
Mechanical Seals	Double Carbon Ceramic			

### WARRANTY

Newton CP Pumps are supplied with a 1-year manufacturers warranty from the proven date of installation or the date of purchase if this cannot be verified. A 3-year warranty is available if the pumps are serviced at intervals agreed by a Newton approved service engineer. In all cases, the warranty is 'back-to-base'. Newton Waterproofing Systems have a returns policy and any issues regarding pumps under warranty should in the first instance be referred to our Head Office by contacting 01732 360 095. Please see our Terms & Conditions of Sale for further information.

### STORAGE

Store in dry conditions at temperatures between 5°C and 35°C. Do not expose to freezing conditions.

### SERVICING

Newton pumps should be serviced by trained and qualified pump engineers only. It is recommended that pumps are serviced within 6 months of installation and then at service engineers discretion, but with at least one inspection or service every 12 months. Please call Newton Waterproofing for an approved service engineer in your area.

### INSTALLATION INSTRUCTIONS

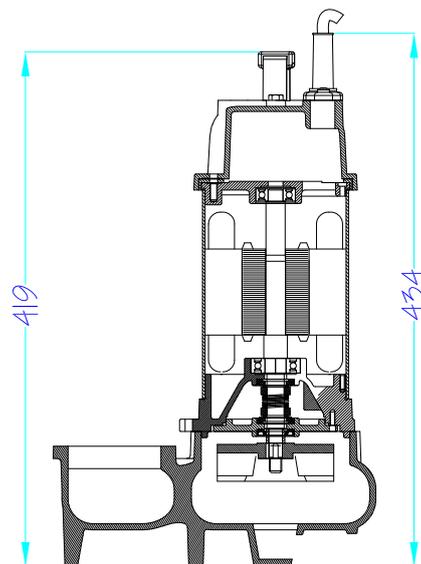
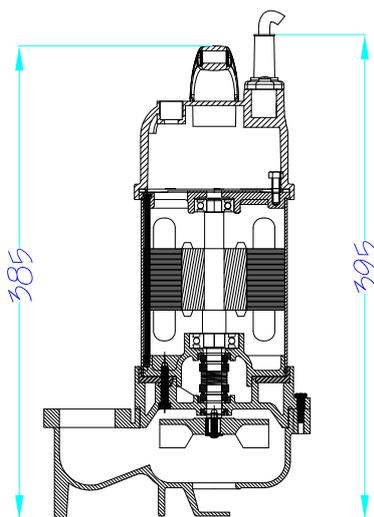
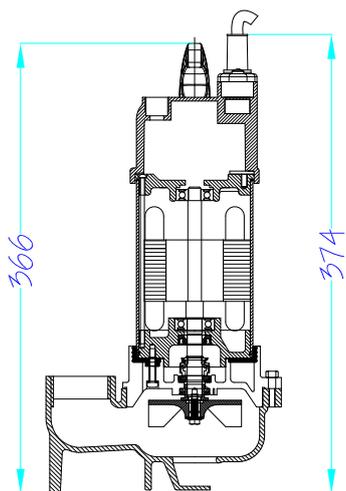
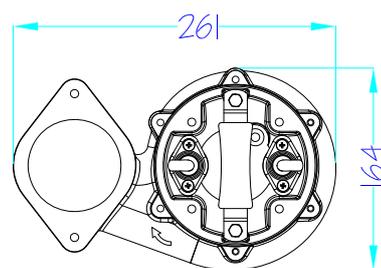
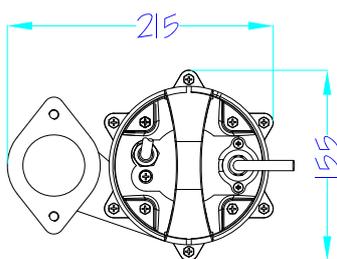
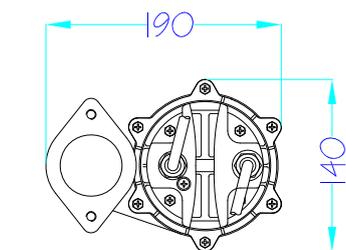
Please see pump installation sheet supplied within pump packaging (also available from our website).

### PACKAGING & HANDLING

Pumps are supplied in reinforced and protective cardboard boxes. Please handle with care.

# NEWTON CP250, CP400 & CP750

A Range of High Quality Clean Water Pumps



CP250

CP400

CP750

## ANCILLARY OPTIONS

Battery back up for CP250 - Newton MultiPlus 12/800/35 - Newton Code BB20

Battery back up for CP400 - Newton MultiPlus 12/1200/50 - Newton Code BB21

Battery back up for CP750 - Newton MultiPlus 12/3000/120 - Newton Code BB22

[High Water Level Alarm](#) - Newton Code PA50

Text & Speech [Dialer](#) for PA50 Alarm - Newton Code PA5

## SUPPLIED PIPE AND PIPE FITTINGS

Newton CP Pumps are supplied with pipe fittings ready to receive pressure rated pipe, the recommended pipe for pumps. The table on page 2 confirms pipe suitability. Options for pipe connections are available and confirmed on page 4. Please specify which pipe connection is required with the pump(s) when purchasing.

The pumps are also supplied with one-way-valves (check valves). The one-way-valves for the CP250 and CP400 are designed to screw directly into the pump body.

The CP750 is not supplied with a one-way-valve and so the valve, if required, must be ordered when the pump is purchased. Please see pipe and valve options across the page.

Pump Name	CP250	CP400	CP750
50mm pressure rated pipe	Suitable	Suitable	Suitable
63mm pressure rated pipe	Not Suitable	Suitable	Suitable
40mm waste pipe	Suitable (but not recommended)	Not Suitable	Not Suitable
Supplied valve	1 ½" flap valve	1 ½" flap valve	None
Supplied final connection to pipework	50mm female socket ready for 50mm pressure rated pipe	50mm female socket ready for 50mm pressure rated pipe	2" BSP male thread

## PACKAGING & HANDLING

Pumps are supplied in reinforced and protective cardboard boxes. Please handle with care.

# NEWTON CP250, CP400 & CP750

## A Range of High Quality Clean Water Pumps

### LIMITATIONS

Not suitable for:

1. Effluent or Washing machine waste (use [NP400W](#) or [SP750 Cutter](#))
2. Sewage (Use SP750 Cutter)
3. Continuous pumping above 40°C. Pumps can be used to excavate hot water from boiler leaks etc. but only for a maximum of 10 minutes pumping in one hour. (use hot water capable pumps - please contact Newton Waterproofing Systems for further information)
4. Water with pH value above 10 or below 4 (use pumps suitable for corrosive water - please contact Newton Waterproofing Systems for further information)
5. Sea water (use sea water pumps - please contact Waterproofing Systems for further information)

### PIPE & VALVE OPTIONS

#### CP250

*Supplied with female socket ready for 50mm pressure rated pipe.*

Adaption to female socket ready for 40mm waste pipe (not recommended) - Newton purchase code PA36

#### CP400

*Supplied with female socket ready for 50mm pressure rated pipe.*

#### CP750

*Supplied with male 2" BSP thread.*

Adaption to female socket ready for 50mm pressure rated pipe - Newton purchase code PP33

50mm Cone Valve for use with 50mm pressure rated pipe - Newton purchase code V2

Adaption to female socket ready for 63mm pressure rated pipe - Newton purchase code PP44

63mm Cone Valve for use with 63mm pressure rated pipe - Newton purchase code V8

### SPECIFICATION

Newton Waterproofing Systems are in partnership with RIBA NBS who publish details of our products and systems within their specification clause library to allow Architects ease of specification through their NBS Plus interface.

NBS clauses can be accessed via the technical resources area of the web site where a live NBS Feed is available at [NBS Plus Live Feed](#)

Our website has drawings available for download in [Technical Drawings](#). A selection are also available via [FastrackCAD](#), as well as a range of BIM objects on the [NBS National BIM Library](#)

### ELECTRICAL SUPPLY

The Newton CP Pumping range require single phase 230V AC power supply. It is advisable that all pumps are connected to their own individual power supply directly from the consumer board so that each of the pumps does not share a consumer board supply with the other pump or with any other electrical circuit or device. In reality, this is normally only achievable with new build properties or where fundamental refurbishment of the whole property or the electrical supply is to be undertaken.

Where it is not planned or possible to have each pump connected to a separate supply from the consumer board, it is preferable that each pump is supplied from a separate circuit. If this is not possible, each pump should be connected to a separate fused and switched spur or socket.

Each separate circuit should have its own RCD protection as required by the 17th Edition Wiring Regulations. The RCD should be correctly sized at 30mA so as not to trip during normal pump start or pump run parameters.

It is preferable for the pumps to be wired to the rear of a switched spur. The spur should be switched and have a neon light confirming the 'on' position. Pumps may be plugged into wall sockets and again these should be switched and have neon light notification of the 'on' position. It is recommended that the spur or socket have a label confirming that the switch must not be switched off unless in an emergency.

The spur or socket should be fitted with the correctly sized fuse appropriate to the motor size of the connected pump.:

CP250 - 5 amps

CP400 - 10 amps

CP750 - 13 amps

The spur or socket should be located in direct eye line of the sump and to the wall closest to the sump so that in an emergency it is obvious which switch will turn off the pump/s.

### HEALTH & SAFETY

Product should only be used as directed. Pumps contain lubricating oil. We always recommend that the Material Safety Data Sheet (MSDS) is carefully read prior to use of the pump. Our recommendations for protective equipment should be strictly adhered to for your personal protection. The MSDS is available upon request from Newton Waterproofing Systems or online via our website. Please see contact details below.

# NEWTON CP250, CP400 & CP750

## A Range of High Quality Clean Water Pumps

### uPVC PRESSURE RATED PIPE AND FITTINGS

50mm Pipe - 2.5m lengths - Newton Code PP1

50mm 90 degree elbows - Newton Code PP2

50mm 45 degree elbows - Newton Code PP3

50mm female-female sockets - Newton Code PP4

50mm Tee - Newton Code PP5

50mm wall mount clips - Newton Code PP6

50mm Hosetail Spigot for flexi pipe - Newton Code PP38

63mm Pipe - 2.5m lengths - Newton Code PP10

63mm 90 degree elbows - Newton Code PP11

63mm 45 degree elbows - Newton Code PP12

63mm female-female sockets - Newton Code PP13

63mm Tee - Newton Code PP14

63mm wall mount clips - Newton Code PP15

63mm Hosetail Spigot for flexi pipe - Newton Code PP39

uPVC Solvent - 0.5 litre - Newton Code G1

uPVC Weld-on WetR 0.24 litre - Newton Code G2

System Sump and Pump  
**NEWTON PUMP CONTROLLER (CP9)**  
Twin Pump Controller with Alarm



This is a dual purpose document that is designed to be the reference manual for the installation of the Pump Controller and then should be handed over to the occupier as the user manual and service record.

Panel Serial Number	
Date Installed	
Installation Company	
Installation Engineer	
Service Contact Number	

**WARNINGS**

**SHOCK HAZARD – DO NOT OPEN**

**THIS CONTROL PANEL MUST ONLY BE INSTALLED BY TRAINED ENGINEERS.**

NO USER SERVICE PARTS INSIDE PANEL - DO NOT OPEN.  
THIS PANEL HAS TWO MAINS POWER INPUTS. BOTH MUST BE ISOLATED BEFORE SERVICE OF PANEL OR PUMPS.

Please keep this Operational Manual with the Pump Controller at all times. The service engineer should confirm findings using the service sheet below.



Date	Engineer	Readings Pump 1 Running Amps / Pump Count	Readings Pump 2 Running Amps

	<b>PAGE</b>
<b>INTRODUCTION</b>	4
<b>DESCRIPTION OF FEATURES</b>	5
<b>CONNECTING POWER</b>	6 - 7
<b>PUMPS &amp; OPTIONAL EQUIPMENT</b>	6 - 7
<b>OPERATION</b>	8 - 9
<b>SIZING OF NEWTON POWER INVERTERS</b>	10 - 11

**DIMENSIONS**

300 mm wide x 132 mm high x 78 mm deep. Weight - 2.5 kg

**WARRANTY STATEMENT**

Limited Product Warranties. Three-year limited product warranty from date on delivery note or invoice to the customer. Delivery note must include the product code number and serial number of the product.

What is covered by this limited hardware warranty?

This limited warranty covers warranty back to base (Newton Waterproofing Systems) only for defects in materials and workmanship. The manufacturer will exchange the product with a product that is new or which has been manufactured from new or serviceable used parts and is at least functionally equivalent to the original product.

What is not covered by this limited hardware warranty?

- Products the supplier has not received payment for
- Normal wear and tear
- Problems caused by defective electrical power supply
- Failure to follow product installation instructions and user instructions
- Failure to perform preventive maintenance of the supplied product or the system the product is used within
- Usage that is not in accordance with the product instructions
- Servicing not authorised by the manufacturer
- Problems caused by connecting devices not supplied or authorised by the manufacturer

**Warranty Information**

This warranty gives you specific legal rights, and you may also have other rights which may vary from area to area (or jurisdiction to jurisdiction). The manufacturers responsibility for malfunctions and defects in the product is limited to repair and replacement as set forth in this warranty statement. All expressed and implied warranties for the product, including but not limited to any implied warranties and conditions of merchantability and fitness for a particular purpose, are limited in time to the term of the limited warranty which is the three-year period reflected on your delivery note or invoice. No warranties, whether expressed or implied, will apply after the limited warranty period has expired.

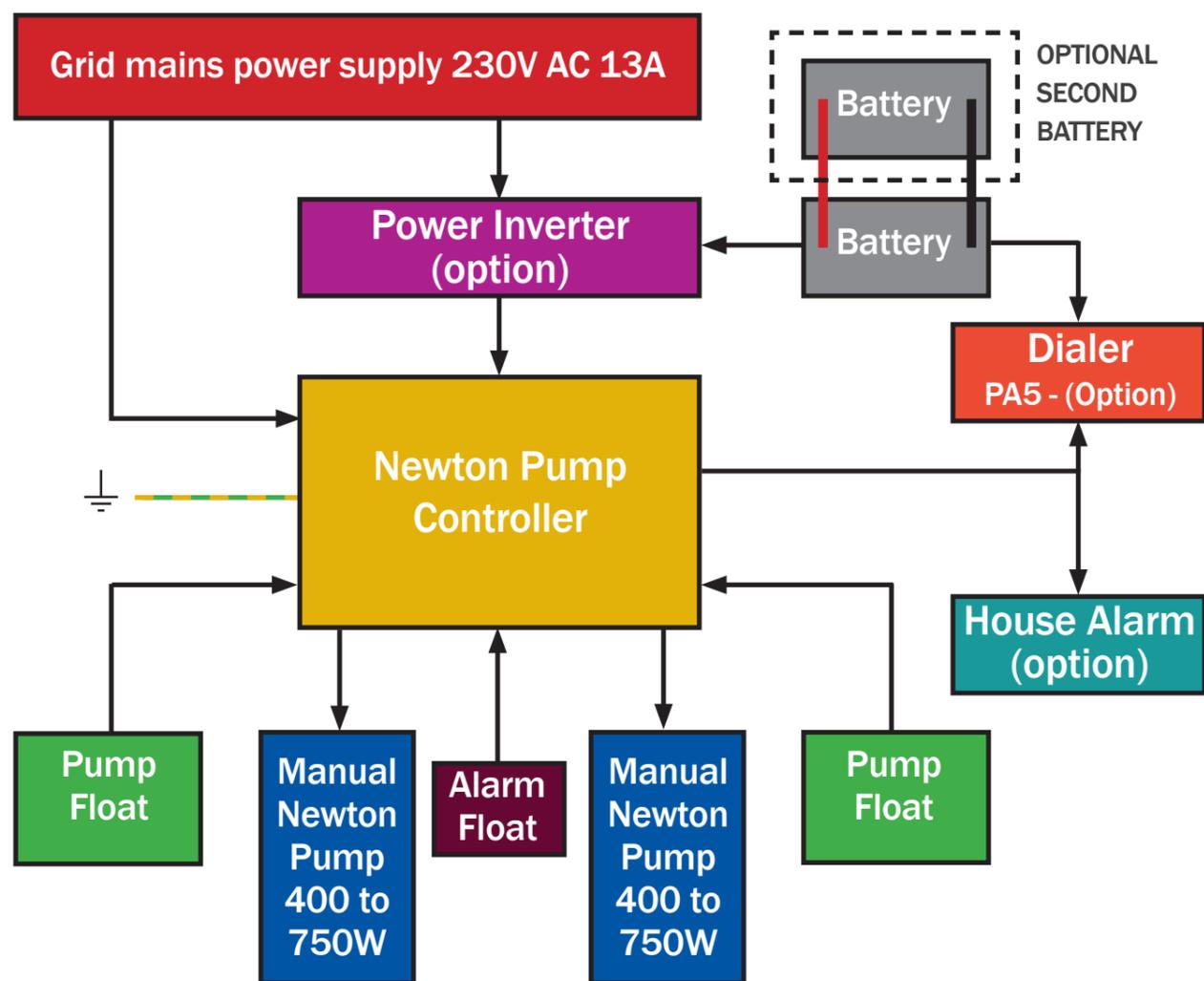
We do not accept liability beyond the remedies provided for in this limited product warranty or for consequential or incidental damages, including without limitation, any liability for third party claims against you, for damages for products not being available for use. Our liability will be no more than the amount you paid for the product that is the subject of a claim. This is the maximum amount for which we are responsible. Newton Waterproofing Systems reserve the right to change the product specification at any time.

The [Newton Pump Controller](#) is designed to be used with matched pairs of manual versions of [Newton NP400](#), [NP400W](#), [NP750](#) or [SP750 Cutter](#) pumps and provides a sophisticated, yet simple to install, twin pump control system which offers some of the features of the Newton Control Panel-Pro, but at a much lower cost.

The controller has a mains powered alarm with battery backup alarm and features interfaces for use with Newton battery backup and telemetry systems, as well as connections to whole house alarm and monitoring systems. The major feature of the control system is the self diagnostic program that operates both pumps on a weekly basis to ensure that they are not stood idle for extended periods so as to prevent seizure and premature pump failure. Each pump will operate for 5 seconds, (one after the other) once per week.

Each pump is operated by its own vertical type float switch with a single reed type switch supplied for the alarm system which incorporates the same PCB as the [Newton PA50 Alarm unit](#). The panel is designed to be used with an optional [Newton Victron Power Inverter](#), sized to suit the pumps and installed with sufficient battery power to ensure continued pumping during power outages.

A typical system is shown below:



**PANEL HIGHLIGHTS**

1. Two independent power supply inputs - Each pump is separately and independently powered from the other. The operation of the pumps is not at all dependent on the operation of the Pump Controller. If the Pump Controller should fail, the float switches will still have the ability to switch on the pumps as if they were automatic pumps.
2. Automatic pump duty assist - If one pump cannot cope with the volume of water entering the sump, the water level will rise to the switch of the second pump, which will automatically start to increase the pumping capability. Please be aware that separate discharge lines maximises the volume of water removed when this feature is utilised.
3. Automatic alarm float checking - An alarm checking signal is continually monitored to confirm the alarm float cables have been fitted correctly, not been tampered with, or have been disconnected.
4. Automatic testing of each pump every 7 days - The test ensures the pumps are used each week. Each control circuit has its own independent timer to ensure that each pump is tested at different times. The SET button starts the 7-day cycle.
5. Test Button - Both pumps can be started from the panel for testing.
6. Alarm Power - The Alarm is powered under normal circumstances by 230V mains and by internal 9V battery during power outage.
7. If the sounder is beeping to warn of high water level, you can mute the sounder by pressing the mute button once. The LED will still flash until reset (in Alarm Mode 1).
8. Pump Counter - An internal, 6 digit counter is included that counts the number of times Pump 1 operates (Not Pump 2). This count includes the weekly pump test and pump operations activated by the float switch.
9. Choice of pumps - A choice of Newton manual pumps of 400 and 750 watts.
10. Battery Backup - Optional Newton Victron Power Inverter can be connected to the unit to provide continuation of pumping (Pump 2) during power outage.
11. Fail-Safe - Telemetry - Pump Controller can be connected to the [Newton Dialer \(PA5\)](#) or to home alarm system (BMS - Building Management System)

**ENCLOSURE**

The Pump Controller is housed in a 300 mm wide x 132 mm high x 78 mm deep, painted steel enclosure with a minimum of 8 knockouts for fitting suitable plastic cable glands or conduit connectors ready for the following cables:

Mains Power 1; Mains Power 2; Pump Float 1; Pump Float 2; Pump 1; Pump 2; Alarm Float; Connection to Dialer. The Pump Controller can be surface mounted or flush mounted. Please ensure the correct variant is ordered:

**SURFACE MOUNTED - PURCHASE CODE CP9    FLUSH MOUNTED - PURCHASE CODE CP9F**

- Parts:
- 1 x Pump Controller
  - 2 x Pump Float Switches
  - 1 x Alarm Float Switch
  - 2 x 32 mm Conduit Connectors
  - 10 m 32 mm Conduit
  - 1 x 25 mm Conduit Connectors
  - 5 m 25 mm Conduit
  - 8 x Cable Glands

- Parts:
- 1 x Pump Controller
  - 2 x Pump Float Switches
  - 1 x Alarm Float Switch
  - 8 x Cable Glands
  - 1 x Flush Mount Trim

Fix the enclosure to the wall or within the wall using fixings that are suitable for the weight of the unit and your wall type. The face plate is attached to the back-box and supplied with M3 flange combi screws and plastic washers.

**ELECTRICAL CONNECTION**

**INSTALLATION WARNINGS:**

**THIS CONTROL PANEL MUST ONLY BE INSTALLED BY TRAINED ENGINEERS.**

**BEFORE COMMENCING INSTALLATION, ISOLATE YOUR MAINS ELECTRIC SUPPLY.**

This product should be installed in accordance with the relevant sections of the building regulations code and the current edition of the IEE Wiring Regulations (BS 7671: Requirements for electrical installations) and appropriate statutory regulations.

As of April 2004, new installations in the UK should be wired using the EU harmonised colours for the supply conductors. **NEW COLOURS:** BROWN = Live, BLUE = Neutral, YELLOW / GREEN = Earth. This installation **MUST** be earthed.

This control panel is not waterproof, is of metal construction and must be installed in a dry, well ventilated area.

Warning: it is important to read and understand the Pump Controller instructions

This Newton Pump Controller has been designed to be wall mounted or recessed within the wall. When the unit is recessed into the wall, the routing of all cables is also within the wall, making a neater installation than if the unit is wall mounted. Cable entry is via the knock-outs to the bottom and side of the panel, and glands are supplied for recessed mounting.

For ease of maintenance in changing pumps, it is recommended to always use 1 x 32 mm conduit for the two pumps, 1 x 32 mm conduit for the two float cables and 1 x 25 mm conduit for the Alarm Float Cable.

For surface mounting, the panel looks neater if the 32 mm and 25 mm conduits are fitted directly to the unit.

**NOTES:**

Low voltage rated cables cannot be run in the same conduit as mains (230V AC) cables. Panel must be earthed.

If the sump chamber is full of water on first powering up the panel, the alarm may sound and both pumps may start together. When the water level is below the alarm float, the alarm sounder will cease and the remainder of the water will be removed by Pump 1.

**CONNECTIONS**

Mains 1 - 230V AC supply suitably rated to operate Pump 1 from a locally fused spur, preferably from its own feed off the consumer board.

Mains 2 - 230V AC supply suitably rated to operate Pump 2 from a locally fused spur, preferably from its own feed off the consumer board OR 230V AC power supply from a correctly sized Newton Power Converter (see page 10 for information on Power Converter sizing).

Float 1 - Connections to 230V AC vertical type float switch.

Float 2 - Connections to 230V AC vertical type float switch.

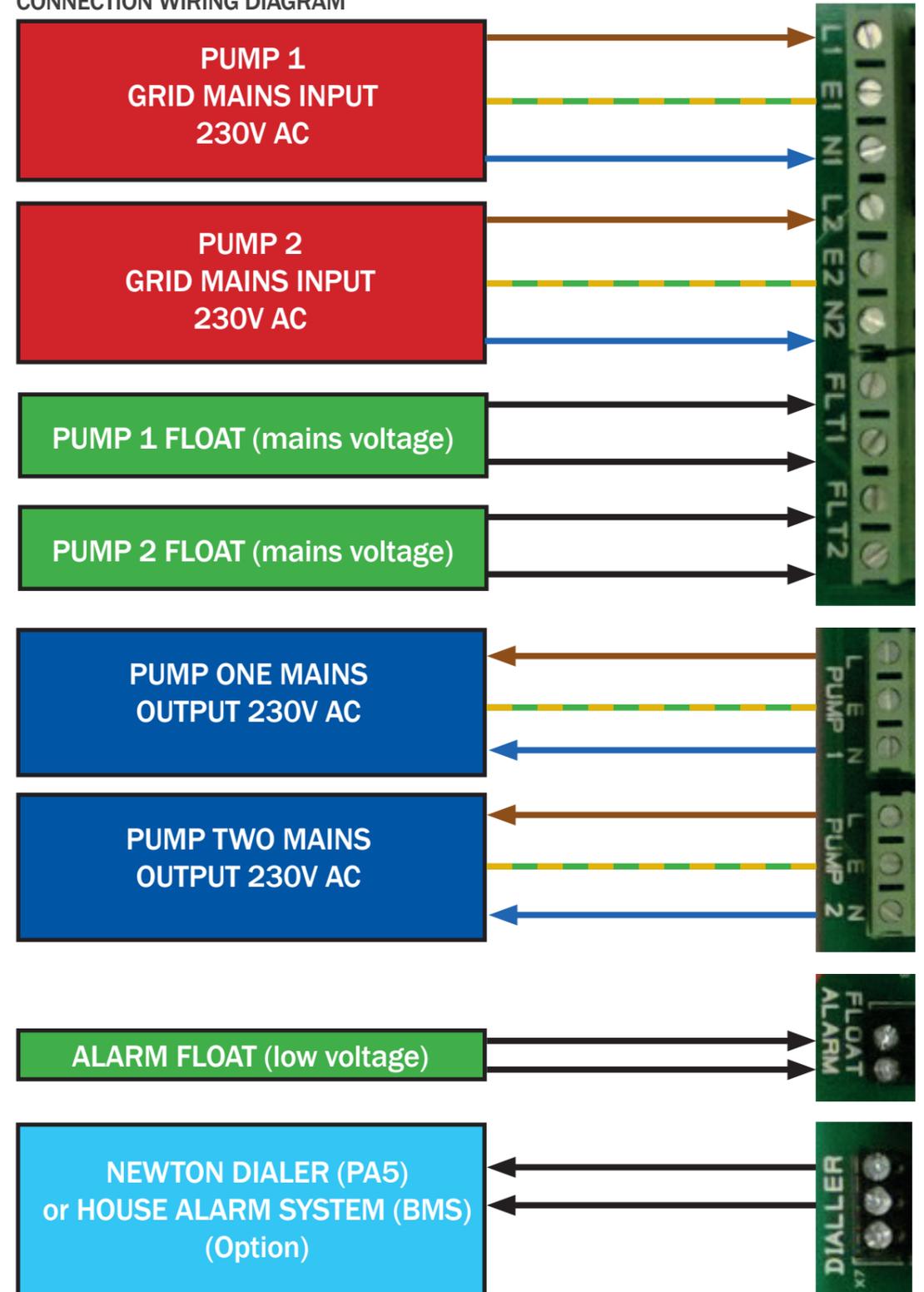
Pump 1 - 230V AC output to Pump 1.

Pump 2 - 230V AC output to Pump 2.

Dialer - Volt free relay contact which operates upon alarm, sending a signal to ancillary alarm options such as the Newton Dialer PA5 or BMS. Use NO (Normally Open) and C (Common).

Float Alarm - For connection of [High Water Alarm](#) float.

**CONNECTION WIRING DIAGRAM**



### CONNECTION NOTES

- Ensure that the grid mains connection is not connected until all connections are complete and the Pump Controller casing is fitted and locked closed.
- The Alarm Float is the smaller Reed Pivot Switch and the Pump Switches are the larger Vertical Action Float Switches. The Alarm Float should be installed so that the switch is always closed and only opens when lifted upwards by rising water.
- The three floats each have two wires. The connection of these wires is not dependent on polarity and can be fitted to either of the terminals for each connection.
- The three switches should be fitted to the two pump vertical discharge pipes in order to give a switching order of: PUMP 1; ALARM; PUMP 2
- Ensure that the switches are set at the correct levels so the pumps operate correctly. If the switch is too high, the switch may not operate until the water level in the sump is at its peak. If the switch is too low, it is possible that the pump removes all the water before the switch has turned off. It is vitally important to test the pump switching to ensure the pumps operate correctly.

**ALARM SET** - Attach the battery with the alarm float in the closed position.

The alarm will continue to sound and the Alarm Warning LED will flash until the client manually resets the alarm. Pressing the mute button once mutes the buzzer and a second press will reset the alarm and cancel the flashing LED light. This means that the client will be aware of an alarm condition, even when the second pump has lowered the water in the sump.

### CONNECTION TO NEWTON DIALER - PA5

The Newton Dialer can receive a signal from the alarm of the Pump Controller, allowing notice of the alarm condition to be received as a voice message to landline phones and as a text message to mobile phones. Up to 8 separate numbers can receive the voice or text message.

The terminals for the connection to the Dialer are at the top of the inside circuit board of the Pump Controller. Use normal two-core bell wire and make a connection with one of the two coloured wires between the NO (Normally Open) terminal of the Alarm and Trigger Input 1 of the Dialer, with the other wire connecting the C (Common) terminal of the Alarm with the OV Trigger Input of the Dialer.

The NC and C terminals in the Alarm (Labelled Dialer) can also be used to send a zero-voltage signal to home alarm and BMS (Building Management System).

### DISPLAY INFORMATION

The Pump Controller fascia is fitted with LED lights which indicate the following:

- OPERATING - Blue LED lit steadily with option to reduce brightness via "Set" button (see Controls section on page 9)
- PUMP 1 - Green LED lit steadily while Pump 1 is running on test
- PUMP 2 - Green LED lit steadily while Pump 2 is running on test (Pump 1 will also be running indicating high water ingress). If Pump 1 is not running, this indicates that Pump 1 did not start. Contact service engineer.  
NOTE: Alarm should have sounded also
- WARNING - Blue LED shows fault on High Water Alarm unit
- WATER HIGH - Blue LED shows High Water Alarm

### INTERNAL INFORMATION

**COUNTER** - A 6-digit counter will count the number of times the output to Pump 1 operates. This count includes the weekly pump test and pump operations activated by the float switch. The counter can be reset by shorting jumper J2 on the PCB.

### CONTROLS

#### Pump Controller

When the Pump Test button is pressed for three seconds, initially Pump 1 will run for 5 seconds and then stop. After a 5 second delay, Pump 2 will run for 5 seconds and then stop.

When the Set button is pressed briefly, (for 1 second or less) the brightness of the "Operating" LED will be reduced to half normal brightness. Pressing briefly when at reduced brightness will return to default full brightness setting.

When the Set button is pressed for more than 3 seconds, it will reset the weekly test operation timer so that the next test will be at the same time the following week from when the button was pressed. The "Operating" LED indicator will flash 3 times to confirm that the timer has been reset.

#### High Water Alarm

When the Alarm Test button is pressed, both the alarm indicators will light and the internal buzzer will sound.

When the Alarm Mute button is pressed, the internal buzzer will be silenced.

### OPERATION

After installation and power up, the weekly timer will start and the blue Operating LED shall light at full brightness.

After one week from initial power up (or after a 3 second press of the Set Button as described above), a test will take place of the two pumps. During the test, both pumps will be separately tested with a 5 second period between the two pump starts. Pump LED lights will show the test occurring.

The test process will repeat each week.

**PERFORMANCE EXAMPLES**

The table below is test data from our pump testing rig and confirms the volumes of water that should be removed with the specified system. The test rig was set with a pumping head of 4 m with 4 pump starts per hour, approximately 66 litres of water discharged at each start, water discharge temperature of 20°C and standard DC power cables. 400 watt pump flow rate was 137 litres per minute. 750 watt pump flow rate was 225 litres per minute, measured by flow per metre.

	400W Pumps				750W Pumps			
	Start Volts	Starts	Hours	Litres	Start Volts	Starts	Hours	Litres
1 x NorthStar NSB 60FT	12.84	56	14.2	3825	12.98	48	12.0	3154
2 x NorthStar NSB 60FT	12.71	104	26.6	7035	12.84	102	25.7	6879
1 x NorthStar NSB 100FT	12.98	106	27.1	7295	13.08	87	21.9	5803
2 x NorthStar NSB 100FT	12.85	212	54.0	14417	12.90	180	45.5	11992
1 x NorthStar NSB 190FT	12.80	182	46.7	12394	12.82	162	41.0	11002
2 x NorthStar NSB 190FT	12.84	395	101.5	26822	13.10	353	89.6	23936
1 x NorthStar NSB 190FT	12.80	2568	642.0	282480	13.10	1632	408.0	244800

**POWER CONVERTER SIZING**

PUMP	POWER CONVERTER SIZE
CP250	MultiPlus 12/800/35
CP400	MultiPlus 12/1200/50
NP400	MultiPlus 12/1200/50
NP400W	MultiPlus 12/1200/50
CP750	MultiPlus 12/3000/120
NP750	MultiPlus 12/3000/120
SP750 Cutter	MultiPlus 12/3000/120

Use only Newton Victron Power Inverters with this Control Panel. Newton Power Inverters have a three-stage charging circuit: Bulk - for when the battery is very depleted; Absorption - for a final top up charge, and Float - a trickle-charge that replaces lost charge. The Inverters are silent, except when in Bulk Mode.

**INSTALLATION OF POWER CONVERTERS**

The Inverter/Charger units are mains powered and should be installed by persons who are electrically competent by way of appropriate training to either fit a fused plug or wire directly to a fused spur. Knowledge of DC input by battery and the connection of DC battery leads to both the battery/batteries and the Inverter/Charger is required.

The product must be installed in a dry and well-ventilated area, as close as possible to the batteries. There should be a clear space of at least 100 mm around the appliance for cooling.

Excessively high ambient temperature will result in the following:

- Reduced service life
- Reduced charging current
- Reduced peak capacity, or shutdown of the inverter

The unit must be installed in a vertical position. Never mount the appliance directly above the batteries.

Always read the Newton Victron Inverter Data Sheet and Operational Manual prior to installation

**BATTERY SIZING**

PUMP	Minimum Battery Size	Combined Maximum Battery Size
CP250	1 x NorthStar NSB 60FT	400 Ah
CP400	1 x NorthStar NSB 100FT	700 Ah
NP400	1 x NorthStar NSB 100FT	700 Ah
NP400W	1 x NorthStar NSB 100FT	700 Ah
CP750	1 x NorthStar NSB 190FT	1200 Ah
NP750	1 x NorthStar NSB 190FT	1200 Ah
SP750 Cutter	1 x NorthStar NSB 190FT	1200 Ah

**BATTERY CHECKING WITH VICTRON BMV600S BATTERY MONITOR**

The BMV600S provides real time information for the battery or bank of multiple batteries:

- Battery voltage
- Discharge current
- Capacity as a %

Please refer to product Operational Manual.

**BATTERY CHECKING WITH BATTERY TESTER**

To check the voltages of a battery, (the following is only a guide to the battery performance) test the battery voltage with the Power Inverter on. Voltage should be approximately 13.5-14.5 Volts. Turn off the Power Inverter, load the battery and test the new voltage (to load the battery the pump must be on and pumping water). The new voltage should read between 12 and 13 Volts. If the battery reads below 11 Volts, the battery should be tested using professional testing equipment and possibly replaced.

**CABLES**

Battery cables have to carry very large currents and will get warm if the inverter is at full capacity. The cables must be checked for any damage and not used if damaged. If two batteries are used, the linking cables must NOT be smaller in size than the cables supplied with the Power Inverter. Power Inverter cables should not be extended as the voltage drop may affect the unit's electronics.

# JN<sup>®</sup>

## NEWTON

---

## WATERPROOFING

Newton Waterproofing Systems Is A Trading Name Of

**John Newton & Company Ltd.**

Newton House, 17-20 Sovereign Way  
Tonbridge, Kent TN9 1RH

T: +44 (0)1732 360095

E: [info@newtonwaterproofing.co.uk](mailto:info@newtonwaterproofing.co.uk)

W: [www.newtonwaterproofing.co.uk](http://www.newtonwaterproofing.co.uk)



## System Sump and Pump

**NEWTON HIGH WATER LEVEL ALARM**

Detects High Water Levels Within Pump Chambers



Rev 2.0 - 19 February 2016

PRODUCT CODE - PA50

**INTRODUCTION**

The Newton High Level Water Alarm - PA50 is designed to detect high water levels within pump sump chambers, and is included within [Newton Titan-Pro](#) and [Newton Titan](#) pumping systems. The alarm is battery operated and uses a standard 9V PP3 battery.

The alarm can be programmed to automatic reset or manual reset after an alarm occurrence. A mute button to the front face silences the alarm once the alarm condition is discovered. A flashing alarm light gives visual indication of an alarm condition and this light will continue to show even when the alarm sounder is muted.

When the unit is to be used within a single pump system, the alarm switch should be positioned just above the point where the single pump should start pumping. When used within a twin pump system, the switch should be set at a height above the point of the start of the lower pump but below the point where the secondary pump would ordinarily start.

**KEY BENEFITS**

- Loud 90dB Alarm
- Auto or Manual reset options
- 5m Float Cable
- Mute Button
- Test Button
- Surface mounting or flush mounting to standard electric back box
- Battery powered
- Zero voltage output to notify the [Newton Text & Speech Dialer](#) or BMS (Building Management System) of an alarm occurrence

**TYPICAL APPLICATIONS**

Provides alarm function for single or twin pump systems where no control panel is installed.

**INSTALLATION INSTRUCTIONS**

Please see installation sheet supplied within packaging (also available from our website).

**ASSOCIATED PRODUCTS**

- Newton [NP](#) and [CP](#) pumping range
- Newton Titan-Pro and Titan packaged pumping systems
- Newton Text & Speech Dialer - PA5

**LIMITATIONS**

Not suitable for use as an alarm for sewage pumps.

**PACKAGING & HANDLING**

Alarm is supplied in reinforced and protective cardboard box. Please handle with care.

**WARRANTY**

The alarm is supplied with a one-year back-to-base warranty which is dated from either the date of purchase or a proven date of installation. If the unit develops a fault during the warranty period, Newton Waterproofing Systems will repair or replace the unit under warranty. Post the unit to the address below, together with an explanation of the problem and a return address. The warranty will be invalidated if the unit is damaged because of improper handling, storage, or installation and in such cases a repair charge may be applicable.

**STORAGE**

Store in dry conditions at temperatures between 5°C and 35°C. Do not expose to freezing conditions.



# NEWTON HIGH WATER LEVEL ALARM

Detects High Water Levels Within Pump Chambers

## TECHNICAL DATA

Features	Result	Units
Width	152.0	mm
Height	92.0	mm
Depth	37.0 (8.00 if mounted in back box)	mm
Weight	700	g
Power supply	9 - PP3 battery (supplied)	V
Sounder volume (dB)	90	(at 1000mm)v
Switching	Reed switch	