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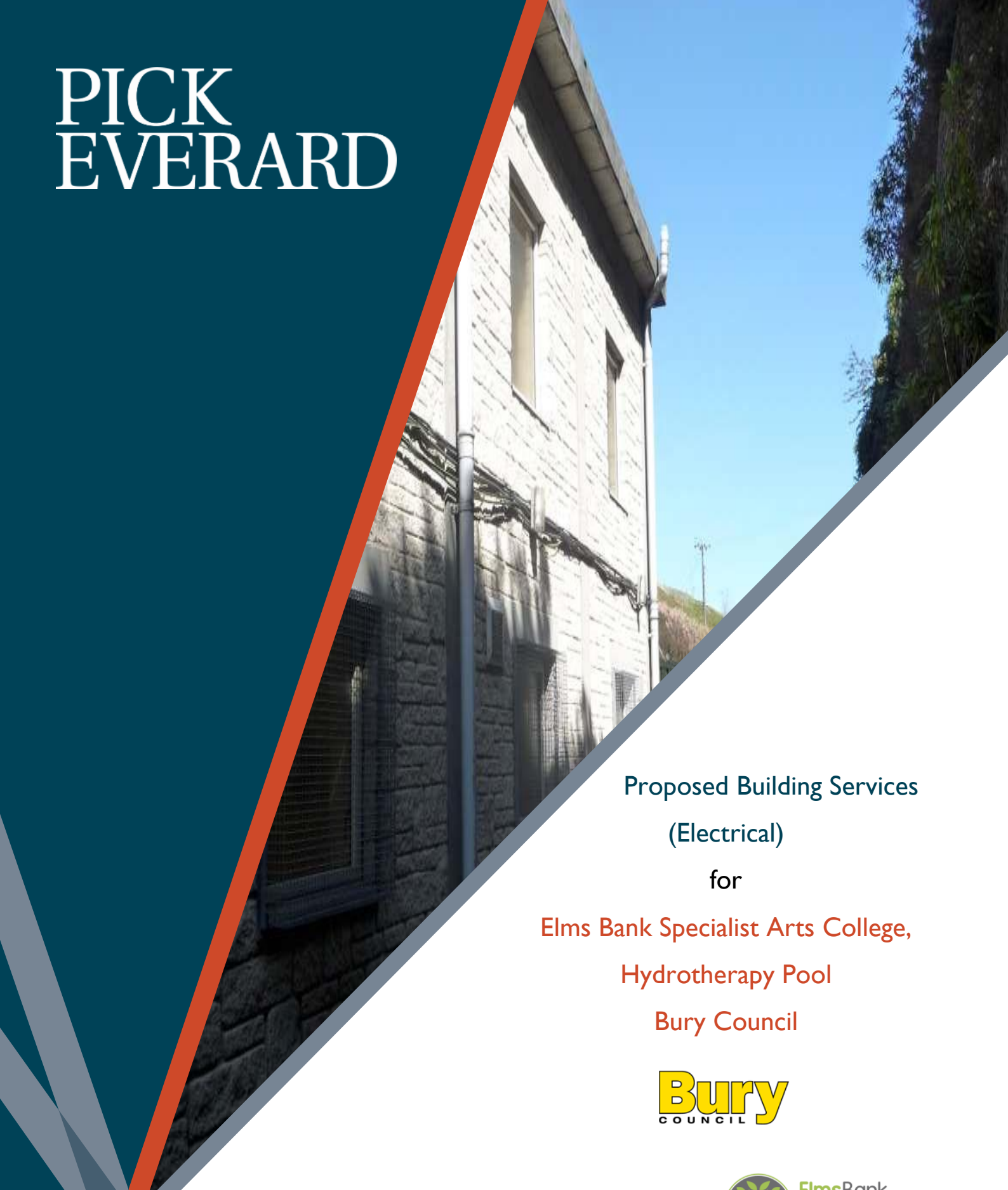

# Proposed Building Services (Electrical)

for

## Elms Bank Specialist Arts College, Hydrotherapy Pool

## Bury Council

Issue Number 01
21 February 2018

## Document History

| Issue | Date | Comment | Author | Chk'd |
|---|---|---|---|---|
| 01 | 21 02 2018 | For Tender | CL | CS |

## Contents

# 1.0 PRELIMINARIES

## 1.1.1 Project Particulars

The scope of works described in this specification and included in the associated tender drawings and information contained within other documentation forming part of the tender package, relates to the installation of the Electrical Services for the new hydrotherapy pool and changing facilities at Elms Bank Specialist College, Bury.

A Principal Contractor shall be appointed and this element of work will form part of their sub-contract. All main items of associated builders work will be undertaken and costed by the Principal Contractor with the nominated sub-contractor undertaking work identified in this specification being responsible for minor builders work such as small holes, fixings, offloading of plant etc.

## 1.1.2 Outline Description

The contractor is to undertake the works ensuring that all systems critical to the school remain functional and are not compromised during any of the work. Any removal works shall be sequenced and controlled in a manner to ensure the buildings operation are at no time compromised. Detailed Risk Assessment and Method Statements will be required for all elements of the work and disposal of plant and materials. The employer operates policies in compliance with ISO 14001 and all waste materials are to be recycled where possible.

The scope of Works described in this specification and included in the associated tender drawings and information contained within other documentation forming part of the tender package.

The Works covered by this package include the whole of the services described together with all additional work which may not be described in detail but are obviously necessary to provide a complete installation. Examples of this are brackets and secondary steelwork which shall be included as necessary for the complete installation.

The project involves supply, installation, testing and commissioning of electrical services to serve the proposed new hydrotherapy pool and changing facilities at Elms Bank College. The project also, involves strip-out of existing services. The new building is an extension of the existing building onsite.

Scheduled below is a summary of the services to be provided. This list is not an exhaustive and is provided to introduce the scope of the works:-

- Provision of method statements and risk assessments.
- Certified disposal of all waste materials and refrigerants.
- Site induction and asbestos awareness instruction.
- Daily management of a permit to work system.
- Provision of identification badges or company logo clothing.
- Site attendance at pre-start, progress, tool box and handover meetings.
- Survey of existing installation.
- Validation and verification of the existing systems.
- Installation of new electrical wiring.
- All builders work including making good, scaffolding, crane hire, holes, erection of the plant platform, plant concrete base extension, etc.
- Removal from site of redundant plant.

- Post changeover site attendance to check for defects.
- Strip out of redundant Electrical services
- Low voltage installation.
- Lighting and emergency lighting.
- Fire alarm alterations.
- Containment associated with Telecoms and Structure Wiring.
- CCTV and security
- Power and data.
- PA/VA systems
- Lightning protection systems

### 1.1.3 Site Visit

Before tendering, the Contractor shall ascertain the nature of the site, access thereto and all local conditions and site restrictions likely to affect the execution of the Works referred to in this document.

The tenderers shall, before completing their tender, examine the whole of the associated documentation and acquaint themselves with all aspects of the site and local conditions.

Escorted site visits may be made by agreement with the Contract Administrator. PPE is required when accessing the Operational areas and an approved Risk Assessment, Method Statement is required before entering the Site.

The site address is:-

Elms Bank
Ripon Avenue
Whitefield
Manchester
M45 8PJ

Tenderers shall have no claim because of want of knowledge for any aspects of the Works or contract.

### 1.1.4 Maintaining Service

The building will remain operational during the construction work and any disruption shall be kept to a minimum.

### 1.1.5 Disruption

Where services isolation is likely to cause disruption outside of the construction areas demise the works/ shutdowns must be agreed 2 weeks in advance with the school and the work carried out of school hours.

### 1.1.6 Builders Work

Provide all builders work and structural supports associated with the Building Services Works necessary for a functionally complete installation, including openings in structure, holes, penetrations, bases, plinths, support steelwork, pits, trenches, floor ducts, bunds etc.

### 1.1.7 The Services Contractors Responsibility to Check and Confirm

The Services Contractor shall check and confirm all elements of the design information that may require changes due to circumstances on site.

### 1.1.8 Fire Stopping

Provide proprietary Fire stopping where the Building Services Works pass through a fire compartment.

### 1.1.9 Information to be provided by the Contractor

The Contractor shall provide the following drawn information;

- Produce or expand on previously produced Schematic Drawings
- Co-ordination drawings
- Installation drawings
- Installation wiring diagrams
- Shop drawings
- Manufacturers' drawings
- Manufacturers' certified drawings
- Builder's work information
- Controls logic drawings
- Switchgear starters etc.
- As installed drawings
- Schedules and schematics
- Upon completion of the Works produce record drawings
- Request additional information as necessary from the Contract Administrator and provide information as necessary in time to meet the programme
- Submit sufficient copies of the design/production information for distribution to all interested parties
- Make any necessary amendments without delay. Unless and until it is confirmed that re-submission is not required, resubmit for further checking and comment, and incorporate any necessary amendments all as before.
- Submit design/ production information where the Works differ from the requirements previously advised documents each such difference must be the subject of a request for substitution or variation, supported by all relevant information.
- Should any amendment required be considered to involve a variation which has not already been acknowledged as a variation, notify the Contract Administrator 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.
- Provide sufficient copies of the final design/production information and distribute to all affected parties.

Documents shall be provided to a programme developed and agreed with the Contract Administrator, for the purposes of tender the following shall be used. The Contractor shall make allowance in his programme for comments made.

### 1.1.10 Production Information

The Contractor must:

- Liaise with others as necessary to help ensure co-ordination of the work with related building services.
- Liaise with the school to obtain all necessary approvals.
- Provide details and other information as specified showing such details of works as the Contract Administrator may reasonable require.
- Submit for comment, make any necessary amendments and re-submit for further comment unless the Contract Administrator confirms that this is not necessary.
- Submit sufficient copies of final information for distribution to any affected parties.

### 1.1.11 General Conditions

The Contractor shall provide any required warranties and shall provide such warranties in favour of the Employer in a form approved by the Employer before any such party is appointed. The warranties when approved shall be in the joint names of the Contractor, the Employer and such other party to which they relate and shall be capable of being assigned to third parties generally.

## 1.2 Tender Drawings

### 1.2.1 Introduction

The following drawings shall constitute part of the tender documents and shall be called the tender drawings. The tender drawings are indicative only and schematic in format and are not intended to show every containment offset etc. These drawings when read in conjunction with the specification and supplemented by a site visit, where necessary, shall provide information for tendering and for the production of working drawings.

Full allowance shall be made in any tender submitted for any contingencies which may arise in carrying out the full installation.

The Contractor shall be responsible for any discrepancies, errors and omissions in the working drawings and any particulars supplied by him provided that such discrepancies, errors and omissions are not due to inaccurate information on particulars furnished in writing.

The production of the installation drawings must suit the contract progress. The Tenderer shall include in his drawing programme a period of four weeks for initial consideration and a further two weeks for formal issue.

The Contractor shall allow for ensuring that the installation drawings prepared for the services installations are fully co-ordinated with all other engineering services including the drainage system and all structural and building details.

### 1.2.2 Drawing Schedule

The tender drawings which accompany this specification and which form part of the tender documents are:

**Electrical Drawings**

1) BUR020-PEV-XX-00-DR-E-0010
Existing Electrical Services Strip-out Layout

2) BUR020-PEV-XX-00-DR-E-0100
Indicative Lighting Layout

3) BUR020-PEV-XX-00-DR-E-0200
Indicative Small Power & Data Layout

4) BUR020-PEV-XX-00-DR-E-0300
Indicative Fire Alarm Layout

5) BUR020-PEV-XX-00-DR-E-0400
Indicative CCTV & Security Layout

6) BUR020-PEV-XX-00-DR-E-0500
Indicative Containment Layout

7) BUR020-PEV-XX-00-DR-E-0900
Indicative Containment Layout

The above list is the extent of drawings being produced by the design team and the Contractor shall include for the preparation of all further working drawings necessary to undertake the installation.

### 1.2.3 Working Drawings

The Employer will call for such copies of working drawings as they consider necessary prior to the installation work proceeding. These drawings must show plans and elevations to a scale not less than 1:50.

Drawings must conform in all respects to the requirements detailed elsewhere in this specification.

### 1.2.4 The Employer

The Employer shall mean Bury Council.

### 1.2.5 The Contract Administrator

The term Contract Administrator is the term used throughout this specification and these duties shall be undertaken by the person or organisation appointed by the Employer

### 1.2.6 Design Team

| | |
|---|---|
| Mechanical Services Engineer: | Bury Council |
| Project Manager: | Bury Council |
| Quantity Surveyor: | Bury Council |
| Electrical Services Engineer: | Pick Everard, Piccadilly House, 49 Piccadilly, Manchester, M1 2AP |

### 1.2.7 The Contractor

The term Contractor is used throughout this document as a means of identifying the organisation tendering and later appointed to carry out the services installation as described in this specification and accompanying documentation.

The tenderers shall, before completing their tender, examine the whole of the associated documentation and acquaint themselves with all aspects of the site and local conditions.

Site visits may be made by agreement with the Client.

# 2.0 BUILDING SERVICES PRELIMINARIES

## 2.1 Regulations, Definitions and Procedures

### 2.1.1 Standards and Regulations

The Works shall be completed in accordance with the appropriate British Standard or Code of Practice. The Contractor shall comply with all statutory instruments and regulations, relating to the area of the site current at the date of tender and shall comply with the requirements of the Local Authority Building Inspector.

The Contractor shall comply also with all Statutory Obligations arising from current legislation and regulations, together with other requirements, including, but not limited to the latest amendment of the following:-

Statutory Obligations

- Conservation of Fuel and Power Part L2
- Health and Safety at Work etc. Act 1974
- Management of Health & Safety at Work Regulations 1999
- Current Building Regulations
- Public Health Acts
- Electricity Acts
- Electricity at Work Regulations 1989
- Workplace (Health, Safety and Welfare) Regulations 1992
- Construction (Design and Management) Amendment regulations 2000
- Control of Substances Hazardous to Health (COSHH) Regulations 1999
- Control of Asbestos at work regulations
- Control of Asbestos at work Amendment, regulations 1998
- Provision and Use of Work Equipment Regulations 1998
- Personal Protective Equipment at Work Regulations 1992
- The Construction (Lifting Operations) Regulations
- Other relevant Safety Regulations
- British & EEC Acts of Parliament
- EEC Legislation
- Manufacturers Recommendations

Other Requirements:

- British Standards and Codes of Practice.
- BS 7671 - Requirements for Electrical Installations (IEE Wiring Regulations).
- CIBSE. Guides to Current Practice and Technical Memoranda.
- NICEIC Technical Manual and other Guidance Documents

All authorities shall be notified by the Contractor in accordance with their regulations and any required approvals obtained for the installation.

Where no specific design, performance or installation standards are quoted the following shall apply;

- CIBSE Code for Interior Lighting.
- CIBSE Technical Memoranda.
- CIBSE Application Manuals.

All equipment and systems shall be designed and installed in accordance with the relevant standards and it shall be ensured that operational compatibility exists between the systems and any other system installed at the same location.

Plant and equipment shall be supplied to achieve the specified design conditions and to provide stable control.

### 2.1.2 Definitions

The definitions of technical terms associated with the engineering services installations are those included in

- BS7671 – Requirements for Electrical Installations (IEE 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.
- Services Areas: Includes area 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.

## 2.2 Handover Documentation and Client Training

### 2.2.1 O&M Manuals

The Contractor shall provide O&M manuals. The detailed requirements for O&M manuals are set out elsewhere in this Specification. Bound printed copies with electronic copy of the same.

### 2.2.2 Record Drawings

Drawings, to be issued in AutoCAD, issued in .dwg format with any xref's bound to the drawing. RDF, without any restrictions on printing, copying, searching etc.

### 2.2.3 Certificates

Original signed copy, along with PDF of the same

### 2.2.4 Building Log Book

The Contractor shall provide a building logbook in accordance with Part L2 of the Building Regulations, GIL 65 – Energy Efficiency Best Practice Programme and Action Energy GPG 348. It should give details to the owner/occupier with details of all building services within the building, the mode of operation, maintenance, estimated energy consumption and the metering strategy.

The Contractor shall provide seven days prior to practical completion a Building Log Book in the format required by CIBSE Technical memorandum TM31.

An allowance shall be made for obtaining all the necessary information from others involved in the contract.

Where necessary the Contractor shall arrange, chair and minute any meetings necessary for the assembly and presentation of the information.

The Contractor shall fully explain the operation of the Building Log Book to the client and any client's representatives.

Information to be provided by the Contractor:-

### 2.2.5 Asset Register

The Services Contractor shall provide an asset register of all Services assets in Microsoft Excel format a minimum of one month prior to Practical Completion and submit to the Main Contractor to produce a dedicated numerical reference for each item /asset.

The Main Contractor will then provide the Services Contractor with an asset number for each item of plant.

The Services Contractor shall then supply and install the Bar code to the respective plant item in accordance with the Schedule.

### 2.2.6 Training of Employers Staff

Before practical completion, explain and demonstrate to the Employers staff the purpose, function and operation of the installations including all items and procedures listed in the Operation and Maintenance File. Include for not less than two operating days for this purpose. The Contractor shall allow for the attendance of any specialist that may be required to fully demonstrate the operation of the system to the satisfaction of the Main Contractor and Client, e.g. Controls Specialist or specific equipment manufacturers or Commissioning Engineers.

A training programme, detailing who is required to be present for each session, shall be provided by the Contractor in good time prior to training being undertaken.

In addition to the Client training carried out at handover, the Contractor shall allow for two days of re-training and demonstration to staff two months after Practical Completion of the building.

The purpose of this training will be to clearly define and explain to the building users how the building should work and what assumptions have been made (e.g., how the demand controlled ventilation systems works, internal comfort controls, lighting versus daylight etc.)

The Contractor shall also allow for monthly 1-day refresher courses to be given to the building occupants for a period of 12 months post-handover.

12 months after Practical Completion attend a ½ day De-Brief meeting with the Client to review the Electrical Services System performance.

### 2.2.7 Commissioning Procedures

Progressive static testing will be witnessed by the Contract Administrator or agreed client's representative when the work is presented for testing. This will include:

Pre-commissioning examination and testing shall be provided to ensure that each system or item of equipment is complete, in a safe condition and all notices are displayed. "Completion" for operational purposes implies the bulk of snagging has been offered to the Contract Administrator and that remedial work has been completed.

All fans, pumps etc. shall be tested for operation, polarity, phase sequence and impedance etc.

The commissioning programme shall be finalised, taking into account site progress and availability of related services, access required for controls etc. and this shall be agreed with all parties.

## 2.3 Operational Demonstration

A written statement shall be provided to the Contract Administrator confirming that each installation has been correctly tested and commissioned and that the performance requirements can be achieved.

The Contractor shall demonstrate to the Contract Administrator that all system components are operating correctly, and the completely integrated installation will function in accordance with the specified performance requirements.

Any demonstration should be carried out if/when requested by the Contract Administrator.

Each plant shall be run for 24 hours minimum, and a log book and record all hours run provided.

Where requested in the particular specification, provide equipment to simulate loads to allow for full testing of air conditioning systems.

## 2.4 Interference with Tests

If by any act of the Employer or Contract Administrator, the Contractor shall be prevented from carrying out the "taking over tests", within two months from the date on which the Contractor has notified the Contract Administrator that the plant/equipment is completed and ready for tests, unless in the meantime the plant/equipment shall have been proved not to be substantially complete in accordance with the Specification and Conditions, the plant/equipment shall be deemed to be taken over as on the said two months. Payment to the Contractor shall be made as if the final satisfactory "take over tests" had taken place.

Nevertheless the Contractor shall make the said tests during the period of maintenance as and when required by the Contract Administrator upon fourteen days' notice in writing and the obligation and liabilities of the Contractor in connection with such tests shall be the same as his obligations and liabilities in connection with the tests specified, provided that the Contractor shall be paid the extra cost (if any) of such tests.

## 2.5 Outstanding Acceptance Tests

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

## 2.6 Operation of Systems Prior to Practical Completion

Systems may not, without the prior written approval of the Contract Administrator be used before Practical Completion.

No system shall be put into use prior to handover to the Employer, except for testing and commissioning, unless otherwise instructed.

Additionally and without adjustment to the price submitted, the Contractor 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.

## 2.7 Operation of Systems Prior to the Production of Record Drawings and/or Operating and Maintenance Manuals

Attendance shall be provided, 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 Contract Administrator, otherwise qualify for Practical Completion.

In the event of the Contractor failing to provide this service satisfactorily the Employer shall be entitled to make his own arrangements and recover the full cost through the Contract.

## 2.8 Type Tests

Certificates of verification of type tests shall be provided by the Contractor. Drawings and other documents forming part of the certificate shall be made available prior to any order being placed.

## 2.9 Test Certificates

Where testing specific to the project is required, test certificates shall include;

- Project title.
- Details and date of test.
- Instruments used, serial numbers, calibration dates.
- Signature of those witnessing test.
- Project name.
- Specific location of the item in the Works.

## 2.10 Inspection and Tests, On or Off Site

Schedules shall be submitted 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, the Contractor shall 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.

The Contractor shall 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.
The Contractor shall arrange access for personnel who require being 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.

All tests required by legislation shall be carried out under the direction of a "competent person".

## 2.11 Inspection and Test Records

A set of drawings and/or report sheets shall be prepared to record accurately the test and inspection information including plant identification, section and installation under test.

## 2.12 Record Documents

Record documentation shall be provided for all elements of the works, to enable the operator to understand the design, operation and maintenance procedures. The documentation shall include;

- Record Drawings and Schedules
- All record drawings shall be completed in Micro station format
- Plant room and switch room drawings, schedules and schematics

- Operating and Maintenance Manuals
- Blank Maintenance Logs
- Log Book.
- Warranty period of installed plant.

As a minimum requirement, the Record Documents shall;

- Clearly record the arrangements of the various sections of the Works the Works as installed and identify and locate all component parts
- Make it possible to understand the extent and purpose of the Works and the method of operation thereof
- Set out the extent to which maintenance and servicing is required and how, in detail, it should be carried out
- 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.

It shall be demonstrated 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.

## 2.13 Obligations During Defects Liability Period

Records of failures or malfunctions of any part of the Works during the Defects Liability Period shall be prepared and submitted together with details of remedial action taken, subsequent re-testing and the results.

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

## 2.14 Tendering

### 2.14.1 Tender

The Employer and/or their representative will not be responsible for any costs incurred in the presentation of any tender. No guarantee is given that the lowest, or any tender will be accepted.

If the tenderer cannot submit a cost for any part(s) of the work as defined in the tender documents, he must inform the Contract Administrator as soon as possible, defining the relevant part(s) and stating the reasons for his inability to tender.

Alterations and qualifications to the specification must not be made without first obtaining written consent to the alternative proposal. Tenders containing such alterations or qualifications may be rejected. Costs relating to items in the specification which are not priced will be deemed to have been included elsewhere in the tender.

### 2.14.2 Schedule of Rates

A schedule of rates shall be submitted within 48 hours of being requested. Failure to submit this by the due date, the Contract Administrator reserves the right to employ at the

Contractor's expense an independent surveyor to prepare and issue a reasonable schedule of rates, which shall be binding. This schedule shall show quantities and unit rates and shall be extended and totalled to the tender figure.

Preliminaries are to be separately priced. Such totals shall agree with the Contractor's sum and sub-totals shall agree with the priced breakdown of the tender.

In the event that any omissions are identified from the schedule of rates, then those items shall be added and the rates for other items verified so that the tender figure shall remain the same.

The schedule of rates, with quantities deleted shall then become part of the contract documents and shall be used for the pricing of variations where applicable.

### 2.14.3 Alternative Equipment / Suppliers

In addition to and at the same time as the tender for the Works as defined in the tender documents, the tenderer may, at his discretion, submit alternative manufacturers or suppliers for consideration. Alternatives which would involve significant changes to other work will not be considered.

Such alternative(s) must include all additional costs arising from necessary changes to the detail of the installation, including changes to the design and drawings, as well as any associated ancillary equipment items.

Such alternative(s) is/are deemed to be alternative tender(s) and each must include a complete and precise statement of the effects on cost and programme. Full technical data for each alternative must be submitted with the Tender together with details of any consequential amendments to the design and/or construction/installation of other parts of the Works.

### 2.14.4 Selection of Alternative Equipment / Suppliers

Where manufacturers', suppliers or installers of products are NOT identified by name, the Contractor is to select products that comply in all respects with the specification and, as and when requested, demonstrate such compliance.

Where manufacturers, suppliers or installers of products are identified by name, or names, but no reference is made to "Or approved" this equivalent must be used exclusively.

Where manufacturers, suppliers or installers of products are identified by name, or names, but reference is made to "Or approved" equivalent the submitted tender must include the named or one of the named suppliers. Alternatives may be selected and shall be submitted to the Contract Administrator for approval, separately.

Any proposed alternatives shall be checked to ensure they comply with any stated British (or other equivalent recognised International) Standards. The tenderer shall confirm equivalence in quality, operation and space requirements to those items which have been specified by name. If, and when requested it shall be demonstrated the proposed alternative is fully equivalent to the specified item and identify any constructional, cost, programme, maintenance or other differences.

### 2.14.5 List of Proposed Equipment / Suppliers

A list of proposed manufacturers/suppliers of products, equipment and plant, including all items for which the choice of manufacturers/supplier is at the discretion of the tenderer, must be submitted within the tender return document.

These manufacturers/suppliers must be approved prior to orders being placed. Approval will not unreasonably be withheld but if the products and/or service offered is not considered acceptable an alternative shall be substituted at no additional cost to the contract.

Where plant and equipment manufacturers have been specified within this specification, no alternatives shall be installed unless they have been approved in writing by the Contract Administrator. Any such products, plant and equipment installed without approval shall be removed and replaced at the discretion of the Contract Administrator and at the Contractor's cost.

The Contractor shall submit system design calculations for all pumps and fans showing the selections in terms of duty against pressure drop prior to order. Design margins and allowances shall be stated.

The Contractor shall not install plant or equipment from suppliers or manufacturers that require exclusive or onerous maintenance agreements, unless such items are herein specified or the Contract Administrator has given permission for such in writing.

## 2.15 Sub-let Works

Where it is proposed that any portion(s) of the Works is to be sublet, a list must be submitted with the tender. The list will define such portion(s) and give, for each, the name and address of the proposed company.

## 2.16 Discrepancies

Tenderers shall include in their tenders for all the work shown on the drawings and/or detailed in the associated documentation. Claims for extra costs cannot be considered for work which has either been detailed on drawings or written within the documentation.

Should the drawings and/or specification contradict concerning the quantity, size or type of any equipment, such contradiction must be pointed out by the tenderer before submitting a tender, when a decision will be given. A discrepancy between drawings and specifications will not be accepted as a basis of claims for extra work during the progress of the works.

Should any portion of the works which would reasonably and obviously be considered as necessary for the completion and satisfactory operation of the installation as a whole, not be described or specified, the installer shall provide and perform such work as part of the Contract and shall not be entitled to any extra payment on that account.

## 2.17 Rejection of Conditions

Any tender can only be considered if returned in accordance with the instructions set out in the accompanying documentation on or before the date and time specified.

A tender cannot be considered if any alteration has been made to any of the documentation, nor can a tender be accepted if any of the conditions have been altered by the inclusion of a tenderers standard condition or sale of any special conditions.

## 2.18 Removal of Rubbish

Costs shall be included for the removal of all rubbish and debris from the working area and from the site itself. The site must be left in a clean, tidy and safe condition after each period of work.

In removing rubbish and debris from the site, the installer must ensure that it is handled, transported and disposed of in accordance with all HSE and Local Authority regulations and requirements.

## 2.19 Location of Plant and Equipment

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.

Any terminals are subject to final positioning on site shall be agreed prior to installation work commencing.

Allow for the movement of all such terminals up to a radius of 2.0m from the positions shown on the drawings.

## 2.20 Painting/Finishing

### 2.20.1 Applicable Surfaces

Painting of the services installation shall be limited to the following;

- Supporting metalwork fabricated on site or purpose-made and delivered pre-painted
- Brackets
- Gas service pipework
- Carbon steel and cast steel pipework prior to the application of insulation
- Backs of frames, brackets etc. and other inaccessible surfaces

All iron and steelwork exposed to the weather include materials in sealed external ducts, shall be galvanised after manufacture.

### 2.20.2 Application Details

All supporting metalwork, brackets, any equipment not delivered pre-finished etc. within plant rooms, ceiling voids, roof voids, service ducts, and similar areas where architectural decorative painting is not undertaken, shall be finally painted with two undercoats and one top coat of oil-based heat resisting paint to approved colours.

Backs of frames, brackets etc. and other inaccessible surfaces shall be painted in the same manner as detailed above.

Carbon steel pipework and cast steel pipework shall be painted with two coats of red oxide paint prior to the application of insulations. This shall include coverage of welds (after de-scaling and cleaning) together with all fitting and flanges (excluding mating faces).

All gas pipework is to be painted two undercoats and one top coat to comply with the British Standard for the Identification of Pipelines and Services and shall then be colour banded in accordance with the same standard.

### 2.20.3 Workmanship

Prior to treatment, all surfaces shall be fully prepared which comprises everything necessary for the preparation of the relative surfaces in accordance with the product manufacturer's instructions including ensuring that no moisture or dampness is present at any stage and rubbing down between applications of the various coats.

Whilst materials for the works may be obtained from several makers, undercoats and finishing coats for a particular surface must be obtained from the same paint manufacturer. It shall be ensured that the primary coat is suitable for finishing coat and vice versa.

Material shall be delivered by the manufacturers in sealed containers direct to site and used strictly in accordance with their instructions. When requested to do so, samples shall be submitted of materials and/or applications and treatments for comment.

The relative number of under and finishing coats may be altered, if required by the selected manufacturer, provided that the total number of applications remain the same as specified.

Galvanising shall be applied by the hot dipped method. Except where otherwise approved all iron and steel shall be galvanised after sawing, shearing, drilling, punching, polishing and machining are complete, and all roughness is to be removed prior to the coating application.
The zinc coating shall be smooth, clean, of uniform thickness and free from defects. The galvanising shall not adversely affect the mechanical properties of the coated materials.

All work shall be carried out by appropriately trained and skilled tradesmen.

## 2.21 Quality Control

Where items of equipment are delivered to site pre-finished, i.e. stove enamelled or similar finish, they shall be checked to ensure that all the same colours match and do not differ in shade.

The following surfaces shall not be painted;

- Stainless steel, chromed or vitreous enamel surfaces and goods fabricated from copper, brass or gunmetal

Bright or machined faces which have become pitted or marked by rust shall be replaced.

Damaged paintwork or equipment supplied shall be made good to the manufacturer's finish.

Should any rust appear after the initial painting, the item shall be wire brushed to remove rust and defective paint and repainted with zinc rich paint before final painting.

All engineering equipment shall be sealed against entry of damp atmosphere before despatch from the manufacturers' works, and all chrome-plated parts protected from deterioration and the protection cleaned off prior to handover.

## 2.22 Installation

### 2.22.1 Supervisor/Engineer/Forman

Full allowance shall be made for retaining on site during the whole progress of the Works a 'Supervisor' who shall ensure constant supervision and management of the Works.

This person will be responsible for planning the work in close co-operation with all other trades and must not be withdrawn from the site unless notice is given in writing.

## 2.23 Reading of Meters

The reading of electricity meters shall be recorded prior to commencement of the Works. The reading of electricity meters shall be recorded immediately on completion of the Works and forwarded to the Contract Administrator.

## 2.24 Setting Out The Works

Allowance shall be made for setting out the Works accurately on site in accordance with the drawings and documentation and Works shall not proceed until the setting out has been approved by the Contract Administrator.

## 2.25 Production Information

The Contractor shall liaise with the Contract Administrator and others as necessary to help ensure co-ordination of the work with the related building elements and services. Drawings and other information as specified shall be provided showing such details of the work as the Contract Administrator may reasonably require:

Submit for comment, make any necessary amendments and resubmit for further comment unless confirmation is received in writing that this is not necessary.

Submit sufficient copies of final information for distribution to all affected parties.

## 2.26 Co-ordination of Engineering Services

Co-ordination of the Engineering Services Installations will be carried out as part of the Works. The principles of co-ordination shall be agreed with all parties concerned. All necessary details/drawings/schedules etc. required to enable the co-ordination drawings to be prepared by others shall be provided. Details provided by others shall be incorporated into the Co-ordination Drawings.

The installation drawings shall make due allowance for all building elements, structure and other services. Prior to submission all drawings, schedules and any other information provided by manufacturers, nominated suppliers or specialist sub-subcontractors shall be checked and approved to ensure that all the requirements of the contract documentation have been incorporated. All documents submitted shall be accompanied by a certificate indicating that they have been checked and the name of the person carrying out the checking procedure.

## 2.27 Builder's Work

Builder's work such as chases, holes through floors and doors, roofs etc. shall either be marked out on site or submitted on dimension drawings all as required.

Builder's work information shall be provided appropriate to the stage of the design development and shall include requirements for foundations, bases, and supporting

structures for plant and equipment. This information shall be in the form of fully dimensioned drawings showing both size and position of builder's work requirements together with weights of equipment.

All cut holes and chases required together with any pockets cast in the concrete, shall be marked on site together with any inserts, any built in sleeves or similar.

Holes may not be cut in steelwork, reinforcement or pre-cast concrete without written permission. Under no circumstances will holes be cut in pre-stressed concrete. Permitted holes in steelwork must be drilled by the steelwork supplier.

Builder's work drawings shall be provided on the immediate commencement of the Works. The drawings shall detail work that forms part of the building construction and shall include concrete bases, the building in of steelwork, foundation bolts and metal inserts, making chases and cutting away and making good etc. The builder's work drawings must indicate accurately the sizes and positions of all items of builder's work required. Alternatively, a request may be made to mark out in advance on site the builder's work requirements.

Where possible the depth of wall chases shall be equal to the external diameter of the conduit to be installed to allow the plaster cover to be of normal thickness.

For external pipework and cabling installations the Contractor will excavate trenches, construct chambers for valves, hydrants etc., form thrust blocks, supply and lay cables, pipes etc. and on completion of the engineering installation work will back fill and reinstate the ground.

Timely indication shall be given of any difficulties likely to be encountered accommodating the plant or equipment in the space available.

The strength of floors across which heavy loads are to be moved shall be checked in good time before the load is applies so that if the strength of the floor is found to be inadequate arrangements for supporting the load can be made without delaying it's movement.

Any builder's work which has been incorrectly advised shall be rectified at the expense of the Contractor who issued the information, irrespective of how this information has been provided.

## 2.28 Site Meetings

Full allowance shall be made for attending all site meetings called in relation to the Works. Personnel attending such meetings must be familiar with all aspects of the work and must be capable of taking decisions binding on the Contractor.

## 2.29 Site Dimensions

Where installations are dependent on site dimensions, the Contractor shall 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, these are to be checked 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, specifications or schedules.

## 2.30 Delivery, Storage and Protection

The Contractor shall provide adequate and safe protection for all materials and products during transportation to site, storage and erection. Any damage will be rectified or products replaced.

The delivery of all tubes, conduits, trunking and associated equipment shall ensure that the open ends are effectively plugged, capped or sealed.

Equipment shall be protected against mechanical damage or damage caused by moisture ingress.

Prior to erection, sufficient safe and secure storage shall be provided for all materials. Where necessary, racks shall be provided to prevent distortion for storage of conduits, pipes and similar materials. Fittings, accessories and sundry items shall be stored in clean bins or bagged and stored in racks and maintained under suitable weatherproof cover.

Once installed, adequate and safe protection shall be provided for all materials and equipment.

All items shall be protected against the ingress of water and dust, formation of condensation, extremes and rapid changes of temperature, building Works and the operations of others.

It is pointed out that protection other than hardboard covers or heavy duty polythene sheets shall be required to certain items of equipment. Such items shall include, but are not limited to, control panels, switchboards, distribution boards, heater batteries, fin pipework, gauge glasses.

All items shall be protected from damage and paint splashes, and where possible items such as grilles diffusers, light fittings, switches, accessories etc. shall be installed as near to practical completion as possible.

Filter mediums in air handling units etc. shall only be installed when the plant items concerned are being commissioned and tested. All plant items shall be covered with a minimum of polythene sheeting except when being worked upon.

During construction, open ends of pipes, ducts etc. shall be blanked as the work proceeds. Where plant and equipment is installed in decorated areas, the equipment shall be left in a ready to paint condition for the decoration work to be carried out by others.

Within plant rooms the painting shall be carried out under this contract, and any painted parts liable to corrosion shall be painted immediately after removal of any temporary protection.

## 2.31 Survey

The nature of the site and all local conditions and restrictions likely to affect the execution of the Works shall be ascertained prior to tender and at various stages throughout the contract. Before commencing work, a survey and examination of the site shall be carried out to identify any elements of the building, structure and any engineering services which are affected by the work.

On existing sites all available drawings of the engineering services shall be examined and any discrepancies that are noted shall be reported.

No claim for want of knowledge for any aspects of the work or contract will be accepted.

## 2.32 Co-ordination of Trades

Allowance shall be made for co-ordinating the Works with the Works of other trades and installations which may be on site during the period of the installation.

## 2.33 Programmes/Progress

The programme for the Works shall be detailed to assist in producing a master programme for the overall Works.

Due allowance shall be made in the programme which shall include, but shall not be limited to the following;

- Ordering and installation periods
- The completion of drawings etc. including the minimum working days for any survey work associated design etc.
- Work resulting from instructions issued in respect of the expenditure of any provisional sums.
- Any temporary Works necessary for the completion of the services installation
- Pre-commissioning, commissioning, performance testing of the engineering services.
- Preparation and provision of record drawings and operating and maintenance manuals
- The programme information shall be provided as a simple bar chart type.

In addition a separate and detailed commissioning programme shall be produced for agreement by all parties which shall make due allowance for the following:-

- Commissioning, demonstration and instruction procedures
- Provision of written notice before each (or series of) tests, inspection, commissioning or demonstration procedures; 14 days' notice is to be provided.
- Demonstration to the Contract Administrator that test instruments and equipment are accurate.

During the progress of the Works on a weekly basis a copy of the programme is to be kept up to date in relation to the sections of the work that have been installed. If any circumstances arise which affect the progress of the Works this programme shall be updated or redrafted without delay.

"As installed" drawings are to be marked up weekly and before any work is hidden from view.

## 2.34 Covering Up

Ensure that no section of the Works are covered, concealed or insulated until completion of a witnessed, satisfactory test. A period of four working days' notice shall be given when any section of the Works are to be covered or concealed indicating that they are ready for examination and/or measurement, and/or testing.

## 2.35 Statutory Authorities

The orders for the incoming services from the Statutory Authorities shall be provided by others. It will be the responsibility of the Contractor to liaise with the Statutory Authorities and provide any test notices required to ensure final connections are made in

accordance with requirements of the testing and commissioning programme. Liaison with the Statutory Authorities during installation shall be carried out under this contract.

The Contractor shall provide all formalities in connection with test notices; agreement and application for supply forms etc. and all documents requiring the signature of the Employer are to be forwarded in time to meet the building programme in order for the necessary test and supply arrangements to be made. No additional payments will be made for expenses incurred due to re-connections, re-visits etc. by supply authorities or any other officials.

## 2.36 Resources

A statement must be submitted within one week of any request describing the organisation and resources which are proposed to provide to control the quality of the Works. The statement must include the number and type of staff responsible for quality control with details of their qualifications and duties.

## 2.37 Maintenance of Existing Services

Any existing services to existing premises shall be maintained during the progress of the Works.

Any additional work and materials necessary to maintain these services at all times during the duration of the Works shall be included within the tender. Any existing services disturbed by the Works are to be reinstated fully in accordance with the standards of quality defined in the specification.

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

## 2.38 Quality Control Resources

A statement must be submitted within 7 days of request and at least two working weeks prior to commencement on site, describing the organisation and resources which the Contractor proposes to provide to control the quality of the contract works. The statement must include the number of type of staff responsible for quality control, with details of their qualifications and duties.

## 2.39 Health and Safety

### 2.39.1 General

A statement shall be submitted with the tender, describing the organisation and resources which the Contractor proposes and undertakes to provide to safeguard the health and safety of operatives and of any person who may be affected by the Works, including:

- A copy of the health and safety policy document, including risk assessment procedures.
- Records of training and training policy.
- The number and type of staff responsible for health and safety on this project with details of their qualifications and duties.

### 2.39.2 Construction and Management Regulations

The requirements of the Construction and Management Regulations shall be complied with by adhering to the rules of the Health and Safety Plan.

Any accidents, injuries or dangerous occurrences should be reported as directed.

Appropriate input shall be provided to the Health and Safety Plan including risk assessments together with the input into the Health and Safety file. This shall include the provision of information on any element of the Works which might affect the Health and Safety of any other person operating on the site during construction and after the systems become operational.

### 2.39.3 Statements

Method statements must be submitted before an order can be placed, detailing the health and safety considerations and how and when the following tasks will be proposed and undertaken;

- Resourcing for design duties
- Testing and commissioning
- Lifting of heavy equipment
- Connecting into existing services etc.

Method statements for other specific parts of the works shall be submitted at the same time. During the continuation of the works, on site method statements shall be provided for all non-standard operations.

### 2.39.4 Risks to Health and Safety

The risks associated with Health and Safety may vary considerably in relation to the type of sites, and all risks shall be continually assessed as the Works progress. Below are items where risks occur on any building site;

- Working in conjunction with, and in close proximity to lifting plant and equipment.
- Hazards associated with welding or gas cutting equipment.
- Work activities being carried out on light load bearing ceilings or other platforms.
- Work activities being carried out confined areas.
- Working in close proximity to other trades.
- Slips, trips and falls.
- Working in close proximity to noisy activities.
- Working with or in close proximity to hot surfaces, pipes, etc.
- Moisture and liquids within or adjacent to electrical systems.
- The presence, removal and disposal of refrigerant gases.
- The presence, removal and disposal of glycol or similar additives.
- The presence, removal and disposal of specified and unspecified hazardous materials.
- Disconnection and removal of live services.
- Connection to live services.
- working on or near electrical systems and equipment at Gas Operational Sites.

### 2.39.5 Health, Safety, Welfare and Environmental Issues

The Contractor shall comply fully with all statutory safety, health and welfare regulations regarding work people, including those employed by other Contractors employed on the site and particularly the Construction and Management Regulations and provide all relevant details to enable the Planning Co-ordinator/Principal Designer to fulfil the requirements of the legislation.

The Contractor shall comply in all respects with the Factories and Safety in Industry Acts and any other Acts and with any Statutory Instruments or Regulations issued there under.

The Contractor is required to provide a safety method statement clearly indicating the proposed sequence of his works and the precautions he will be taking at each stage in the works to protect his employees, and those of other contractors, visitors and the employers personnel and any plant and equipment etc. Full details of any chemicals or substances proposed to be used in the project construction process should also be detailed fully and the Employer's prior written approval received for its use.

The Contractor shall include for compliance with the Safety, Health & Welfare at Work Acts and Regulations current at the date of tender.

The Contractor shall include for providing all necessary information as required for the Construction to enable the preparation and completion of the Health & Safety File.

## 2.40 Identification

Where appropriate ensure that all materials, plant and equipment bear the brand name, serial/batch no. and any other data required to identify their nature in relation to the Works.

In addition, it is essential that the contents of any pipework shall be identified correctly, and all warning notices installed as appropriate.

## 2.41 Record Drawings and Schedules

Record Drawings and Schedules shall be produced to form part of the Health & Safety file, which is left on site following completion of the Works.

Record Drawings and Schedules shall be to a scale not less than 1:50 from the "As Installed Drawings" which are maintained on site as the Works progress. All such documents shall be clearly marked "RECORD DRAWINGS". Where agreed, certain detailed information may be provided in schedule form. All electrical drawings shall be prepared in accordance with BS EN 61082. Reduced scale copies shall be included in the operating and maintenance manuals as detailed.

Further copies of the record drawings shall be provided electronically in Auto Cad and Micro Station format.

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 relevant information.
- Position 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, builder's' 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 plant rooms, service subways, trenches, ducts and other congested areas, where, in the opinion of the Contract Administrator 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.

## 2.42 Record Drawings and issuing of the as Installed Information

The contractor shall include for updating the site electrical information to incorporate the new works and alterations carried to the associated electrical circuits.

## 2.43 Operating and Maintenance Manual Specialist

On all projects with a services context exceeding £50,000 a specialist shall be employed to produce the Health & Safety, operating and maintenance manuals. On projects below this value, they can be prepared by the Contractor although preparation by a specialist is recommended.

## 2.44 Operating and Maintenance Manuals

Before preparation commences, the format and content of the manual shall be agreed. The manuals shall be A4 size, plastic covered, loose-leaf, four-ring binders with hard covers, each indexed and sub-divided into sections. Drawings larger than A4 shall be included in the binder so that they may be unfolded without being detached from the rings.

Three hard copies of the manual and one copy in PDF format shall be provided.

The operating and maintenance manuals must include;

- A full description 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.
- A photo-reduction of all record drawings together with an index. Reduced size A3
- 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 manufacturer's guarantees or warranties, together with all maintenance agreements offered by Contractor’s 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 changeovers 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 test 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.
- Back-up copies of any system software.

- Documentation of the procedures for updating and/or modifying software operating systems and control programs.
- Instructions for the creation of control procedure routines and graphic diagrams.
- Details of the software revision for all programs provided.
- Two back-up copies of all software items, as commissioned.
- Copies of relevant HSE/CIBSE/IEE Guidance notes etc.

Prepare a temporary file with provisional record drawings, detailed items of equipment and preliminary performance data available at commencement of commissioning to enable Contract Administrator's staff to familiarise themselves with the installation. These should be of the same format as the final manuals with temporary inserts for items which cannot be finalised until the installations are commissioned and performance tested.

Provide one copy of the file in draft from not less than 8 weeks before Practical completion.

Practical completion will not be certified until the health & Safety file and the Operation & Maintenance Manuals have been provided and are accepted by the Contract Administrator.

### 2.44.1 Requirements in the Absence of Manuals

In the event of the Operation and Maintenance Manuals (incorporating Building Log Book) and/or Record Drawings not being available to the Contract Administrator in their final, approved form at handover the Contractor will be required to provide a full time representative whom will be available until such a time as all copies of the O&M Manuals and Record Drawings are handed over to the Contract Administrator. The representative must be a qualified tradesmen/engineer with sufficient knowledge and experience to maintain the operation of the entire installation in a safe and efficient manner.

## 2.45 Training Staff of the Employer

The purpose, function and operation of the installations, including all items and procedures listed in the Operation and Maintenance Manual shall be demonstrated and explained before practical completion to all staff nominated by the Employer and building user.

All appropriate reference and training manuals shall be provided.

An initial instruction shall be complete prior to commissioning of the system with a final instruction within the 7 days prior to contract completion.

The training shall include a full conducted tour of the site for familiarisation with the equipment and location. Where specialised equipment is installed, a representative from the equipment supplier shall carry out the training.

Provide training for the operation of the controls, monitoring or BMS installations as follows:

- Carry out initial training at the controls supplier's works.
- Include 'hands-on' experience of equipment and software, similar to the installation.
- Include instruction on the procedures for testing and routine inspection of sensors and actuators to enable the operator to assess the nature of faults and extent of remedial action required.
- Provide site instruction on the installed system.

## 2.46 Building Log Book

Upon completion of the works, a building log book shall be produced by the Contractor in accordance with the requirements of CIBSE TM31: 2006.

## 2.47 General

### 2.47.1 Plant Operating Conditions

The Contractor shall ensure that all plant items are suitable for operation in the environment in which they are to be located.

All plant, motors, starters and ancillary equipment shall be suitable for operation at full capacity in the following conditions;

- Ambient temperatures;
  peak 30°C in summer
  lowest -3°C in winter
- Internally to the buildings plant shall be capable of operating between temperatures of 0°C to 30°C

### 2.47.2 Electro-magnetic Compatibility

All equipment and systems installed shall provide electro-magnetic compatibility within the system and with any other systems installed in the same area. All systems and buildings are assessed for protection to, and that such protection meets the requirements of BS6651. In addition all equipment shall meet the requirements of the appropriate electro-magnetic compatibility standards.

### 2.47.3 Performance Characteristic Details

Details of the equipment as selected for inclusion in the Works shall include, in a format to be agreed, the following information;

- Plant item description, reference identification and serial no.
- Electrical input rating - kVA, volts, phase
- Operating mode - duty, standby, generator etc.
- Starting characteristics - starter type, current, starts per hour, standing time.
- Performance characteristics - full load current, power factor correction etc.
- Noise level
- Weight
- Type of refrigeration gas and charge weight

### 2.47.4 Software

The Contractor shall 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 up-dating. The application software shall be written in compliance with BS7649.

### 2.47.5 Site Modifications to Equipment

Site modifications to assemblies are not to be made without authorisation from both the manufacturer and the Contract Administrator. Where site modifications to assemblies are authorised, these are to be made in agreement with manufacturer's certified drawings and

instructions. Ensure that modifications made comply with any type test certificate obtained for arrangement of components.

## 2.48 Drawings

### 2.48.1 Introduction

Drawings are to be supplied in time to meet the overall programme for the Works bearing in mind the time required for comment by others.

It should always be considered that the programme may be dictated by others involved in the project e.g. Structural Engineer, and not just the services installation itself.

Various types of drawings are required throughout the contract, and these are detailed in subsequent paragraphs.

The people/organisations responsible for producing these drawings are detailed elsewhere.

### 2.48.2 Drawings

Sketch drawings, schematic drawings, detailed design drawings, co-ordination drawings, installation drawings, installation wiring diagrams, shop drawings, manufacturer's drawings, manufacturer's certified drawings, record drawings, builder's work drawings are as defined in the BSRIA Technical note TN 21/97 Appendix A.

### 2.48.3 Sketch Drawings

Line diagrams and layouts indicating basic proposals, location of main items of plant, routes of main pipes, air ducts and cable runs in such detail as to illustrate the incorporation of the Engineering Services within the project as a whole.

### 2.48.4 Schematic Drawings

These are line diagrams describing the interconnection of components in a system. The main features of a schematic drawing are as follows;

- A two dimensional layout drawing with divisions to show the distribution of the system between building levels or an isometric style layout indicating the distribution of systems across individual floor levels. The drawing is not necessarily constructed to scale. Include all functional components which make up the system, i.e. plant items, pumps, fans, valves, strainers, terminals, electrical switchgear, distribution and components.
- Symbols and line conventions shall be in accordance with good practice.
- The drawing shall be labelled with appropriate pipe, duct and cable sizes where these are not shown elsewhere.
- Indicate components which have a sensing and control function and show the links between them, e.g. building management systems, fire alarms and HV controls.
- Identify the major components indicated on the schematic drawing so that their whereabouts in specification and on other drawings can be easily determined.
- Include all data essential to testing and commissioning including volumetric flow rates, design total pressure losses at equipment, locations of dampers, valves and flow measuring stations, electrical fault levels, current ratings, short circuit capacities and tripping times.

### 2.48.5 Detailed Design Drawings

These are drawings showing the intended locations of plant items and service routes in such detail as to indicate the design intent. The main features of detailed design drawings should be as follows;

- Plan layouts to a scale of at least 1:100
- The drawing will not indicate the precise position of services, but it should be feasible to install the services within the general routes indicated. It should be possible to produce co-ordination drawings or installation drawings without major re-routing of the services.
- Represent pipework by single line (or double line) layouts.
- Represent ductwork by either double or single line layouts as required to ensure that the routes indicated are feasible.

### 2.48.6 Co-ordination Drawings

These are drawings showing the inter-relationship of two or more engineering services and their relation to the structure and building fabric. The main features of a co-ordination 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. Plant room layouts to a scale of at least 1:20, accompanied by cross-sections and elevations to a scale of at least 1:20.
- A spatially co-ordinated drawing, i.e. no physical clashes between the system components when installed at the scaled-off positions shown on the drawing. Provide dimensions in areas where tolerances are minimal.
- Make allowance for the service at its widest point for spaces between pipe and duct runs. Allow for insulation, standard fitting dimensions and joint widths on the drawing. Also allow for those plant items specified by the designer and identified in the design specification. The drawing shall indicate positions of main fixing points and supports where they have significance to the structural design.
- Make allowance for installation working space and space to facilitate commissioning and maintenance and arrange the services so that it is possible to demonstrate a feasible sequence of installation.
- Support the drawing with individual services drawings for clarity.

### 2.48.7 Installation Drawings

These are drawings based on the detailed drawing or co-ordination 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 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. Plant room layouts to a scale of at least 1:20, accompanied by cross-sections and elevations to a scale of at least 1:20.
- A spatially co-ordinated drawing, i.e. no physical clashes between the system components when installed at the scaled-off positions shown on the drawing. An allowance shall be made for inclusion of all supports and fixings necessary to install the Works, and for the service at its widest point for spaces between pipe and duct runs. Allow for insulation, standard fitting dimensions and joint widths on the drawing.
- Make allowance for installation details provided from shop drawings and include for installation working space; space to facilitate commissioning and space to allow on-

going operation and maintenance in accordance with the relevant health and safety requirements.
- Make allowance for plant and equipment including those which are chosen as alternatives to the designer's specified option.
- Provide dimensions where the positioning of services is considered to be important enough not to leave to the tradesmen on site.

### 2.48.8 Installation Wiring Diagram

These are drawings 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.

The following shall be indicated: maximum electrical loading for each supply cable; cable termination facilities; and cable identification and all terminal numbers.

### 2.48.9 Shop Drawings

These are drawings prepared by a fabricator or supplier unique to the project. This includes supplier's drawings for ductwork, pre-fabricated pipework, sprinkler systems, control and switchgear panels and associated internal wiring.

### 2.48.10 Manufacturers Drawing

These manufacturers or suppliers drawings are provided to indicate a typical representation of the product, component or plant item to be supplied for a particular project.

Manufacturers certified drawings are provided by a manufacturer or supplier to indicate details of the product, components or plant items and which the manufacturer or supplier guarantees the supplied equipment will comply with.

### 2.48.11 Record Drawings

These are drawings 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;

- Record drawings should be in micro station format.
- To provide a record of the locations of all the systems and components installed including pumps, fans, valves, strainers, terminals, electrical switchgear, distribution and components.
- Drawn to a scale not less than that of the installation drawings
- 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 (as in the case of underground services).

### 2.48.12 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.

### 2.48.13 Builder's Work drawings

Design Stage

These are drawings to show the provisions required to accommodate the services which significantly affect the design of the building structure, fabric and external Works. Also drawings (and schedules) of work to be carried out by building trade, and required to be costed at the design stage e.g. plant bases.

Installation Stage

Drawings are to developed and provided to show requirements for building Works necessary to facilitate the installation of the engineering services (other than where it is appropriate to mark out on site).

### 2.48.14 Controls Logic Diagrams

These are 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.

### 2.48.15 Switchgear, Starter and Control Instrumentation Panel Drawings

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

### 2.48.16 Examination of Drawings/Information

The drawing will be examined to ensure the propositions submitted comply, in principle, with the design intent. Such an examination shall not relieve the originator of such documents of his responsibilities and obligations under the contract.

After preparing the drawings, the Contractor must not proceed with the Works until the drawings have been commented on in writing.

### 2.48.17 Drawing and Design Information Submission

Drawings shall be assessed using an A/B/C drawing status system. Review and comment by the Contract Administrator does not constitute a formal check of the information. The Contract Administrator comments shall not constitute any form of "approval", and they shall not necessarily be exhaustive. Comments shall not remove or dilute the Contractor's design and detailing responsibility and liability, nor shall they absolve the Contractor from any issues not apparent to the client's representative when reviewing the drawings. Rejection of the drawings for reasonable technical shortcomings or lack of spatial co-ordination shall be binding, however. Comments shall be made in the following format:

- Status "A" - No comment, the Contractor may proceed
- Status "B" - The Contractor may proceed subject to incorporating the comments as set out
- Status "C" - The Contractor shall re-submit the drawing before proceeding further, incorporating comments.

Drawing comments shall be issued as five hard copies (not electronic format) drawings to the Contract Administrator of his representative for review, with a single copy to the Quantity Surveyor, the Acoustician and the Project Manager.

A single copy of each of the latest set of Contractor's drawings shall be issued to the Contract Administrator for review on demand.

Drawing submissions should be provided by the Contractor to allow at least two weeks for the Contract Administrator's representative to return comment. The Contractor shall obtain a record of receipt from the Contract Administrator's representative within three days of any drawing issue. Should comment not be forthcoming after two weeks, the Contractor shall further communicate with the Contract Administrator's representative to record the consequences of any lack of comment. Lack of comment shall in no circumstance confer any acceptance or approval of the Contractor's proposal.

The Contractor shall allow sufficient time within the design programme for submissions for comment and the incorporation of subsequent revisions.

It shall be noted that any installation proposal drawings shall not be given a status higher than status "C" if not accompanied by a multi-service co-ordination drawing that demonstrates that correct clearances and tolerances have been designed between all services, adequate commissioning and maintenance access has been detailed, and correct clearances have been provided between the services and the structure.

Any installation works carried out on proposed installations designated status "C" or unchecked by the Contract Administrator's representative, shall be at the Contractor's own risk and any claim for delays or recompense should the works be found to be defective or inadequate.

## 2.49 Fixing to Building Fabric

### 2.49.1 Standards

The works shall comply with BS 3974-1 in relation to fixings and shall ensure that fixings such as expanding anchors are tested for tensile loading in accordance with BS 5080-1.

All fixings are to be approved prior to installation, and installed in accordance with the manufacturer's instructions.

Plugs of suitable size and length for fixings shall be used, manufacturer from plastic, fibrous or soft metal and non-deteriorating and suitable for the application. Wood plugs shall not be used.

When screws are in place the threaded length shall be within the plug and the screw fixing shall be set-in to the correct depth prior to final tightening.

### 2.49.2 Screws

Generally sherardized steel wood screws to BS 1210 shall be used for fixing to concrete, brickwork or block work.
In damp or exposed situations greased brass wood screws shall be used.

### 2.49.3 Drilling

Holes shall be drilled squarely using drills of requisite size and depth which are appropriate to fabric being drilled.

Flame-cutting of holes in metal work shall not be permitted.

### 2.49.4 Fixing to Reinforced Concrete

When fixing to reinforced concrete seek advice from the structural engineer in advance. Take precautions to avoid fixing through reinforcement.

### 2.49.5 Fixing to Brickwork

Fixings shall be made directly into the bricks. Do not fix to unsound material or mortar between brickwork courses.

### 2.49.6 Fixing to Timber Rails

Equipment, brackets and supports shall be fixed by drilling hole through timber rail and fixing with bolt, back plate, washer and loose nut.

### 2.49.7 Fixing to Hollow Stud/Tile/Block Walls

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.

Equipment brackets and supports where there is no access at rear of wall shall be fixed by the drilling of holes and the use of screw anchor type fixings or gravity type toggle fixings.

### 2.49.8 Fixing to Concrete, Brickwork or Block work

Equipment brackets and supports using wood screws in plugs. Holes shall be drilled and fixings obtained by using steel bolts of grouted bolt type or expanding bolt type fixings.

### 2.49.9 Fixing to Metalwork

Equipment, brackets and supports by drilling holes and fixing using set screws or bolts complete with washers, shake-proof washers and loose nuts.

### 2.49.10 Fixing to Structural Steelwork and Concrete Structures

Manufacturer's information on recommended fixing shall be provided and approval obtained for any fixing to structure steelwork and concrete structures.

Proprietary fixings are to be used for structural steelwork and concrete structures.

Approval to cut holes in structural steelwork or concrete structures or weld structural steelworks shall be obtained prior to installation commencing.

# 3.0 DESCRIPTION OF BUILDING SERVICES INSTALLATIONS

## 3.1 Summary of Electrical Services

The scope of the Electrical Services Installations shall include the following;

- Initial site verification and inspection
- Strip-out redundant electrical services
- Alterations to existing systems
- Electrical distribution including installing new MCCB and distribution board
- Cable Containment
- Small Power and data
- Lighting, emergency lighting and controls
- External Lighting
- Fire alarm system
- Access control, intruder alarm and CCTV systems
- Electrical supplies to mechanical equipment
- PA/VA system
- Lightning protection system
- Interfacing and coordination
- Earthing and Bonding installation
- Provision of labelling and charts
- Testing and commissioning
- Provision of spares
- Provision of Operating and Maintenance manuals, drawings and Product literature.
- Provision of Building Log Book

### 3.2 Design Standards

The following standards shall be applied;

- Current Building Regulations
- The Chartered Institute of Building Services Engineers guidance, including toolkits for Part L2 compliance.
- All relevant British/European Standards.
- Specific Regulations and Guidance as published by Regulatory Bodies associated with specific services (i.e. HVCA, IEE, NICEIC)
- HSC Approved Codes of Practice.
- Manufacturer's Recommendations.

In cases of contradiction, the more onerous shall apply. Unless contradictions in design requirements have been queried and clarified within the tender period the final say between design requirements shall be at the discretion of the contract administrator.

The mechanical and electrical services installation shall be designed and installed so as to reduce the likelihood of damage and/or vandalism, and as such shall be required to be fit for purpose.

## 4.0 Electrical Services Installation

### 4.1 General

The Services Contractor's work shall form part of the provision of the new Electrical Services installation of the new hydrotherapy pool and changing facilities at Elms Bank Specialist College, Bury.

The contract includes supplying, installing, testing, commissioning and full documentation of the Electrical services installation as described in this specification and as shown the

Electrical services drawing. There are elements of contractor design packages detailed in the specification.

The Contractor shall include within their tender all elements necessary to provide a full and complete installation whether indicated on the drawings or referred to in the specification.

The Contractor shall ensure that full co-ordination takes place with all other services/trades to enable all the installations to be installed correctly and function efficiently.

The Contractor shall provide a sample of all Electrical fittings to the Client's Project Manager for approval before placing a purchase order or installation.

In addition to the equipment detailed within this specification and as indicated on the drawings, the Contractor is to allow for all fixtures, fittings, containment, wiring, control equipment and other ancillaries necessary in order to provide a fully working installation in accordance with manufacturer's recommendations.

### Scope of Works

The scope of the Electrical Services Installations shall include the following;

- Strip-out redundant electrical services
- Alterations to existing systems
- Initial site verification and inspection
- Electrical distribution including installing new panel and distribution boards
- Cable Containment
- Small Power, data
- Lighting, emergency lighting and controls
- External Lighting
- Public Address / Voice Alarm (PA/VA)
- Structured wiring
- Structure Wiring containment
- Fire alarm system
- Lightning protection system
- Security system including access control and intruder alarm systems
- Electrical supplies to mechanical equipment
- Interfacing and coordination
- Earthing and Bonding installation
- Provision of labelling and charts
- Testing and commissioning
- Provision of spares
- Provision of Operating and Maintenance manuals, drawings and Product literature.
- Provision of Building Log Book

All installations shall comply with the requirements of BS7671 – Requirements for Electrical Installation, IEE Wiring Regulations 17th Edition and CIBSE guidelines. The Contractor shall supply, install, test commission and set to work the Electrical services installation as indicated on the tender drawings, the specification, and as may reasonably be inferred.

## 4.2 Design And Design Responsibility

The Contractor shall be responsible for all activities normally undertaken through the custom and practice of the industry, such as:

- Phasing of works
- Detailed coordination of cableways, conduit and trunking routes with all bends, sets hangers, supports including sizing of wireways for final circuit distribution.
- Supplementary earth bonding
- Fire detection and alarm systems
- Lighting control system
- Security system

The Contractor shall be responsible for ensuring that the works undertaken is fully co-ordinated and compatible with the remainder of the project design.

All costs shall be allowed by the Contractor for the complete installation of the works. All supports and brackets will be provided by the Contractor up to and including the final attachment to primary structure/building fabric.

The Contractor shall be responsible for the provision of working drawings and submit to the engineer/CA for review before installation. The Contractor shall be responsible for determining cable containment sizes and routes. Cable containment routes and sizes shall be shown on the working drawings and 'as-built' drawings.

## 4.3 Provision of Labelling and Charts

The Contractor shall supply and install a clear labelling system that complies with the requirements of the Client for indicating circuit references on both ends of the new cables and new protective devices in the distribution boards.

The Contractor shall supply typed written updated circuit chart contained within clear plastic wallets fitted securely to the inside of the distribution board. The circuit chart shall contain such information as the circuit type, what it is supplying, design current and cable sizes.

## 4.4 Strip-out/Enabling Works

The strip-out/enabling works shall be read in conjunction with the other relevant sections identified with each element of work.

The Contractor shall allow safely isolating, disconnecting, remove/relocate and disposing of if required, all existing electrical services affected by the proposed works and as shown on the drawings.

Disposal of redundant items of equipment shall be carried out in an environmentally friendly and recognised manner in line with current legislation.

All redundant equipment shall be offered to the Client for possible re-use. Any equipment not required by the Client shall be disposed of properly by the Contractor in accordance with COSHH guidelines and regulations.

## 4.5 Isolation of Supplies

The Contractor shall ensure that all isolation complies with regulation 13 of Electricity at Work Regulations 1989 (EAWR) which requires 'Adequate precautions shall be taken to prevent electrical equipment, which has been made dead in order to prevent danger while work is being carried out on or near that equipment, from becoming electrically charged during that work if danger may thereby arise'

Any Isolation of services shall be agreed with the Building Manager onsite.

When isolation is taking place the Contractor / Sub Contractor shall consider the implications of the isolation and take appropriate safeguards regarding the welfare of all people employed, occupied and working on site. Isolation of services, connection and associated testing shall be carried out outside of normal school hours. (These are usually 07.00 till 16.00 Hrs) The Contractor shall allow in his price for these works.

## 4.6 LV Distribution and sub-distribution board

The main electrical switchgear is located in the existing switchroom. The school is believed to be currently served via a 160A TP&N supply, the main panel is MCCB switchgear and appear to be in reasonable condition.

The contractor shall use the available TPN spare way of the existing panel to serve the new distribution board. The new board shall be 18-way, three phase plus neutral Schneider Acti9 Isobar distribution board (complete with integral split-meters) with fitted 125 Amp switch disconnector at the location shown on the tender drawing.

The distribution board shall be a wall mounted and outgoing ways shall be protected by MCB's/RCBO's. New 35mm multi-core XLPE/SWA/LSF submain cable shall be provided to serve the new distribution board.

The distribution board is designed to have at least 15% spare capacity.

### 4.6.1 Labelling

All out going ways shall be labelled using engraved white-black-white (WBW) laminated material attached to the compartments using nickel plated brass screws, nuts and washers. The labels shall not be glued.

The text size shall be 3.5mm

## 4.7 Sub Distribution

Within the building, new Lighting and Power distribution board shall be installed to serve the new installation. The distribution board shall be as Schneider Isobar type, with integral metering as described in Section 4.6.

All necessary earthing and bonding shall be completed by the Electrical Contractor, in order to comply with BS7671. A complete set of test, commissioning and completion certificates will be provided one week prior to handover.

The proposed new 125A 18-Way TP&N board is to supply the building lighting and power; mechanical control panel and pool control panel.

Where miniature circuit breakers are used they shall be to BS EN 60898 suitably rated for the designated circuit:-

i) Type B for small power circuits
ii) Type C for lighting circuits

iii) Type D for motor circuits.

Harmonized cable colours shall be used throughout the new installation, providing careful attention to labelling/identification to BS7671 where required.

The Contractor shall ensure that the new harmonised cable colours are used throughout this installation.

The Contractor shall provide NICEIC certification upon completion of the electrical installation. The Contractor shall also test and provide certification for those areas outside of the scope of works to ensure a complete and up to date system.

## 4.8 Cable and Cable Containment systems

### 4.8.1 Containment and Ceiling Void Co-ordination

New containment shall be provided in the form of steel trunking for the lighting and power distribution, cable tray for sub-mains and cable baskets for the fire systems and the structured wiring installation.

### 4.8.2 Containment for Power

The tender drawings provides indicative containment routes, the contractor shall make allowances for all necessary primary containment plus all secondary containment in order to provide a complete and continuous installation. The contractor shall be responsible for the sizing, selection and route of the Containment required to provide a complete and continuous installation.

Armoured sub-main shall be multi-core XLPE/SWA/LSF type and shall be terminated directly onto the sheet metal switchgear enclosure or sheet metal collection trunking at the main switchgear position using compression type glands and to provide an effective earth connection for the steel wire armour.

Cables shall be fixed to tray utilising LSØH nylon cable ties.

The internal bending radius of the cable shall be not less than eight times the overall diameter of the cable.

During cable installation, care shall be taken to ensure the outer sheath or insulation is not scuffed or torn, that no undue tension is applied during cable pulling, causing the cable to stretch and that even tension is applied to the outer sheath and internal cores.

No cable installation shall be undertaken when the ambient temperature falls below 0°C.

Polystyrene or formaldehyde based products shall not be allowed to come into contact with the cables.

Where separate earth cables are installed, these shall be run with the submain cables and clipped at a maximum of 300mm centres to the appropriate submain cable with LSØH cable ties.

All submains shall be fitted with type cable markers identifying the board they emanate from and their destination. The cable shall also have a unique reference which shall tally with references indicated on the tender drawings.

The markers shall be provided at both ends of the cable.

The wiring system shall generally comprise XLPE/LSF/SWA cables on trays high and final drops in conduits.

### 4.8.3 Containment for Specialist Installation ELV Wiring

The contractor shall install a basket for specialist ELV wiring for systems such as fire alarm system, intruder alarm, CCTV system, etc as required.

Other than for fire alarm system wiring (which is mechanically protected by construction) all other specialist installation wiring shall be installed in suitable conduits from the cable tray/basket to the point of use.

### 4.8.4 Basket and Cable Tray sizes

The Electrical Contractor shall be responsible post-tender for sizing all conduits, trunking, cable trays and cable baskets. Where sizes are indicated in the specification or on the drawings the Services Contractor shall be responsible for reviewing the size and shall ensure that at tender stage costs are included for all containment to meet the following criteria;

Trunking sized in accordance with BS 7671 and associated guidance notes with minimum 25% spare capacity.

Cable trays sized with all cable flat and touching in a single layer with minimum 20% spare capacity.

Cable baskets, sized with cables bunched but within the depth of the basket with minimum 20% spare capacity.

## 4.9 Installation & Wiring

The installation shall generally be surface mounted or recessed into the building fabric where applicable. The installation shall be galvanised steel conduit, recessed accessories and surface mounted 3 compartment dado trunking in the office.

Wiring to emergency lighting installations shall comply with the requirements of BS5266.

Socket outlets, lighting switches and other wiring accessories, shall be fitted with white PVC faceplates. The location of socket outlets, lighting switches etc. shall comply with Disabled Discrimination Legislation (DDA) and agreed with the EA.

## 4.10 General Small Power

The Services Contractor shall supply, install, test and commission a complete power installation to comply with British Standard 7671 and as indicated on the drawings and as described below.

The complete small power installation shall be installed to comply with regulation 543.7 of BS7671, The Wiring Regulations, i.e. to comply with the earthing arrangements for items of equipment with high earth leakage currents.

Socket outlets shall be installed with the dual earth terminal facility as standard regardless of their intended use or location.

Power wiring shall generally be XLPE/SWA/LSF cables installed on heavy duty cable trays supplying items such as distribution board, mechanical equipment and pool control panel.

General power circuits shall be installed using LSF singles cable contained within galvanised steel trunking and conduit, fed from MCB's/RCBO located within the general distribution board, drops to accessories to be in recessed steel conduit. The Services Contractor shall supply isolators and make the final connection to all equipment using suitable sized flexible cable. Final connection to any external equipment and mechanical plant shall be protected by flexible metallic conduit e.g. Kopex. Full size CPC's, where appropriate, shall be installed to every circuit.

Where detailed, 3 compartment PVC surface fixed Cat 6 compliant dado trunking shall be used as containment for final small power circuit wiring and structured cabling in the office. Dado trunking shall be manufactured by MK as per the Prestige 3D dado range. Prior to installation the Services Contractor shall provide samples to the Project Manager, Client and Architect for approval.

The trunking shall be installed using manufacturer's prefabricated components. Site constructed components will not be acceptable. Where junctions and changes of direction are present, proprietary units shall be installed as per the manufacturer's instructions.

All circuits shall be identified with the circuit reference at the point of use.

The Services Contractor shall provide NICEIC certification upon completion of the electrical installation.

### 4.10.1 Cleaner's sockets.

The contractor shall supply cleaners socket outlets

The cleaners socket outlets shall be supplied as follows:

- Cleaners sockets to be on a ring circuit
- Cabling to be LSF in galvanised steel conduit
- Cleaner's sockets shall be single MK 1 gang, double pole, switched metalclad plus socket outlets. .
- The sockets shall be labelled "Cleaners"

### 4.10.2 Hand Dryers

The Electrical Contractor shall supply and install hand dryers as indicated on the tender drawings.

The hand dryers shall be connected via a high level switched fused connection units with a recessed outlet plate at the rear of the dryer.

The whole installation shall be fully concealed.

The hand dryers shall be as manufactured by Warner Howard, Airforce range or equal and approved.

### 4.10.3 Dishwasher and Tumble Dryer socket outlets

The contractor shall supply and install at each dishwasher and tumble dryer a socket outlet operated by a 20-amp switch

The socket outlet shall be located behind the appliance, while the 20 amp switch shall be mounted above the worktop.

The dishwasher/tumble dryer socket outlets shall be supplied as follows

- Each dishwasher/tumble dryer on laundry ring main circuit
- Cabling to be LSF in conduit and trunking
- Switch accessory shall be MK 20 amp, double pole, switched with neon indicator metalclad plus.
- Socket shall be single MK 1 gang, double pole, un-switched metalclad plus socket outlets.
- The switch shall be labelled "dishwasher"/ "tumble dryer"

### 4.10.4 Electrical Supplies for Mechanical Services

The Services Contractor shall supply, install, test and commission appropriately sized electrical supplies terminating in suitably rated rotary isolator for each item of mechanical plant and as indicated on the drawing. The Services Contractor shall be responsible for the provision of all necessary containment systems, as previously described, in order to install the electrical supplies.

The Isolator shall be supplied as follows:

- 63 Amp SPN isolator from new the distribution board.
- Cabling to be XLPE/SWA/LSF on galvanised steel cable tray.

The Services Contractor shall allow for full and appropriate liaison with the Mechanical Services Contractor to fully understand the electrical supply and containment requirements for the mechanical services installation.

Controls wiring shall be by others, however, the Services Contractor shall provide the 'main' containment 'runs'. The Services Contractor shall allow for full and appropriate liaison with the Mechanical Services Contractor to fully understand the control philosophy and extent of the containment requirements.

The Mechanical Contractor is responsible for supply and installation of all the power cables from the new isolators to the mechanical equipment.

General power requirements for mechanical services have been indicated on drawings and within the specification. The Services Contractor shall develop and co-ordinate these with the mechanical Services Contractor prior to installation.

Electrical Heating

The services contractor shall be responsible for installation of electrical panel heaters as per the drawing. These are to be supplied by the mechanical contractor. The contractor is to provide switched fused spur to each heater and include thermostatic timer controls to

each room. The Contractor is to ensure that all wiring associated with the heating controls is undertaken to provide a fully functioning system at handover.

### 4.10.5 Supplies to Pool Control Panel

The Services Contractor shall supply, install, test and commission appropriately sized electrical supplies terminating in suitably rated rotary isolator for the Pool Control Panel (PCP) as indicated on the drawing. The Services Contractor shall be responsible for the provision of all necessary containment systems, as previously described, in order to install the electrical supplies.

Refer to Appendix for Specialist Pool installation details – Barr + Wray.

The Isolator shall be supplied as follows:

- 32 Amp TPN isolator from new the distribution board.
- Cabling to be XLPE/SWA/LSF on galvanised steel cable tray.

## 4.11 General Lighting

The Contractor shall supply, install, test and commission a complete general lighting, emergency lighting installation and their switching arrangements to comply with BS7671, BS5266, CIBSE guidelines as shown on lighting layout drawings.

The new lighting installation shall comprise of recessed and surface mounted LED luminaries with colour temperature of 4000K, layout and quantities as per the Electrical drawing.

All luminaires shall be installed in accordance with the manufacturers' recommendations. The Contractor shall be responsible for ensuring all luminaires are correctly and neatly installed on the ceiling.

More than one phase shall not exist at a switch point.

The lighting system consists of recessed/suspended surface luminaires. The control method is by absence/presence detection and manual switching.

Upon completion of the general lighting and emergency lighting installation the Contractor shall provide a NICEIC/ECA test certificate for the lighting and emergency lighting installation. The Contractor shall make allowance for commissioning of the system within his tender return document.

Contact: Paul King
Zumtobel Lighting
E: paul.king@zumtobelgroup.com
M: 07748 775411

### 4.11.1 Lighting Installation method

The general installation method shall be

- Soffit mounted lighting control module (LCM) mounted adjacent the ceiling mounted.
- Each LCM own radial circuit
- Cabling to LCM to be LSF in conduit and trunking with final connection by flexible conduit
- Cabling between presence detectors and LCM to be LSF flex
- Cabling between LCM and luminaires to be LSF flex
- The luminaires to be mounted on galvanised steel trunkings / recessed
- Switch accessory shall be MK metalclad grid plus with 10 amp SP.

### 4.11.2 Lighting control General

It shall be the Contractors' responsibility to supply and install a fully functional lighting control system.

CP Electronics shall supply the lighting control system.

The Contractor shall employ the specialist lighting control manufacturer (CP Electronics) to fully commission the automatic lighting controls.

### 4.11.3 Lighting Controls

The contractor shall supply and install CP electronic Vitesse Modular lighting control modules (LCM) as shown on the drawings. Each LCMs shall be have eight luminaire outputs (one starter pack and one extender) The LCMs will utilizing a 6-pin connection plug to the luminaires.

The control method for all areas are detailed on the tender drawings.

### 4.11.4 Lighting control commissioning

The contractor shall employ CP Electronics to program and commission the lighting control system within the area of the works.

The contractor shall supply to the school one number CP Electronics IR Professional Commissioning Handset upon project handover

## 4.12 Emergency Lighting

Emergency lighting will be designed and installed to meet the requirements of B.S. 5266 and B.S. 5588 where appropriate; signs will be to B.S. 5499 and the requirements of the Building Control Officer/Approved Inspector and Building Regulations.

Emergency lighting will be via 3 hour self-contained, Non-maintained LED luminaires. The emergency luminaires shall be separate to the standard luminaires except pool areas where they are integral to the standard luminaires.

## 4.13 External Lighting

The Contractor shall supply, install, test and commission new external lighting scheme as indicated on the drawing.

The external lighting shall be controlled via photocell and timeclock. The new time clock and photocell shall be located as per the drawing and the time clock located adjacent to the new lighting and power distribution board.

The new external lighting shall be fed from the new Lighting and Power distribution board with a sized RCBO's.

## 4.14 Fire Alarm installation

The Contractor shall allow to supply, install and commission the fire alarm installation to meet the requirements of the local fire and building control officers, the specification and BS5839 system. The Contractor shall employ the services of a specialist. The system shall meet BS5839 L1 classification and linked to the existing main panel at the reception with a repeater panel at the new office.

The new repeater fire alarm panel shall be fed via the new MCB distribution board.

The location of the fire alarm devices as shown on the drawings shall be coordinated with all other building services. New fire alarm devices shall be wired using enhanced fire rated cable, such as FP Gold or similar.

### 4.14.1 Interface unit final connection

Interface units shall be provided to automatically isolate the following equipment/services

- AHU Supply fan

The interface unit shall be installed adjacent the Mechanical Control Panel (MCP) in the plant room.

Upon completion the fire alarm system shall be fully tested and commissioned in order to leave a fully operational system and the Contractor shall provide a BS 5839 Part 1 2002 test certificate prior to handover.

A revised A3 sized colour zone chart shall be provided mounted adjacent to the fire alarm panel in a glazed frame.

### 4.14.2 Fire detection Documentation

Responsibility for the provision of Documentation to comply with BS5839 Part 1, 2002 shall be as follows:-

| Document | Provided by Contractor or Specialist |
|---|---|
| Fire detection system Design Certificate | Yes |
| Fire detection system Installation Certificate | Yes |
| Fire detection system Commissioning Certificate | Yes |
| Acceptance Certificate | Yes |
| Updating Zone Chart | Yes |

| | |
|---|---|
| Installation Test Results | Yes |
| Fire System Log Book | Yes |
| As Fitted Drawings | Yes |
| O and M Manual | Yes |
| Installation Test Results | Yes |

### 4.14.3 Maintenance contract

The Contractor shall include for the alterations to the fire alarm system to be included in the existing maintenance contract for the fire alarm system presently operated by the college.

### 4.14.4 Fire alarm system installer

The Contractor shall employ the college's approved specialist to design, supply, alter and install the fire alarm system.

The approved specialist is JB Eye Ltd.

It shall be the Contractor's responsibility to ensure that the quotation offered is fully compliant and includes for all work necessary to provide a full and complete working installation

## 4.15 Disabled Alarm Systems and Staff Call System

The contractor shall supply, install and commission disabled alarm system. All alarms to be linked with central panel located at the main reception and mimic/repeater panel and the new office area.

Contractor is to employ a specialist to design, supply, install and commission the disabled alarm and staff call system. The staff call system shall be fixed not mobile. The Contractor is to include for all containment.

## 4.16 Security Installations

### 4.16.1 Closed Circuit Television System (CCTV)

The Contractor shall allow to supply, install and commission the CCTV system. The system shall include external wall mounted cameras (fixed), internal cameras, monitor and DVR. The Contractor shall employ the services of a specialist. The new cameras shall be linked to the existing system.

The contractor shall employ the college's approved specialist, JB Eye Ltd to design, supply, install and commission the CCTV system.

### 4.16.2 Intruder Detection System

The contractor shall allow to supply, install and commission intruder detection system. The system shall include new intruder alarm panel linked to the existing panel and movement sensors.

The contractor shall employ the college's approved specialist, JB Eye Ltd to design, supply, install and commission the intruder detection system.

### 4.16.3 Access Control System

The contractor shall allow to supply, install and commission access control system. The system shall include new access control panel linked to the existing panel and proximity readers to match the existing.

The contractor shall employ the college's approved specialist, JB Eye Ltd to design, supply, install and commission the access control system.

## 4.17 Data, IT and PAVA Installations

The contractor shall supply and install Cat 6e data points shown on the tender drawing.

The following list below details the design and installation responsibility of items to be installed

- Items to be supplied and installed as part of the contractor fit out package;
    - Containment
    - Accessory Outlet back boxes
    - Cat 6e cabling
    - Terminations
    - Outlet plates
    - Patch Leads
    - Additional 24 port Cat 6 patch panel
    - Testing and commissioning

- The following Items will be supplied by College's AV or IT services for installation by the contractor
    - Wireless transmitters/ adapters

- The following PAVA system to be designed, supplied, installed and commission by the electrical contractor.
    - PA system
    - VA active equipment

The contractor is to employ data installation specialist to carry out the works.

The IT and data system will be based upon a CAT 6e cabling system

## 4.18 Lightning Protection System Installations

The contractor is to employ a lightning protection design specialist to design, supply, install and commission the lightning protection system. The tender drawing shows indicative positions of copper tape down conductors and earth pits.

## 4.19 Earthing & Bonding

The Contractor shall supply and install a complete earthing and bonding installation to comply with the requirement of BS 7671 (and in particular Chapter 54 and the requirements of a PME installation) and BS7430 Code of Practice for Earthing.

All metallic fixed tables, equipment and exposed pipework including hydrotherapy pool shall be equipotentially bonded.

## 4.20 Provision Of Labelling And Charts

The Contractor shall supply and install a clear labelling system that complies with the requirements of the Client for indicating circuit references on each light switch, socket outlet, fused connection unit and isolator etc. The labels shall be laser printed self-adhesive labels with black lettering on a white background.

Distribution boards shall be clearly identified and labelled with Traffolyte engraved labels with 10mm high black lettering on a white background. The labels shall be securely fixed with screws.

The Contractor shall adopt the labelling system used by the Client within the building.

The Contractor shall supply typed written circuit charts contained within clear plastic wallets fitted securely to the inside of each distribution board. The circuit chart shall contain such information as the circuit type, what it is supplying, design current and cable sizes.

## 4.21 Provision of Spares

The Services Contractor shall allow for the provision of spare parts as follows;

- Lamps - 5%, minimum 2No. of each type.
- Fuses - 3No. of each type and rating.
- MCB's - 2No. of each type and rating.
- RCD's - 2No. of each type and rating.
- Socket Outlets - 2No. of each type.
- Light Switch Interiors - 2 No of each type.
- Four replacement fire alarm break glasses.
- Fire alarm detection devices – 1No. of each type
- Intruder detection devices – 1No. of each type

All other spares as per Manufacturer's Recommendations.

All spares to be made available to the Client's representative prior to handover, and a signed receipt shall be obtained from the Client. All spares shall be handed over at the same time.

## 4.22 Testing And Commissioning

The Contractor shall allow for all elements of the Electrical installation to be tested and commissioned in accordance with the relevant British Standards and guidelines.

The Contractor shall test the complete section of works prior to handover of each section in accordance with BS 7671 & NICEIC. All test certificates shall be submitted to the Project Manager after completion of each section of the works. The Contractor shall include copies of the test and commission certificate in the Operational and Maintenance Manual.
The Contractor shall allow for all necessary attendance for the duration of the testing and commissioning by any specialist Contractor as required.

The Contractor shall allow for the provision of operation and maintenance information.

## 4.23 Provision Of Operating And Maintenance Manuals, Drawings And Product Literature

The Contractor shall employ a specialist to prepare O&M manuals. The Contractor shall allow to liaise with and to provide all information required to the specialist contractor. The Contractor shall allow for all costs associated with the preparation of the O&M manual.

The Contractor shall provide 'As installed' drawings, product literature, systems descriptions and other information to allow the O&M manual to be compiled. The Contractor shall liaise and co-ordinate with all members of the design team and all other parties to achieve a complete O&M manual.

As installed drawings are required to be updated on a regular basis so as to represent the installation as it is being installed and to this end the O&M manuals shall be compiled progressively throughout the project to enable one copy of the manual to be handed over to the Client at practical completion. The remaining manuals shall be completed within two weeks of practical completion.

## 4.24 Electrical Accessories Mounting Height Schedule

Wall mounted wiring accessories, equipment and boxes shall be mounted at the following dimensions:

Any ambiguities shall be referred to the services consultants/architect prior to installation.

| Accessory | Location | Height (mm) |
|---|---|---|
| | | |
| Lighting Switch | | 1100 to bottom |
| Socket Outlet | General | 1100 to bottom |
| | Above Worktop | 200 to bottom from worktop |
| Fused connection unit | General | 1100 to bottom |
| | Above worktop | 200 to bottom from worktop |
| Room thermostat / sensor | | 1200 to bottom |
| Telephone/data outlet | | 1100 to bottom |
| Push Button | | 1100 to bottom |

# 5.0 Electrical Materials and Workmanship Specification

## V30 Low voltage distribution systems

To be read with Preliminaries/ General Conditions

**GENERAL**

110 LOW VOLTAGE SWITCHGEAR GENERALLY

- Location: General.
- Coverage: Building
- Type: Switchgear assembly. AS EXISTING
- Incoming device type: Isolator
- Outgoing device type: MCCB
- Metering:
  - Function: Meter electricity consumption. AS EXISTING
  - Type: Ammeters, Digital multi-function sub-metering equipment, Voltmeters and Wattmeters.

  Indicator lamps: Phase indicators.
- Safety matting: Required.

120 CABLING AND CONTAINMENT GENERAL

- Cable type: LSF Singles and Multi-core XLPE/ SWA/ LSF.
- Containment: Cable Trunking and Cable tray.
- Rewireable installation: Required.
- Concealed installation: Required.

**SYSTEM PERFORMANCE**

210 DESIGN

- Standard: To BS 7671.
- Design: Complete the design to cater for the complete working building.
- Spare capacity throughout the low voltage distribution system: 25% of current carrying capacity.
- Equipment: Provide electrical supplies to equipment requiring power.
- Proposals: Submit drawings, technical information, calculations and manufacturers' literature.
- Switchgear drawings: To BS EN 61082-1.

**PRODUCTS**

310 SAFETY MATTING

- Standard: To BS 921.
- Manufacturer: Contractor's choice.
  - Product reference: Contractor's choice.
- Thickness (minimum): 6.5 mm.
- Width (minimum): 900 mm.
- Length (minimum): Match switchgear.

**EXECUTION**

410 INSTALLING LOW VOLTAGE DISTRIBUTION SYSTEMS

- Standard: To BS 7671.
- Layout: Position cabling and equipment to provide safe and easy access for operation and maintenance.

450 INSTALLING SAFETY MATTING

- Front access equipment: Install safety matting in front of the equipment.
- Rear access equipment: Install safety matting in front of and behind the equipment.
- Installation: Fix securely to the floor.

**COMPLETION**

910 TESTING AND COMMISSIONING

- Standard: To BS 7671.

## V31 Low voltage switchgear – AS EXISTING

To be read with Preliminaries/ General guidance

**PRODUCTS**

310 PROTECTIVE DEVICES GENERALLY

- Handles: Removable only when switch is in the OFF position.
- Locking: Provide for padlocking in the OFF position.
- Rated duty: Uninterrupted.

320 CIRCUIT BREAKERS– MCB

- Standard: To BS EN 60947-2.
- Manufacturer: Merlin Gerin.
  - Product reference: Contractor's choice.
- Door interlocks: Prevent enclosure doors being opened while circuit breakers are closed.
- Properties:
  - Utilzation category: A.
  - Interrupting medium: Air.
  - Design: Moulded case.
  - Operating mechanism: Independent manual operation.
  - Isolating type: Required.
  - Provision for maintenance: Non-maintainable.
  - Method of installation: Fixed.
  - Ingress protection to BS EN 60529: Match enclosure.
  - With RCD: Where specified.
  - Mechanical interlocking: Not required.

330 SWITCHES, DISCONNECTORS, SWITCH-DISCONNECTORS AND FUSE COMBINATION UNITS General.

- Standard: To BS EN 60947-3.
- Manufacturer: Contractor's choice.
  - Product reference: Contractor's choice.
- Properties:
  - Utilization category: AC-23.
  - Operation: Frequent (category A).
  - Operating mechanism: Dependent manual operation..
  - Isolating type: Required.
  - Ingress protection to BS EN 60529: IP65.
  - Electrical interlocking: Not required.

350 CONTROL AND PROTECTIVE SWITCHING DEVICES

- Standard: to BS EN 60947-6.2.

- Manufacturer: Contractor's choice.
  - Product reference: Contractor's choice.
- Properties:
  - Method of operation: Electromagnetic.
- Method of control: Automatic.
- Reset after overload: Local manual resetting.
  - Rearming after short-circuit: Manual via a circuit breaker.
  - Utilization category: AC-40.
  - Ingress protection to BS EN 60529: IP65.

360 RESIDUAL CURRENT DEVICES

- Standard: To BS EN 61008-1.
- Manufacturer: Merlin Gerin.
  - Product reference: Contractor's choice.

370 RESIDUAL CURRENT DEVICES WITH INTEGRAL OVERCURRENT PROTECTION

- Standard: To BS EN 61009-1.
- Manufacturer: Merlin Gerin.
  - Product reference: Contractor's choice.

390 MINIATURE CIRCUIT BREAKERS

- Standard: To BS EN 60898.
- Manufacturer: Merlin Gerin.
  - Product reference: Contractor's choice.

420 BUSBARS

- Standard: To BS EN 13601.
  - Approval: ASTA certified.
- Material: Hard drawn high conductivity copper.
- Cross section: Rectangular with radiused edges.

450 DIGITAL MULTI-FUNCTION SUB-METERING EQUIPMENT

- Manufacturer: Contractor's choice.
  - Product reference: Contractor's choice.
- Display: LCD.
- Ingress protection to BS EN 60529: Match assembly enclosure.
- Metering functions: Voltage between phases (V), Voltage between phases and neutral (V), Phase currents (A), Frequency (Hz), Power factor, Active power (W), Active energy (kW · h), Apparent power (V · A), Current demand (A), Active power demand (W), Apparent power demand (V · A), Peak current demand (A), Peak active power demand (W), Peak apparent power demand (V · A) and Pulsed output (kW · h).
- Mounting: Surface mounted.

480 CURRENT TRANSFORMERS

- Standard: To BS EN 60044-1.
- Type: Cast resin encapsulated solid ring.
- Manufacturer: Contractor's choice.
  - Product reference: Contractor's choice.
- Primary rating: 10 A.
- Secondary rating: 1 A.
- Rated short time current: Match the rating of the circuit in which the current transformer is installed.
- Test links: Provide for connection of calibration instruments and meters.

490 PADLOCK AND KEY CABINETS

- Cabinet for padlocks and keys: Wall mounted metal.

- Finish: Match switchgear.

**FABRICATION**

510 SWITCHGEAR GENERALLY

- Switchgear: Factory built.
- Free standing switchgear: Provide lifting bolts within reinforced top frame.
- Neutral terminations: Match current carrying capacity of phase conductor.
- Insect proofing: Cover assembly openings with non-combustible and non-corroding insect proof mesh.
- Spare capacity (minimum): 20% protective device capacity. Provide spare devices.

515 PROPOSALS

- Content: Include the following:
  - Overall dimensions.
  - Degree of ingress protection.
  - Form of internal separation and details of busbar and terminal shrouding.
  - Mounting and fixing details.
  - Builder's work requirements and plinth details.
  - Fault level and rated short circuit characteristics.
  - Functional unit details.
  - Details of internal and external paint systems and colour finishes.
  - Door swings.
  - Access panel details.
  - Schedule of labels.
  - Dimensioned general arrangement drawings, plans, elevations and sections.
  - Shipping sections.
  - Gland plate details.
  - Routing of cabling within assembly.
  - Busbar arrangements, links and supports.
  - Internal controls, instrument and meter wiring diagrams.

525 DISTRIBUTION BOARDS AND CONSUMER UNITS

- Standard: To BS EN 60439-3.
- Manufacturer: Merlin Gerin.
  - Product reference: Contractor's choice.
- Enclosure:
  - Material: Metal.
  - Locking mechanism: Cylinder locks with a standard key type.
- Ingress protection to BS EN 60529: IP44.
- Incoming devices:
  - Type: Switch disconnector.
  - Size: As required.
- Busbars and connections: Fully shrouded.
  - Position within enclosure: Locate in same position relative to protective device for each pole.
- Neutral and earth bars: Individual terminal for each outgoing circuit.
- Outgoing ways:
  - Poles: As Circuit schedules.
  - Quantity: As circuit schedules.
  - Protective devices: As Circuit schedules.
  - Spare ways: Fit with blank plates.
- Identification:
  - Neutral and earth bar terminals: Label with the outgoing circuit reference.

- Cable terminations: Label with circuit reference, with push-on plastics markers.

540 LAYOUT

- Phase sequence: Set-out phase sequence for phases L1, L2, and L3, from left-to-right, top-to-bottom, and back-to-front when viewed from the front of the assembly.
- Fuseholders: Mount such that fuses can be withdrawn towards the operator and away from live parts.
- Heights of components (from finished floor level to underside of component):
  - Equipment requiring operation or maintenance: 500–1600 mm.
  - Instruments: 1200 - 2000 mm.
  - Emergency switching devices: 800–1600 mm.
- Busbars and connections:
  - Supports: Insulated.
  - Identification: Provide 25 mm wide colour bands to busbars at 500 mm intervals with a minimum of one band in each compartment.
  - Future extensions: Pre-drill busbars for future extensions and extend busbar droppers into spare functional unit locations.

545 DOORS AND PANELS

- Doors:
  - Form: Right angle return construction with rounded edges and corners, concealed hinges and internal gaskets.
  - Swing: 90°.
  - Stays: Fit to outdoor assemblies.
  - Hardware: Corrosion-resistant lever type handles with latching mechanism, able to withstand explosive forces from fault conditions.
  - Locks: Cylinder. Standardize key type.
- Fixing of removable panels: Captive, corrosion resistant knurled thumb screws.

550 CABLE ENTRIES AND INTERNAL ROUTING

- Cable entries: Provide for incoming and outgoing cabling.
- Gland plate gaskets: Match the assembly's degree of ingress protection.
- Single core cables: Use non-ferrous plates.
- Internal cable zones: Sufficient to allow cabling to be neatly routed and terminated.

**EXECUTION**

610 ALTERATIONS TO EXISTING SWITCHGEAR

- Standards: In accordance with manufacturers' instructions and type test certification.
- Alterations: Submit records of alterations made to assemblies.

620 INSTALLING SWITCHGEAR GENERALLY

- Switchgear cubicles: Arrange in modular form to facilitate future extension.
- Clearance (minimum):
  - Front access switchgear: 1000 mm in front of switchgear.
  - Rear access switchgear: 1000 mm in front of and behind switchgear.
- Fixing equipment: Fix independently of wiring installation with zinc electroplated fasteners.
  - Indoor equipment: Fix using internal lugs.
  - Outdoor equipment: Fix using external lugs.
- Extension boxes: Provide where necessary.
- Gland plates: Non-ferrous for single core cables.
- Close coupled switchgear: Interconnect.

- Cable type: XLPE Singles.
- Containment: Tray.

630 SWITCHGEAR INCOMING POWER CONNECTION

- Incoming point of supply: Connect to DNO main intake.

640 INSTALLING METERING EQUIPMENT

- Digital metering equipment: Connect to building management system.

650 INSTALLING CURRENT TRANSFORMERS

- Identification details: Mount current transformers so that polarity markings and name plate details are easily viewed in situ.

660 FRAMEWORK FOR MOUNTING SWITCHGEAR

- Material: Metal channel to BS 6946.
- Finish: Hot dip galvanized.
- Arrangement and fixings: Submit proposals.

**COMPLETION**

910 TESTING AND COMMISSIONING GENERALLY

- Standard: To BS 7671.

920 TESTING AND COMMISSIONING OF SITE-ASSEMBLED SWITCHGEAR

- Notice before testing and commissioning: 7 d.
- Switches and circuit breakers: Vacuum clean.
- Protective devices settings: Configure to match the grading study.
- Routine testingand commissioning: Submit results.
- Switchboard monitoring: Continuous for 30 minutes following first energizing.
- Additional inspection and testing:
  - Check levelling and alignment of assembly.
  - Check operation of instruments and metering devices.
  - Check and adjust tightness of busbar connections and supports
  - Check tightness of bolted connections.
  - Check busbar joints with ductor resistance measurements.
  - Check earth connections at compartments, switches and earth electrodes.
  - Check clearance of live parts from direct contact.
  - Check polarity and phase sequence of protective devices.
  - Check operation of protective devices using secondary and primary current injection.
  - Manually operate protective devices.
  - Carry out earth fault protection simulation tests.
  - Check functional operation of circuit breakers.
  - Check operation of switch tripping devices.
- Inspection and test results: Submit.

930 TESTING AND COMMISSIONING OF SWITCH TRIPPING DEVICES

- Tripping function: Verify correct operation.
- Indicators: Verify correct operation.
- Results: Submit.

940 SPARE TOOLS

- Tools: Supply the tools, necessary for maintaining the equipment, including racking handles and a torque spanner.

• Tool cabinet: Include name plate, labelled shelves and non-lockable door. Size for storing racking handles, special tools, spare lamps, spare fuse links and other equipment necessary for satisfactory assembly operation.
- Location: Separate wall mounted, with finish matching switchgear.

950 SPARE FUSES
• Spare fuses:
- Quantity (minimum): 2 of each type and rating used.

960 PADLOCKS AND SPARE KEYS
• Non-interchangeable padlocks:
- Locking mechanism: Five lever.
- Material: Brass.
- Quantity per item of switchgear: 1.
• Padlock keys: Two for each padlock.
• Padlock identification: Stamp padlock describing its function.
• Keys for switchgear door locks: Supply 2 of each key type.

970 LABELLING
• Switchgear terminals: To BS EN 60445.
• Anti-condensation heaters: Provide caution notices advising against accidental switching off.
• Standby power: Provide danger warning notices stating that assemblies may be energized from more than one source.
• Indicator lamps:Label each lamp describing its function.
• Fuses, terminal blocks and other assembly components: Label describing their purpose.
• Spare fuses:Label, describe their rating and associated outgoing ways.
• Cabinets for padlocks and spare keys: Label.

980 CALIBRATION CERTIFICATES
• Certificates of calibration for meters and instruments: Submit.

## V32 Low voltage cabling

To be read with Preliminaries/General conditions.

**PRODUCTS**

310 CABLES GENERALLY
• Standard: To BS 7671.
• Approval: British Approvals Service for Cables (BASEC) certified.
• Proposed selection of low voltage cables: Submit drawings, technical information, calculations and manufacturer's literature.
• Conductor sizes (minimum):
- Sub main cables: 16 mm 2.
- Lighting final circuits: 1.5 mm 2.
- Power final circuits: 2.5 mm 2.
• Spare capacity (percentage of current carrying capacity): 25%.
• Cable sizes not stated: Submit proposals and calculations.

315 NON-FLEXIBLE CABLES AND CONDUCTORS IDENTIFICATION
• Identification: Throughout cable length.
• Colour identification of cores: To BS 7671 Amendment 2.
• Phase rotation: Identify with the coding L1, L2 and L3.

316 FLEXIBLE CABLES AND CORDS IDENTIFICATION

- Phase rotation: Label with the coding L1, L2 and L3.

320 PVC INSULATED CABLES

- Standard: To BS 6004.
- Manufacturer: Contractor's choice.
  - Product reference: Contractor's choice.
- Rigid PVC insulated cables (PVC singles, H07V):
  - Construction: To table 4a.
- PVC insulated and PVC sheathed cables (PVC/ PVC):
  - Construction: To table 7.
  - Sheath colour: Grey.
- PVC insulated, PVC sheathed cables with circuit protective conductor (PVC/ PVC with CPC):
  - Construction: To table 8.
  - Sheath colour: Grey.
- Heat resisting PVC insulated cables (HR PVC singles, H07V-K):
  - Construction: To table 11a.

330 FLEXIBLE CORDS

- Standard: To BS 6500.
- Manufacturer: Contractor's choice.
  - Product reference: Contractor's choice.
- Light duty PVC insulated and sheathed flexible cords (LD PVC/ PVC cord, H03VV-F): - Construction: To table 26.
  - Sheath colour: White.
- Ordinary duty PVC insulated and sheathed flexible cords (PVC/ PVC cord, H05VV-F): - Construction: To table 27.
  - Sheath colour: White.
- Ordinary duty 90 °C PVC insulated and sheathed flexible cords (HR PVC/ PVC cord, H05V2V2-F):
  - Construction: To table 29.
  - Sheath colour: White.

340 INDUSTRIAL FLEXIBLE CORDS

- Standard: To BS 7919.
- Manufacturer: Contractor's choice.
  - Product reference: Contractor's choice.
- Heavy duty, heat resisting EPR insulated and sheathed flexible cords (HD HR Rubber cord, H07BB-F):
  - Construction: To table 12.

350 PVC INSULATED CABLES FOR SWITCHGEAR AND CONTROL GEAR

- Standard: To BS 6231.
- Manufacturer: Contractor's choice.
  - Product reference: Contractor's choice.
- Single core type CK flexible heat resisting cables (Single core tri-rated):
  - Construction: To table 9.

360 SINGLE-CORE HEAT RESISTING INSULATING CABLES

- Standard: To BS 6007.
- Manufacturer: Contractor's choice.
  - Product reference: Contractor's choice.
- Heat resisting rubber insulated cable (HR Rubber singles, H07G-U):
  - Construction: To table 3.

370 THERMOSETTING INSULATED CABLES

- Standard: To BS 7211.
- Manufacturer: Contractor's choice.
  - Product reference: Contractor's choice.
- Rigid thermosetting insulated single core cables (LSZH singles, H07Z):
  - Construction: To table 3a.
- Thermosetting insulated and sheathed single core cables (LSZH/ LSZH singles):
  - Construction: To table 5.
- Thermosetting insulated and sheathed cables with circuit protective conductor (LSZH/ LSZH with CPC):
  - Construction: To table 7.

380 THERMOSETTING INSULATED AND PVC SHEATHED CABLES (XLPE/ PVC SINGLES)

- Standard: To BS 7889.
- Manufacturer: Contractor's choice.
  - Product reference: Contractor's choice.
- Conductors: Copper.

390 INSULATED AND SHEATHED ARMOURED CABLES

- Manufacturer: Contractor's choice.
  - Product reference: Contractor's choice.
- Rated voltage: 600/ 1000 V.
- Conductors: Copper.

393 THERMOSETTING INSULATED AND LSZH SHEATHED ARMOURED CABLESmulti-core

XLPE/ SWA/ LSZH

- Standard: To BS 6724.
- Insulation: Cross-linked polyethylene.

410 MINERAL INSULATED CABLES

- Standard: To BS EN 60702-1.
- Manufacturer: Contractor's choice.
  - Product reference: Contractor's choice.
- Metallic sheath: Copper.
- Light duty mineral insulated with outer sheath (LD MICS/ LSZH):
  - Construction: To tables 7, 8 and 9.
- Heavy duty mineral insulated with outer sheath (HD MICS/ LSZH):
  - Construction: To tables 10, 11 and 12.

420 FIRE RESISTANT, INSULATED AND SHEATHED CABLES

- Standard: To BS 7629-1.
- Approval: LPCB certified.
- Manufacturer: Contractor's choice.
  - Product reference: Contractor's choice.
- Screen: Aluminium tape.

430 FIRE RESISTANT, INSULATED AND SHEATHED ARMOURED CABLES

- Standard: To BS 7846.
- Manufacturer: Contractor's choice.
  - Product reference: Contractor's choice.
- Insulation: Cross-linked polyethylene.
- Fire resistance category: F2.

440 SPLIT CONCENTRIC, INSULATED AND SHEATHED CABLES

- Manufacturer: Contractor's choice.

- Product reference: Contractor's choice.
- Conductor: Copper.
- PVC insulated and sheathed:
  - Standard: To BS 4553-1.
- Thermosetting insulated and PVC sheathed:
  - Standard: To BS 4553-2.
- Thermosetting insulated and LSZH sheathed:
  - Standard: To BS 4553-3.

460 INSULATING TAPE

- Standards: To BS EN 60454-1.

465 UNDERGROUND CABLE MARKER TAPE

- Manufacturer: Contractor's choice.
  - Product reference: Contractor's choice.
- Material: Polyethylene.
- Size:
  - Width: 150 mm.
  - Thickness: 0.1 mm.
  - Format:
  - Background colour: Yellow.
  - Text colour: Black.
  - Labelling: _CAUTION ELECTRIC CABLE BELOW_ continuous along the tape length.

480 CABLE ACCESSORIES

- Cold-pour resin compound and heat-shrink joints:
  - Standard: To BS 6910-1.
- Glands:
  - Standard: To BS EN 50262.
- Terminations for mineral insulated cables:
  - Standard: To BS EN 60702-2.

**EXECUTION**

610 CABLE INSTALLATION GENERALLY

- Standard: To BS 7671.
- Timing: Do not start internal cabling until building enclosure provides permanently dry conditions.
- Preparation: Store cables above 5°C for 24 hours before installation.
- Installation temperature (minimum): 5°C.
- Cables: Install in one length.
- Cable pulling: Do not overstress. Prevent kinks and twisting of the cable.
  - Installation method: Submit proposals.
- Cables passing through walls: Sleeve with conduit or pipeduct. Bush at both ends.
- Cables surrounded or covered by insulation: Derate.
- Jointing: At equipment and terminal fittings only.

620 CABLE ROUTES

- Cables generally: Conceal wherever possible.
  - Concealed cable runs to wall accessories: Run vertically from the accessory.
- Exposed cable runs: Submit proposals.
- Distance from other services running parallel: 150 mm minimum.
  - Heating pipes: Position cables below.

630 CABLES IN PLASTER

- Protection: Enclose within rigid PVC conduit.

640 CABLES IN VERTICAL TRUNKING AND DUCTS

- Supports: Pin racks or cleats at each floor level or at 5 m vertical centres, whichever is less.
- Heat barriers: Required.

650 CABLES IN ACCESSIBLE ROOF SPACES

- Cables running across ceiling joists: Fasten to timber battens which are nailed to the joists.

660 CABLES ON CABLE SUPPORTS

- Position: Place cables side by side.
- Fastenings: Enable any cable to be individually removed.

670 SURFACE MOUNTED CABLES

- Fastening Direct to surface.
- Orientation: Dress cables flat, free from twists, kinks and strain.
- Terminating cables when not using glands: Take sheathing of cables into accessory boxes and equipment and protect against abrasion with grommets.

680 CABLES IN TRENCHES

- Base: Newly prepared bedding.
- Multiple cables in same trench: Set 150 mm apart.
  - Cable formation within trench: Space cables apart by a distance of half the cable diameter.
- Trefoil cable groups and protective conductors: Bind at 1 m intervals.
- Cables below roads and hardstandings: Duct and derate if longer than 10 m. Extend ducts 1 m each side of hard standing.
- Cable identification and protection: Underground cable marker tape and Underground concrete cable protection covers.

700 INSTALLING CABLE DUCTS

- Duct formation within trench: Contractor's choice.
- Gradient (maximum): 1:20.
- Duct bends: Suitable for cable bending radii.
- Manholes: Provide manholes, draw pits and jointing chambers.
  - Location: At change of direction and every 30m on straight runs.
- Duct alignment: Check before installing cables.
- Duct cleaning: Clean duct run before installing cables.
- Draw ropes: Install draw ropes in ducts.
  - Type: Corrosion resistant, minimum breaking strength 550N.
- Duct ends: Plug and seal with proprietary duct plugs.

710 CABLES IN DUCTS

- Cable installation from cable drums: Submit method statement.
- Single core trefoil cable groups and protective conductors: Install within a single duct and bind at 1 m intervals.

720 CABLES IN CONDUIT AND TRUNKING

- Cable installation: Install cables so that they are orderly and capable of being withdrawn.
- Single core wiring: Arrange using the loop-in method.
- Ties: 2 m intervals for cables of the same circuit reference. Label ties with circuit reference number at 10 m intervals.
- Cables in vertical conduit: Provide cable clamps in accessible conduit boxes at 10 m intervals.

730 INSTALLING MINERAL INSULATED COPPER SHEATHED CABLES

- Installation: In accordance with BS 6207-3.
- Bending: Do not corrugate sheath. Straighten and dress cables neatly.
- Moisture damage to the insulation: Prevent.
- Temporary seals: Provide for cables when cut.
- Cables chased into walls: Terminate cabling within ceiling void or another accessible position.
  - Containment for cable tails: Heavy gauge galvanized conduit.
- Fastening to fabric:
  - Bare cables: Bare copper P-clips.
  - Sheathed cables: LSZH covered copper P-clips.
- Testing: Test each length immediately after fastening. Repeat test 24 – 48 h later.

740 INSTALLING ARMOURED CABLES

- Galvanized steel guards: Provide where cables are vulnerable to mechanical damage.
- Earthing: Bond armour to equipment and main earthing system.
- Connections to apparatus: Moisture proof, sealed glands and shrouds.

750 INSTALLING FLEXIBLE CORDS

- Cords: Grip securely at connections. Where cord grips do not form an integral part of the accessory or equipment, provide separate proprietary cord grips.

760 CABLE JOINTING AND TERMINATING

- Preparation: Cut cable ends immediately before jointing or terminating.
  - Cables left unconnected for more than 24 h: Seal to prevent moisture ingress.
- Cable stripping:
  - Length of exposed cores and conductors: Minimize. Leave no exposed conductor after termination.
  - Strands: Do not damage when stripping cable cores. Twist together. Do not reduce number. Secure at terminations.
- Joints and terminations: Use qualified cable jointers, using jointing materials, components and installation techniques recommended by the cable manufacturer and the jointing accessory manufacturer.
- Tooling certificate: Submit before installing connectors.
- Cable glands: Provide in accordance with BS 6121-5.
- Cold pour resin and heat shrink joints: Provide in accordance with BS 6910-2.
- Plastics sheathed cables: Seal with proprietary shrink-on end caps.
- Bolted terminal connections to equipment and switchgear without integral cable clamping terminals: Compression or solder type lugs, of correct bore.
- Compression joints: Provide in accordance with BS 7609.
- Conductor labelling: Identify cable conductor cores at each end of cable and at joints.
- Unused cable cores: Connect to earth.

770 JOINTING AND TERMINATING ELASTOMER AND PLASTICS INSULATED CABLE

- Cable glands: Shroud.
- Core connections to equipment without integral clamping terminals: Compression lugs.

780 TERMINATING MINERAL INSULATED CABLES

- Standard: To BS EN 60702-2.
- Terminating copper sheaths: Earth to non-ferrous plate fixed to enclosure.
- Connections to vibrating equipment: Loop cables in a complete circle next to the point of connection.

- Connection to equipment and boxes: LSZH shrouded glands.
- Conductor cores: Identify at cable ends.
- Insulation resistance: Test at the time of termination and 24 h later.
  - Test report: Submit.

790 MINERAL INSULATED CABLE JOINTS
- Terminations: Terminate cables in externally threaded glands with seals. Indicate temperature rating.
- Joints: Crimped connectors.
- Connectors: Insulate and seal connectors with insulating tape to conductor sleeving. Terminate glands into internally threaded brass sleeve.
  - Brass sleeve protection Heat shrink sleeve.

810 COLD-POUR RESIN COMPOUND AND HEAT-SHRINK JOINTS
- Installation: In accordance with BS 6910-2.

820 VOLTAGE SURGE SUPPRESSORS
- Voltage surge suppressors: Provide in accordance with cable and equipment manufacturers recommendations.
- Installation: In accordance with BS EN 60099-5.

## V34 Controls and starters

To be read with Preliminaries/General conditions

**PRODUCTS**

**COMPLETION**

910 TESTING AND COMMISSIONING
- Standard: To BS 7671.
- Notice before testing and commissioning: 7 d.
- Controls and starters: Vacuum clean.
- Protective device settings and starters: Commission.
- Controls: Verify operation.
- Results: Submit.

930 LABELLING
- Controls: Describe their function.
- Indicator lamps: Label each lamp describing its function.
- Fuses, terminal blocks and other assembly components: Label describing their purpose.

## V39 Electrical inspection and testing

To be read with Preliminaries/ General Conditions.

**COMPLETION**

910 ELECTRICAL INSPECTION AND TESTING TYPE
- Type: Initial verification, Alterations and additions and Periodic inspection.

915 ELECTRICAL TEST ENGINEER
- Electrical test engineer: Independent of installation contractor.
- Approval: NICEIC.
  - Evidence of approval: Submit.

920 GENERAL

- Standards: To BS 7671 and in accordance with IEE Guidance note 3.
- Notice before commencing tests (minimum): 7d.
- Installed equipment standards: Verify and confirm compliance with the relevant equipment standards.
- Electronic devices: Isolate to prevent damage during testing.
- Continuity of protective conductors:
  - Parallel earth paths: Isolate before testing.
  - Equipment: Continuity tester with short circuit current of at least 200 mA, and a no load d.c. or a.c.voltage between 4 V and 24 V.
- Minimum permitted insulation resistance: 1M ohm. :
- External earth fault loop impedance: Direct measurement.
- Earth fault loop impedance:
  - Method: Direct measurement.
  - Measurement locations: Origin, switchgear, fixed equipment and outlets, circuit extremities.
- Prospective fault current:
  - Method: Direct measurement.
  - Location: Origin, and at points where protective devices are required to operate under fault conditions.
- Phase sequence: Verify.
- Cable containment: Measure electrical continuity and insulating properties of containment. Submit results.

930 PERIODIC INSPECTIONS

- Scope: As table 3.3 of Guidance Note 3.

940 TEST EQUIPMENT CALIBRATION

- Test equipment calibration: UKAS approved.

950 INSPECTION AND TEST RESULTS

- Standard: To BS 7671.
- Certificates: Submit.
  - Number of copies: 4.
- Test equipment identity: Record on test certificates.
- Certificates of calibration: Submit for each test instrument.

960 ELECTRICAL INSTALLATION CERTIFICATES

- Format: To NICEIC standard.
- Schedule of test results: Submit.

970 MINOR ELECTRICAL INSTALLATION WORKS CERTIFICATES

- Format: To NICEIC standard.
- Schedule of test results: Submit.

980 PERIODIC INSPECTION REPORTS

- Format: To NICEIC standard.
- Schedule of test results: Submit.
- Remedial works: Submit proposals.

## V40 Small power systems

To be read with section Preliminaries/ General conditions.

**GENERAL**

110 CABLING AND CONTAINMENT General

- Cable type: LSF Singles or Multi-core XLPE/ SWA/ LSF.
- Containment: Cable basket, Cable tray and trunking/conduit .
- Rewireable installation: Required.
- Concealed installation: Required.

**SYSTEM PERFORMANCE**

220 REQUIREMENTS

- Small power outlets: As Small power schedule.
- Layout: Equi-space unless otherwise indicated.

**PRODUCTS**

**EXECUTION**

610 SMALL POWER INSTALLATION

- Standard: To BS 7671.

630 INSTALLING SOCKET OUTLETS

- General: Wire in ring final circuits without spurs.

640 FINAL CONNECTIONS

- Equipment requiring final connections: Mechanical Services.
- Length of final connection: Sufficient to allow for equipment cleaning, maintenance and removal.

650 PARTIAL INSTALLATION

- Equipment to be installed only: Power supplies for Mechanical Services equipment .
- Provide power supplies and final connections only to the following equipment: Intruder Alarm,
  Access Control Systems, CCTV Systems.
- Provide containment for the following: Structured Wiring Containment, including back boxes and blank plates.
  - Draw cords: Required.
  - Proposals: Submit.

**COMPLETION**

910 TESTING AND COMMISSIONING

- Standard: To BS 7671.
- Controls: Check operation.
  - Results: Submit.

920 DOCUMENTATION

- Operation and maintenance instructions: Submit.
- Record drawings: Submit.

## V41 Three phase power systems

To be read with section Preliminaries/ General conditions

**GENERAL**

110 THREE PHASE POWER SYSTEM FOR PLANT ROOM OUTLETS

- Low voltage switchgear: As section V31.
- Low voltage cabling: LSF Singles as section V32
  and Multi-core PVC/ SWA/ LSF as section V32.
  - Sizes: As Circuit schedules.
- Containment: Cable trunking as section Y63, cable tray as section Y63.
- Rewireable installation: Required.
- Concealed installation: Not required.
- Outlets: Industrial socket outlets as section Y65.
- Controls and starters: As section V34.

**SYSTEM PERFORMANCE**

220 REQUIREMENTS
- Three phase power outlets: As required.

**EXECUTION**

620 THREE PHASE POWER INSTALLATION
- Standard: To BS 7671.

630 FINAL CONNECTIONS
- Equipment requiring final connections: Mechanical Services equipment.
- Length of final connection: Sufficient to allow for equipment cleaning, maintenance and removal.

640 PARTIAL INSTALLATION Power supplies for Mechanical equipment
- Requirements: Install and Provide power supplies and final connections.
- Proposals: Submit.

**COMPLETION**

910 TESTING AND COMMISSIONING
- Standard: To BS 7671.
- Notice before commencing testing: 7 days.
- Phase rotation: Verify at outlets.
- Controls: Check operation.
- Results: Submit.

920 DOCUMENTATION
- Operation and maintenance instructions: Submit.
- Record drawings: Submit.

930 MAINTENANCE
- Servicing and maintenance: Undertake.
  - Duration: Until 12 months after Practical Completion.

## V50 General lighting systems

To be read with Preliminaries/ General conditions.

**GENERAL**

110 LIGHTING SYSTEM General
- Luminaire types: As Luminaire schedule.

- Operating voltage: Low voltage.
- Lamp types: As required by luminaire manufacturer.
- Connections to luminaires: Ceiling roses.
- Control gear: Electronic or DALI.
- Controls: Manual/automatic
- Accessories: Smoke hoods and blankets where required.

120 CABLING AND CONTAINMENT General
- Cable type: LSF Singles.
- Containment: Trunking/conduit, cable basket.
- Rewireable installation: Required.
- Concealed installation: Required.

**PRODUCTS**

330 CEILING ROSES
- Standard: To BS 67.
- Manufacturer: Klik.
  - Product reference: Contractor's choice.
- Rating: 6 A.
- Mounting type: Surface.
- Flex length (maximum): 2 m.
- Colour: White.

**EXECUTION**

610 INSTALLING GENERAL LIGHTING SYSTEMS
- Standard: To BS 7671.

630 MODIFYING EXISTING LIGHTING SYSTEMS
- Existing luminaires: Clean.
- Existing lamps: Replace.

650 MANUAL CONTROLS
- Location: Adjacent to door into space being illuminated.
- Staircases: Two way switching at top and bottom landings with intermediate at full landings.

**COMPLETION**

910 TESTING AND COMMISSIONING OF GENERAL LIGHTING SYSTEMS
- Controls: Check operation.
  - Results: Submit.
- Lamps: Check operation.
  - Results: Submit.

930 DOCUMENTATION
- Operation and maintenance instructions: Submit.
- Record drawings: Submit.

940 MAINTENANCE
- Servicing and maintenance: Undertake.
  - Duration: Until 12 months after completion.

## V55 Self-contained emergency lighting and signage systems

To be read with Preliminaries/General conditions.

**GENERAL**

110 SELF-CONTAINED EMERGENCY LIGHTING AND SIGNAGE SYSTEM

- Emergency luminaires: Combined luminaires with at least two lamps, one of which is energized from the emergency lighting supply and Re-engineered general lighting luminaires with emergency conversion modules.
- Way guidance lighting: Photoluminescent low mounted way guidance lighting.
- Emergency signs: Internally illuminated and Externally illuminated.
- Open area lighting: Not required.
- High risk task area lighting: Not required.
- Standby lighting: Not required.
- Testing: Manual.
- Accessories: Visual charge indicators.

120 CABLING AND CONTAINMENT General

- Cable type: LSF Singles.
- Containment: Trunking/conduit, cable basket.
- Rewireable installation: Required.
- Concealed installation: Required.

**SYSTEM PERFORMANCE**

210 DESIGN

- Standards: To BS EN 1838 and in accordance with BS 5266-1.
- Design: Complete the design of the emergency lighting and signage systems.
- Proposals: Submit drawings, technical information, calculations and manufacturers' literature.
- Mode of operation: Non-maintained.
- Duration: 3 h.
- Nominal battery voltage: As luminaire schedule.

230 ESCAPE LIGHTING DESIGN

- Escape route lighting: Within corridors.
  - Horizontal illuminance (minimum) of permanently unobstructed escape routes: 1 lx.
- Open area anti-panic lighting: N/A.
- High risk task area lighting: N/A.
  - Working plane: N/A.

260 PHOTOLUMINESCENT LOW MOUNTED WAY-GUIDANCE LIGHTING DESIGN

- Standard: In accordance with BS 5266-6.

**PRODUCTS**

310 BATTERIES

- Standard: To IEC 60285.
- Type:Sealed nickel-cadmium.
- Life (minimum) when operating under normal conditions at 25°C and subject to complete charge and discharge every 6 months: 4 years.
- Labelling: Indelibly mark with year of manufacture and installation.

320 EMERGENCY LUMINAIRES GENERALLY

- Standard: To BS EN 60598-2-22.
  - Approval: In accordance with ICEL 1001.
- Manufacturer: As luminaire schedule.
  - Product reference: As luminaire schedule.
- Housing: Locate components necessary for the operation of the luminaire

(including batteries, charger, lamp, and control gear) within the luminaire body.

330 GENERAL LUMINAIRES RE-ENGINEERED FOR EMERGENCY USE

- Manufacturer: ICEL 1004 registered company.
- Photometric data: Submit for re-engineered luminaires.
  - Standards: To BS 5225-1 and -3.

360 PHOTOLUMINESCENT LOW MOUNTED WAY-GUIDANCE SYSTEMS

- Standard: In accordance with BS 5266-6.
- Manufacturer: Contractor's choice.
  - Product reference: Contractor's choice.

370 PHOTOLUMINESCENT EMERGENCY SIGNS

- Standard: To BS 5499-1, -5 and in accordance with BS 5499-4 and Photoluminescent Safety Products Association (PSPA) Standard 002 part 1.
- Manufacturer: Contractor's choice.
  - Product reference: Contractor's choice.
- PSPA material class: Class 1.
- Base material: Rigid plastics.
  Thickness: Contractor's choice.
- Fixing: Contractor's choice.

380 VISUAL CHARGE INDICATORS

- Type: Red light-emitting diodes.
  - Position within luminaire: Readily visible. Fix to luminaire body.

390 MANUAL TEST FACILITY

- Type: Match general lighting controls.
- Mechanism: Key operated.
- Location: With the general lighting controls.

420 EMERGENCY LUMINAIRE SUPPORTING COUPLERS

- Standards: To BS 6972 and BS 7001.
- Manufacturer: Klik.
  - Product reference: Contractor's choice.
- Rating: 6 A.
- Colour: Red plug with red cover.
- Plug type: Rewireable, independent.
  - Pin configuration: 4 pin.
- Flex length (maximum): 2 m.

**EXECUTION**

610 STRIPPING OUT

- Extent of stripping out: As detailed in separate Strip Out document.
- Disposal of batteries: In accordance with manufacturer's procedures.

630 INSTALLATION GENERALLY

- Standards: To BS 7671 and in accordance with BS 5266-1.

640 INSTALLING EMERGENCY SIGNS

- Fixing: Fix to building fabric such that the removal of the sign requires a special tool.
  - Orientation: Plumb and level.

660 INSTALLING PHOTOLUMINESCENT LOW MOUNTED WAY GUIDANCE SYSTEMS

- Standard: In accordance with BS 5266-6.

**COMPLETION**

910 INSPECTION AND TESTING
- Standard: In accordance with BS 5266-1.
- Controls: Check operation.
- Full discharge test: Required. Following restoration of the normal supply verify the operation of charge indicators.
  - Results: Submit.

930 DOCUMENTATION
- Standard: In accordance with BS 5266-1.
- Certificate of testing: Submit.
  - Standard: In accordance with BS 5266-1, Annex B.
  - Number of copies: 4.
- System log book: Required.

940 CERTIFICATION FOR RE-ENGINEERED LUMINAIRES
- Certification: Submit completed ICEL 1004 model test record certificate.

950 SPARES
- Secret keyswitches for testing: Provide 3 spare keys.

## V59 Luminaires and lamps

To be read with Preliminaries/General conditions.

**PRODUCTS**

400 LUMINAIRES
- Standard: to BS EN 60598-1 and BS EN 55015.
  - Approval: Kitemark certified.
- Photometric performance: To BS 5225-1.
- Ballasts CELMA energy efficiency index (minimum): A1.
- Controlgear: Integral within luminaire.
- Supply circuit conductor connections: Screw terminals.
- Fuse holders and fuses: Required for incoming circuit phase connections. Label with circuit reference.

410 POWER FACTOR CORRECTION
- Luminaires: Correct power factor to a minimum 0.9 lagging.

420 AIR HANDLING LUMINAIRES
- Standard: To BS EN 60598-2-19.

450 LIGHTING TRACK
- Standard: To BS EN 60570-2-1.
- Type: Single circuit.
- Class: Class I.
- Conductor rating: 16 A.
- Neutral rating: 16 A.
- Mounting: Surface.

460 LUMINAIRE SMOKE HOODS
- Smoke hoods and blankets: Match fire performance of building fabric.

**EXECUTION**

610 SAMPLES

- Samples: Before ordering, supply samples of the following luminaires: 1 of each type.
- Submittals: Include manufacturer's technical information with each sample.
- Identification: Label samples with the luminaire references.

620 INSTALLING LUMINAIRES AND LAMPS GENERALLY

- Standard: To BS 7671.
- Location: As drawings.
- Orientation: Parallel with ceiling.
- Lamps and accessories: Provide.
- Supports: Adequate for weight of luminaire.

630 LUMINAIRE CABLE CONNECTIONS

- Cable connection size (minimum): 1.5 mm².
- Conduit mounted: Terminate directly within luminaire.
- Trunking mounted: Terminate directly within luminaire.
- Suspended trunking: From cable connection mounted on side of trunking.
  - Type: Plug and socket outlet to BS 546.
- Rod or chain suspended: Plug and socket outlet to BS 546.
  - Cable type: HR PVC/ PVC cord, clipped to chain or rod. Do not pass cord through chain links.
- Cable entry: Grommet.
- Class 1 earth connections: Connect to luminaire circuit protective conductor.
- Wiring within luminaires: Minimize. Clip at 300 mm intervals.

640 LUMINAIRES MOUNTED AS PART OF A SUSPENDED CEILING

- Luminaire supports: Independent suspension wires.
- Luminaire final connection: Plug and socket outlet to BS 546.
  - Mounting: Surface mounted on side of trunking.
  - Length (maximum): 2 m.

650 INSTALLING LIGHTING TRACK

- Orientation: Level with ceiling.
- Track suspensions: Rigid.

670 INSTALLING CONTROLGEAR

- Location: Adjacent to luminaire.
- Fixing: Secure to building fabric.

690 INSTALLING LUMINAIRE SUPPORTS

- Support and fixing arrangement: Submit proposals.
- Luminaire suspensions: Vertical.
  - Multiple suspensions: Provide as necessary.
- Levelling: Adjust the length of suspensions so that luminaires are level.
  - Levelling tolerance: ± 3 mm.
- Conduit supports:
  - Size (minimum): 20 mm.
  - Type: Match cable containment.
  - Conduit boxes: Provide for each luminaire suspension point.
- Rod supports: Continuously threaded rods.
- Chain supports: Steel chain with conduit box hook and cover.
- Ball and socket: Provide as top support and fix cover to circular conduit box. Route cable from conduit box through ball and socket.
- Number of supports for luminaires longer than 600 mm (minimum):

- Luminaire width<300 mm: 2.
- Luminaire width >300 mm: 4.

**COMPLETION**

910 CLEANING
- Luminaires and lamps: Clean when building works are complete.

920 TESTING AND COMMISSIONING
- Luminaires and lamps: Check operation.

930 SPARE LAMPS
- Quantity to be supplied: 5 of each type installed.
- Labelling: Label the lamps with the corresponding luminaire reference.

## V80 Electrical identification

To be read with Preliminaries/ General conditions.

**PRODUCTS**

310 IDENTIFICATION AND NOTICES
- Standards: To BS 7671, BS 5499-1 and -5.

320 EQUIPMENT LABELS GENERALLY.
- Material: Face engraved rigid plastic laminate.
- Colour:
  - Background: White.
  - Lettering Black.
- Typography:
  - Font: Helvetica medium.
  - Size: Submit proposals.

330 ELECTRICAL SHOCK TREATMENT SIGNS
- Type: Plastics encapsulated.
- Manufacturer: Contractor's choice.
  - Product reference: Contractor's choice.

340 DIAGRAMS
- Material: Paper print, glazed frame.
- Format: Single line engineering drawings to BS EN 61082-1.
- Information to be included:
  - Supply characteristics.
  - Maximum demand.
  - Cable types and sizes.
  - Switchgear ratings.
  - Protective device types, ratings and function.
  - Prospective fault current values: At each item of switchgear.
  - Earth fault loop impedance values: At each item of switchgear.
  - Circuits containing equipment vulnerable to testing: Label.
- Mounting: Wall.

**EXECUTION**

610 INSTALLING ELECTRICAL IDENTIFICATION
- Standards: To BS 7671, BS 5499-1 and -5.

620 SAMPLES

- Labels: Submit samples showing material, style, colour, lettering, and fixing method for each label type.

630 ARRANGEMENT

- Location: Submit proposals.
- Fixing: Secure, plumb and level.
  - Type: Round head bolt, washer and lock nut.

640 IDENTIFYING METAL CONTAINMENT FOR FIRE DETECTION AND ALARM SYSTEMS

- Identification:
  - Standard: To BS 1710.
  - Colour: BS 4800 reference 06 E 51.
  - Application: Adhesive tape banding 150 mm wide.

650 IDENTIFYING SUB-MAIN CABLES

- Labels at both ends: Include circuit reference and cable size.
  - Marker type: Face engraved rigid plastic laminate.

660 FUNCTIONAL EARTHS

- Labels at cable ends: State the purpose of functional earth cables.
- Instructions for operation and maintenance: Encapsulated card at cable ends.

670 PROTECTIVE CONDUCTORS

- Labelling of busbar and bare conductors: Throughout the length of the conductor.

680 EQUIPMENT LABELLING

- Electrical equipment: Label indicating its purpose.
- Safety signs: Install where voltages above ELV exist.
- Voltage warning notices: Label equipment when the voltage exceeds 230 V.
  - Format: To BS 5499-5 8.A.0044, include warnings of the voltage present.

690 CIRCUIT CHARTS

- Location: Distribution boards and consumer units.
- Format: Card within a reusable clear plastics envelope.
  - Size A4.
- Typed information: State outgoing circuit references, their device rating, cable type, cable size, circuit location and number of points served.
- Fixing: Fit to the inside of each unit with nylon hoop and loop self-adhesive pads.
- Switchgear outgoing ways: Label corresponding to the circuit chart.

700 ENGRAVING OF ELECTRICAL ACCESSORIES

- Fused connection units and isolators: Describe function and Identify circuit reference.
- Emergency lighting test key switches: Engrave with the wording _E LTG TEST_.
- Multigang light switches:
- Socket outlets: Engrave with the wording _Cleaners socket_.
- Fill colour: Black.

710 INSTALLING DIAGRAMS

- Location: At main switchgear.
  - Installation: Wall mounted with cup & screw fixings.

720 INSTALLING PERIODIC INSPECTION NOTICES

- Location: At the incoming point of supply.
- Frequency of inspection: 5 year.

730 INSTALLING MAINTENANCE NOTICES

- Maintenance procedures: Install notices describing essential maintenance procedures and their frequency.
  - Location: At the incoming point of supply and plant/boiler rooms.

740 INSTALLING ELECTRIC SHOCK TREATMENT SIGNS

- Location: Electrical switch rooms.
  - Installation: Wall mounted with cup & screw fixings.

750 INSTALLING HAZARD SIGNS

- Location: At each item of switchgear.

## V81 Earthing and bonding systems

To be read with Preliminaries/ General conditions.

**GENERAL**

110 EARTHING AND BONDING SYSTEMS

- Standard: To BS 7671 and in accordance with BS 7430.
- Main incoming earth: Establish with the Electricity Distributor.
- Main equipotential bonding: Connect the following to the main earth bar: Gas, water, structural steel, lightning protection, fuctional earth's.
- Supplementary equipotential bonding: Bond the following: As required by BS7671 and testing.
- Earth bars: Separate wall mounted main earth bar and 'functional' earth bar.
- Earthing of metal fencing around substations: Not required.

**SYSTEM PERFORMANCE**

210 DESIGN

- Standard: To BS 7671 and in accordance with BS 7430.
- Design: Complete the design of the earthing and bonding systems.
- Proposals: Submit drawings, technical information, calculations and manufacturer's literature.

220 ELECTRICITY DISTRIBUTOR'S REQUIREMENTS

- Electricity distributor: Comply with the requirements of the Electricity Distributor.
  - Evidence of compliance: Submit.

230 EQUIPOTENTIAL BONDING IN BUILDINGS WITH INFORMATION TECHNOLOGY EQUIPMENT

- Standard: To BS EN 50310.
- Objectives: Provide functional earth bar for IT use.

240 FUNCTIONAL EARTHING DESIGN

- Standard: In accordance with BS 6701.
- Objectives: functional earth bar for IT use.
- Connection type: To a separate functional earth bar connected directly to the main earth bar.

260 HIGH INTEGRITY EARTHING DESIGN

- Scope: To BS7671.

290 DESIGN TO MINIMIZE UNDESIRABLE STATIC ELECTRICITY

- Standard: In accordance with BS 5958-1 or PD CLC/TR 50404.

**PRODUCTS**

310 PRODUCTS GENERALLY

- Standards: To BS 7671 and in accordance with BS 7430.

320 EARTH CONDUCTORS

- Bare, tinned, LSZH-covered and lead-covered copper tape: To BS EN 13601.
- PVC insulated copper tape: To BS EN 13601.
- Bare stranded copper tape: To BS 6360.
- Manufacturer: Contractor's choice.
  - Product reference: Contractor's choice.

330 FUNCTIONAL EARTH CABLES

- Standard: In accordance with BS 6701.
- Sheath colour: Cream to BS 6746C.

340 HARD DRAWN COPPER BARS

- Standard: To BS EN 13601.
- Manufacturer: Contractor's choice.
  - Product reference: Contractor's choice.

350 FLEXIBLE BRAIDS

- Standard: To BS EN 13602.
- Material: High conductivity copper.
- Manufacturer: Contractor's choice.
  - Product reference: Contractor's choice.

360 EARTH RODS

- Standards: In accordance with BS 7430 and Energy Networks Association Technical Specification 43-94.
- Type: Solid copper rods.
- Manufacturer: Contractor's choice.
  - Product reference: Contractor's choice.
- Size (diameter): Contractor's choice.

370 COPPER EARTH PLATES

- Standard: To BS EN 13601.
- Type: Contractor's choice.
- Manufacturer: Contractor's choice.
  - Product reference: Contractor's choice.
- Size: Contractor's choice.
  - Thickness: Contractor's choice.

380 EARTH ELECTRODE INSPECTION PITS

- Type: Concrete.
- Manufacturer: Contractor's choice.
  - Product reference: Contractor's choice.
- Load rating (minimum): 5000 kg.
- Identification: Permanently identify with the wording _SAFETY EARTH_.

390 EARTH BARS

- Manufacturer: Contractor's choice.
  - Product reference: Contractor's choice.

- Material: Hard drawn copper.
- Location: Main switchroom, IT/Comms room.
- Size:
  - Profile: 25 mm x 6 mm.
  - Length: Contractor's choice.
- Predrilled connections: 10.
- Disconnecting links: 2.

410 MAIN EQUIPOTENTIAL BONDING CONDUCTORS
- Type: LSZH singles or Bare copper tape.

420 SUPPLEMENTARY BONDING CONDUCTORS Cable type: LSZH singles.

430 CIRCUIT PROTECTIVE CONDUCTORS
- Type: LSZH singles.
- Size: To BS 7671 Regulation 543-01-04.

440 EARTH CLAMPS
- Standard: To BS 951.

**EXECUTION**

610 GENERAL INSTALLATION
- Standards: To BS 7671 and in accordance with BS 7430 .

630 EXISTING INSTALLATIONS
- External earth fault loop impedance: Direct measurement.
- Earth fault loop impedance: Measure.
  - Method: Direct measurement.
  - Locations: Origin, switchgear, fixed equipment and outlets, and circuit extremities.
- Results: Submit.

640 INSTALLING EARTH CONDUCTOR TAPES
- Fasteners: Non-metallic direct contact clips.
  - Spacing (maximum): 600 mm.
- Anti-vandal capping: Provide.
  - Type: Galvanized steel.
  - Location: In areas where damage may be likely and up to height of 2m.

650 EARTH CONDUCTOR JOINTS AND CONNECTIONS
- Number of joints: Minimize.
- Contact surfaces: Clean. Coat with corrosion inhibitor.
- Bimetallic joints: Do not cross-contaminate.
- Joints and connections subject to moisture: Protect.
  - Type of protection: Heat shrink clear sheathing.
- Connections to test points: Clamp.
- Copper tape jointing: Phosphor bronze clamps, nuts, bolts and washers.
  - Conductor overlap (minimum): 100 mm.
- Protective cable terminations: Compression lugs with phosphor bronze nuts, bolts and washers.

660 INSTALLING EARTH RODS
- Position: In undisturbed ground.
  - Location: At least 2 m from building and metal fencing, avoiding communications cabling.

- Rod separation: Space the rods apart by at least 1.25 times the depth of the longest rod.
  - Clean earth installations: Space rods apart by at least 6 times the depth of the longest rod.
- Rod alignment: Vertical.
- Rod length (minimum): 2.4 m.
- Couplings: Apply corrosion inhibiting paste to the threads and enclose so that rods meet at centre of coupling.
- Earth rod heads: Enclose and position within 100 mm of ground level.
  - Enclosure: Concrete inspection pit.
- Earth rods: Interconnect with bare copper tape.
  - Tape size: 25 mm x 3 mm.
  - Tape depth: 750 mm below ground.
  - Jointing method: Bolts.
- Internal earth rods: Provide seals.

680 INSTALLING EARTH PLATES

- Earth plates: Install vertically. Backfill immediately following installation.
  - Depth of plate top (minimum): 1000 mm below finished ground level.

690 SOIL CONDITIONING AGENTS

- Type: Bentonite.
- Location: Contractor's choice.

700 INSTALLING EARTH BARS

- Main earth bar location: Next to the main switchboard.
- Multiple earth bars: Connect with a conductor ring.
- Mounting: Insulated supports.
  - Support spacing: 300 mm for 25 mm bar and 450 mm for 50 mm bar.
  - Clearance between wall and earth bar (minimum): 30 mm.

710 INSTALLING MAIN EARTH CONNECTIONS

- Main incoming earth: Connect to the earth bar. Provide interlocking tiles and PVC warning tape along the length of the route at a depth of 300 mm.
  - Connection to earth electrodes: Heavy duty copper alloy mechanical clamps.
- Earth conductors: Connect to separate earth bar connections with compression lugs and phosphor bronze nuts and bolts.
- Size of main earthing conductors: To BS 7671 Regulation 543-01-04.
- Connections: Contractor's choice.

720 INSTALLING MAIN EQUIPOTENTIAL BONDING CONDUCTORS

- Separate and continuous connections: Install between each service and the main earth bar.
- Earth connections: Connect with compression lugs.

730 INSTALLING SUPPLEMENTARY BONDING CONDUCTORS

- Earth connections: Connect with compression lugs.

740 INSTALLING EARTH ELECTRODE PITS

- Inspection pit lid: Install flush with the finished ground surface.

750 DISSIMILAR METALS

- Connecting dissimilar metals: Prevent electrolytic action.

760 EARTHING AND BONDING OF STREET FURNITURE

- Standard: In accordance with the Electricity Distributor's requirements.

- Supplies to street furniture: Use cables with separate phase, neutral and protective conductors.

**COMPLETION**

910 INSPECTION AND TESTING

- Standards: To BS 7671 and in accordance with BS 7430.
- Notice before commencing tests (minimum): 7d.
- Continuity of protective conductors:
  - Parallel earth paths: Isolate before testing.
  - Equipment: Continuity tester with short circuit current not less than 200 mA, and a no load d.c.or a.c. voltage between 4 V and 24 V.
- External earth fault loop impedance: Direct measurement.
- Earth fault loop impedance:
  - Method: Direct measurement.
  - Measurement locations: Origin, switchgear, fixed equipment and outlets, and circuit extremities.

920 NOTICES AND LABELS

- Standard: To BS 7671.
- Material: Face engraved rigid plastics laminate.
- Colour:
  - Background: White.
  - Lettering: Black.
- Typography:
  - Font: Helvetica medium.
  - Size: Submit proposals.
- Earth bars: Describe each connection and label with _SAFETY ELECTRICAL CONNECTION – DO NOT REMOVE_.
- Main earth connections: Describe each connection and label with _SAFETY ELECTRICAL CONNECTION – DO NOT REMOVE_.

930 IDENTIFICATION OF FUNCTIONAL EARTHING

- Labelling: Identify the purpose of functional earth cables along their length using clip-on cable markers.
  - Spacing (maximum): 3 m.

940 DOCUMENTATION

- Operation and maintenance instructions: Submit.
- Record drawings: Submit.

## W41 Intruder detection and alarm systems

To be read with Preliminaries/General conditions

**GENERAL**

110 INTRUDER DETECTION AND ALARM SYSTEM

- Standard: To BS EN 50131-1.
- Manufacturer: Galaxy.
  - Registration: A member of BSIA.
- Grade: Grade 2.
- Power supply: Type A.
- Environmental classification: Class II.
- Areas to be protected: Rooms with external glazing.
- Perimeter protection: All external doors.
- Detectors: Passive infrared detectors and Protective switches.
- Equipment interconnectivity: Wired.
- Warning devices:
  - Internal: Electronic sounders.
  - External: Sounders and To alarm receiving centre (ARC).
  - Signalling method: Digital communicator.
- Control and indicating equipment (CIE): Main control panel and Remote keypad.
- Accessories: None.

120 CABLING AND CONTAINMENT

- Cable type: Multi-core intruder alarm cable.
- Containment: Cable basket.
- Rewireable installation: Required.
- Concealed installation: Required.

**SYSTEM PERFORMANCE**

225 ZONING AND DEVICE IDENTIFICATION

- Zoning: Divide the installation into separately controlled and identifiable zones.
- Device identification: Individual address.

230 SPARE CAPACITY

- Spare capacity (minimum): 10% spare devices.

240 CONNECTION TO FIRE DETECTION AND ALARM SYSTEMS

- Fire and fault signal: Accept and relay to the alarm receiving centre.

260 POLICE RESPONSE

- Response: In accordance with Association of Chief Police Officers (England, Wales and Northern Ireland) Security systems policy.

**PRODUCTS**

316 COMBINED DETECTORS

- Manufacturer: Submit proposals.
  - Product reference: Contractor's choice.
- Sensor types: Passive infrared detectors.
- Mounting: Wall.
- Features: None.

322 PROTECTIVE SWITCHES

- Standard: To BS 4737-3.3.
- Type: Magnetic reed switch.
- Manufacturer: Submit proposals.
  - Submit proposals: Contractor's choice.
- Circuit configuration: Closed-circuit.
- Material: Plastics.
- Mounting: Surface.
- Features: None.

340 ELECTRONIC SOUNDERS

- Manufacturer: Submit proposals.
  - Product reference: Contractor's choice.
- Colour: White.

360 EXTERNAL SOUNDERS

- Type: Self activating bell, foam proof.
- Manufacturer: Submit proposals.
  - Product reference: Contractor's choice.
- Stand by power supply: Integral.
- Colour: Submit proposals.
- Strobe: Integral.
- Visual indication: LED.
- Ingress protection to BS EN 60529: IP65.

370 DIGITAL COMMUNICATORS

- Standards: To BS EN 50136-1-3 and BS EN 50136-2-3.

400 CONTROL AND INDICATING EQUIPMENT (CIE)

- Standard: To BS EN 50131-1.
- Manufacturer: Galaxy.
  - Product reference: Submit proposals.
- Controller: Microprocessor based.
- Features:
  - Event time recording.
  - Alarm and fault indication.

404 SUPPLEMENTARY PROCESSING OF SIGNALS FOR GRADE 2 SYSTEMS

- System status, set:
  - Indication required for: Intruder signal/ messages, Tamper signals and Fault signal.
  - Internal warning devices: Indication required.
- System status, unset:
  - Indication required for: Intruder signal/ messages.
  - Alarm transmission system message types required for: Fault and Tamper.

412 SUPPLEMENTARY INDICATIONS FOR GRADE 2 SYSTEMS

- During setting: Zone identification, Detector masked and Contractor's choice.
- System set: System set, Alarm condition, Zone identification, Zone isolated, General fault, Prime power fault, Alternative power fault, Zone first to alarm, Part set, Tamper condition, ATS fault and Detector masked.
- During unsetting: System set, Zone isolated, Alternative power fault, Zone first to alarm, Part set, ATS fault and Detector masked.
- System unset: Zone identification, Zone isolated, Zone first to alarm, Part set and Detector masked.

420 NOTIFICATION REQUIREMENTS FOR GRADE 2 SYSTEMS

- Means of notification: Option A.

428 SUPPLEMENTARY TAMPER DETECTION FOR GRADE 2 SYSTEMS
- Additional forms of tamper detection: Masking of movement detectors.

434 MONITORING SUBSTITUTION OF GRADE 1 AND 2 SYSTEM COMPONENTS
- Substitution of system components: Not required.
- Substitution of signals/ messages: Not required.
- Timing:
  - Substitution of system components: 60 s.
  - Substitution of signals/ messages: 60 s.
- Supplementary system states where monitoring is to be operational: During setting and At other times.

438 EVENT RECORDING FOR GRADE 2 SYSTEMS
- Memory capacity (minimum): 100 events.
- Endurance of memory after system power failure (minimum): 30 days.
- Event recording functions: User identity when setting/ unsetting, Prime power fault, Battery change required, Changes to time and date, Substitution of components, Substitution of signals or messages and Availability of means of communication.

450 REMOTE KEYPADS
- Backlight: Required.
- Individual zone identification: Required.
- Individual device identification: Required.
- Deliberately operated button: Integral.

480 MULTI-CORE INTRUDER ALARM CABLES
- Standard: To BS 4737-3.30.
- Conductor: 0.22 m², 7 x 0.2 mm stranding.
- Sheath: LSZH.
- Cores (minimum): 6.

**EXECUTION**

620 INSTALLING INTRUDER DETECTION AND ALARMS SYSTEMS
- Standards: To BS 7671 and BS EN 50131-1.
- Location of intruder alarm equipment: As drawings.
- Main power supply: From an unswitched fused connection unit. Permanently wire with a dedicated circuit from the building's main low voltage switchboard.
- Dummy external sounder: Required.

630 INSTALLING CABLES
- Route: As drawings.
- Device wiring: Individual radial circuit from control panel.
- Timing: Do not start internal cabling until building enclosure provides permanently dry conditions.
- Cables: Install in one length.
- Cable pulling: Submit proposals. Do not overstress. Prevent kinks and twisting of the cable.
- Cables passing through walls: Sleeve with conduit or pipeduct. Bush at both ends.
- Jointing: At equipment and terminal fittings only.

**COMPLETION**

910 TESTING AND COMMISSIONING GENERALLY

- Standard: To BS EN 50131-1.
- System commissioning agent: System manufacturer.
- Notice before commencing tests (minimum): 2 weeks.
- Cable testing
  - Insulation resistance: Submit results.
  - Earth continuity: Submit results.
- Charger: Verify operation.
- Detection devices: Verify the operation, and adjust to provide maximum coverage.
- Device voltage: Submit details of the voltage at powered devices.
- Local warning devices: Verify operation.
- Remote signalling: Verify operation.
- Standby supply: Verify operation in the event of a mains failure. Check capacity and submit results.
- Tamper detection: Verify operation.
- Timers: Set up and adjust entry and exit timers.
- User codes: Set up and commission.

920 DEVICE IDENTIFICATION AND TESTING

- Device list: Before commissioning submit proposals, including proposed device, zone and group names.
- Zone diagram: Before commissioning submit proposals.
- Device identification: Label devices with a unique address corresponding to that used by the CIE.
  - Device testing: Verify the operation of each device. Submit a schedule of devices, including the device test methods and results.

930 SYSTEM SOAK TESTING

- Soak test: Undertake when construction works are complete, but before handover and before connection to a remote alarm receiving centre.
  - Period: 14 days.
  - Re-test after remedial works.

940 STANDBY BATTERY TESTING

- Mains power supply: Isolate.
- Quiescent mode: Measure current supplied by standby source when intruder detection and alarm system is operating in the quiescent mode. Submit results.
- Alarm mode: Measure current supplied by standby source when intruder detection and alarm system is operating in the alarm mode. Submit results.

950 TESTING ACTUATION, INTEGRATION AND INTERFACING WITH ALARM AND SECURITY SYSTEMS

- Connections with other systems and equipment: Verify and demonstrate operation of the systems and equipment under fire and fault conditions. Submit results.

970 DOCUMENTATION

- Standard: To BS EN 50131-1.
- Operation and maintenance manual: Submit.
- Record drawings: Submit.

980 LOG BOOK

- Type: Hard back cover embossed "INTRUDER DETECTION AND ALARM SYSTEM LOG BOOK" with A4 lined paper, minimum 100 pages.
- Number of copies: 4.

990 SPARES AND CONSUMABLES

- Supply the following spares:
  - Deliberately operated devices: 1 of each type.
  - Detectors: 1 of each type.
  - Protective switches: 2 of each type

995 MAINTENANCE

- Servicing and maintenance: Undertake.
  - Duration: Until 12 months after Practical Completion.

## W50 Fire detection and alarm systems

To be read with Preliminaries/General conditions.

**GENERAL**

110 FIRE DETECTION AND ALARM SYSTEMS

- System:
  - Design, installation and commissioning: In accordance with BS 5839-1.
  - Manufacturer approval: BFPSA certified.
  - Type: Automatic analogue addressable.
  - Category: L1.
  - Areas to be protected: Escape routes, rooms onto escape routes, high risk areas such as Server/comms rooms, boiler rooms, plant rooms and switch rooms.
- Detectors:
  - Environment: Normal.
  - Types: Manual call points, Point heat detectors and Point smoke detectors.
- Equipment interconnectivity: Wired.
- Internal alarms:
  - Primary: Electronic sounders.
  - Secondary: Xenon beacons.
- External alarms: To alarm receiving centre (ARC).
- Controls: Main control and indicating equipment.
- Accessories: Automatic door release mechanisms and Remote indicators.

120 CABLING AND CONTAINMENT

- Cable type: Standard.
- Containment: Cable basket, cable tray.
- Rewireable installation: Required.
- Concealed installation: Required.

**SYSTEM PERFORMANCE**

220 PERFORMANCE

- System objectives: Provide early response to fire to enable building occupants to evacuate before the build up of smoke, fire and fumes prevent this.
- Spare system capacity: 10% of installed detection devices and 10% of installed alarm devices.
- Number of devices per zone (maximum): As determined by system manufacturer.

230 SYSTEM CATEGORY L2

- Objectives: Provide early response to fire to enable building occupants to evacuate before the build up of smoke, fire and fumes prevent this.
- Coverage: Escape routes, rooms onto escape routes, high risk areas such as Server/comms rooms, boiler rooms, plant rooms and switch rooms.

250 DETECTION ZONES

- Zoning: Submit proposals.

255 ALARM ZONES

- Alarm zoning: As drawings.
- Mode of operation: Upon receipt of alarm signal building evacuates completely.
- All zone evacuate control: Required.

265 INTEGRATION WITH OTHER ALARM AND SECURITY SYSTEMS

- Standard: To BS 7807.

- Objectives: To fail safe equipment during fire alarm conditions.
- Systems to be integrated: Provide interface for Access Control systems, passenger lift, mechanical control panels, door release units.

266 INTERFACES TO EQUIPMENT

- Interfaces to equipment not forming part of the fire detection and alarm system: Design system to interact with the equipment in the event of a fire or fault signal.
- Equipment and mode of operation: Automatic doors:– Operation under evacuate signal: Doors open.
  Gas solenoid valves:– Operation under evacuate signal: Close.
  HVAC control panels:– Operation under evacuate signal: Close down ventilation systems.
  Lifts:– Operation under evacuate signal: Return to ground floor.
  Magnetic locks:– Operation under evacuate signal: Release.

270 INTERFACE ISOLATION FOR TESTING PURPOSES

- Isolation of systems and equipment: Design system so that the actuation, integration and interfacing can be isolated during fire alarm testing.
- Means of isolation: Single isolate key switch.

280 VISUAL ALARM SIGNALLING

- Objective: Provide visual indictaion in areas of high ambient noise.
- Type: Xenon beacons.

281 ALARM SIGNALLING FOR THE HEARING IMPAIRED

- Type: Xenon beacons.

290 REMOTE SIGNALLING

- Means of signal transmission:
  - Primary: Automatic – via public switched telephone system.
  - Secondary: None..
- Transmission path monitoring: RedCare.
- Signals to be transmitted to ARC: Separately identifiable. Include the following:
  - Pre-alarm.
  - Alarm.
  - Fault.
  - Device isolated.
  - Zone isolated.

**PRODUCTS**

310 DETECTION DEVICES

- Device address setup: Automatic via CIE.
- Removal of devices: With a special tool. Must not affect the operation of alarm equipment.
- Device bases: Maintain circuit continuity when device is removed.

350 POINT HEAT DETECTORS

- Standard: To BS EN 54-5.
- Manufacturer: System manufacturer.
  - Product reference: System manufacturer.
- Classification: A1.
  - Suffix: S.
- Type: Point.

360 POINT SMOKE DETECTORS

- Standard: To BS EN 54-7.
- Manufacturer: System manufacturer.
  - Product reference: System manufacturer.
- Detection method: Optical and ionization.

400 MANUAL CALL POINTS

- Standard: To BS EN 54-11.
- Manufacturer: System manufacturer.
  - Product reference: System manufacturer.
- Operation: Type A.
- Frangible element: Non-resettable.
- Integral red visual indicator: Required.
- Mounting: Semi-recessed.
- Time delay between activation of manual call point and the alarm signal (maximum): 3 s.
- Protective covers: Not required.

420 STANDARD FIRE RESISTING CABLING

- Type: Fire resistant insulated and sheathed armoured cables.
- Sheath and accessory colour: Red.

440 POWER SUPPLY EQUIPMENT

- Standard: To BS EN 54-4.
- Standby source: Rechargeable battery.
  - Time after which sufficient capacity remains to power the fire alarms for at least 30 minutes: 24 h.
- Housing: Remote enclosure.
- Monitoring of power supplies: By the CIE.

450 CONTROL AND INDICATING EQUIPMENT (CIE)

- Standard: To BS EN 54-2.
- Main display: LCD.
- Zone indication to BS 5839-1: Individual LED status indicators.
- Installed capacity: 2 loop.
  - Monitored sounder circuits (minimum): 2.
- Printer: 40 column printer.
- CIE indications: Fault signals from points, Total loss of power supply and Alarm counter.
- CIE controls: Coincidence detection, Delays to the activation of outputs, Disablement of addressable points and Test condition facilities.
- CIE outputs: Output to fire alarm devices and Standardized input and output interface.
- Input device: Alphanumeric keypad.
- Enclosure: System manufacturer's standard.
  - Ingress protection to BS EN 60529: System manufacturer's standard.
  - Finish: Submit proposals.
  - Mounting: Semi-recessed.

470 ZONE DIAGRAMS

- Style: Paper print mounted in a glazed frame.
- Size: A3.
- Layout: Submit proposals.
  - Fire authority: Obtain agreement.

490 SOUNDERS

- Standard: To BS EN 54-3.
- Manufacturer: System manufacturer.

- Product reference: System manufacturer.
- Ingress protection standard: Type A.
- Colour: Red.
- Directional output at 1 m (minimum): 100 dBA.
- Integral beacon: Required.
- Mounting: Semi-recessed.
- Power supply: From loop.

510 XENON BEACONS

- Lamp: Replaceable xenon tube.
- Flash rate: 125/min.
- Lens:
  - Material: Polycarbonate.
  - Colour: Red.
- Enclosure ingress protection to BS EN 60529: IP65.

530 AUTOMATIC DOOR RELEASE MECHANISMS

- Standard: To BS 5839-3.
- Manufacturer: Contractor's choice.
  - Product reference: Contractor's choice.
- Control type: Electromagnetic.
- Mounting type: Wall mounted.
- Operation: Automatic via CIE.
- Power: Separate power supply unit.
- Integral manual release button: Required.

550 SHORT CIRCUIT ISOLATORS

- Manufacturer: System manufacturer.
  - Product reference: System manufacturer.
- Power supply: Loop powered.
- Integral LED status indicator: Required.

**EXECUTION**

620 WORKING IN AREAS PROTECTED BY FIRE DETECTION AND ALARM SYSTEMS

- Minimize false alarms: Inform staff of the presence of automatic fire detectors and of the precautions to be adopted when working.
  - Method: Submit proposals.

650 INSTALLING CONTROL AND INDICATING EQUIPMENT (CIE)

- Location: Main entrance.
- Power supply: Derive from a dedicated circuit from the main switchboard and connect to CIE via unswitched fused connection units.

660 INSTALLING CABLING

- Standard: To BS 7671.
- Cable route: Segregate from other cabling. Where installed in trunking, locate in a dedicated fire cabling compartment.
  - Type: Loop or radial circuits without spurs pr tees
- Mechanical protection: in areas where physical damage may occur.
- Fastening cables:
  - To building fabric: Metal P-clips with red plastic coating.
  - To cable supports: Metal bands with red plastic coating.
- Cables passing through the building fabric: Sleeve.
- Jointing: At equipment terminals.
- Cable terminals: Use ceramic terminal blocks.

- Maximum circuit resistance: Measure before concealment. Submit results.

670 INSTALLING POINT DETECTORS
- Protective cage: Not required.

680 INSTALLING MANUAL CALL POINTS
- Location: Prominent position.
- Mounting height generally (above finished floor level): 1200mm.
- Test key: Locate to allow easy test operation.
- Labelling: Identify the manual call point address.
  - Type: Face engraved rigid plastic laminate.
  - Background: White.
  - Lettering: Red.

700 INSTALLING SOUNDERS
- Circuit wiring: Distribute and interleave multiple sounder circuits around the building.
- Protective cage: Not required.

710 INSTALLING SHORT CIRCUIT ISOLATORS
- Location: Plant rooms and risers.
- Labelling: Identify the associated zones.

720 INSTALLING END OF LINE DEVICES
- Location: Integral within detection device.
- Labelling: Identify the presence of an end of line device, and describe its function.

730 INSTALLING REMOTE INDICATORS
- Concealed detection devices: Install individual LED indicators.

740 INSTALLING INTERFACES TO OTHER EQUIPMENT AND SYSTEMS
- Connection to equipment: Install interconnecting wiring between interface unit and equipment controlled.
- Interface units: Label, describing their function.

750 INSTALLING ALL ZONE EVACUATION CONTROLS
- Location: Separate labelled enclosure mounted next to the main CIE.

**COMPLETION**

910 TESTING AND COMMISSIONING GENERALLY
- System commissioning agent: System manufacturer.
- System verification agent: Contractor.
- Notice before commencing tests (minimum): 2 weeks.

911 SYSTEM INFORMATION
- Device list: Before commissioning submit proposals, including proposed device and zone names.
- Zone diagram: Before commissioning submit proposals.

920 DEVICE IDENTIFICATION AND TESTING
- Device identification: Label devices with a unique address corresponding to that used by the CIE.
- Device testing: Verify the operation of each device. Submit a schedule of devices, including the device test methods and results.

925 CABLE TESTING

- Insulation resistance: Submit results.
- Earth continuity: Submit results.

930 SYSTEM SOAK TESTING

- Soak test: Undertake when construction works are complete, but before handover.
  - Period: 7 days.
  - Re-test after remedial works.

935 STANDBY BATTERY TESTING

- Mains power supply: Isolate.
- Quiescent mode: Measure current supplied by standby source when fire detection and alarm system is operating in the quiescent mode. Submit results.
- Alarm mode: Measure current supplied by standby source when fire detection and alarm system is operating in the alarm mode. Submit results.

940 TESTING ACTUATION, INTEGRATION AND INTERFACING WITH ALARM AND SECURITY SYSTEMS

- Connections with other systems and equipment: Verify and demonstrate operation of the systems and equipment under fire and fault conditions.

945 MEASUREMENT OF SOUND PRESSURE LEVELS

- Sound pressure levels: Measure throughout the building.
- Test instrument:
  - Standard: To BS EN 61672-1.
  - Setting: Slow response, weighting A.
- Doors: Close before measuring sound pressure levels.
- Results: Submit.
  Format: Room schedule with results.

960 CERTIFICATION

- Format: In accordance with BS 5839-1 Annex G.
- Number of copies: Match operation and maintenance manuals.
- Design certificate: Submit.
- Installation certificate: Submit.
- Commissioning certificate: Submit.
- Verification certificate: Submit.

965 DOCUMENTATION

- Operation and maintenance manual: Submit.
- Record drawings: Submit.
- Fire evacuation plan: Submit.
  - Format: Electronic colour CAD layout.

970 LOG BOOKS

- Format: To BS 5839-1 Annex F.
- Number of copies: 1.

980 ACCEPTANCE CERTIFICATE

- Acceptance certificate: Prepare and submit.

990 SPARES AND CONSUMABLES

- Supply the following spares:
  - Frangible elements for manual call points: 10.

Detectors: 1 of each type.
- Printer ink and paper roll: Replace immediately before handover.

995 MAINTENANCE
- Servicing and maintenance: Undertake.
  - Duration: Until 12 months after completion.

## Y60 Conduit & trunking

To be read with Preliminaries, General conditions.

**PRODUCTS**

310 CONDUIT AND TRUNKING GENERALLY
- Standard: To BS 7671.
- Proposals: Submit drawings, technical information, calculations and manufacturer's literature.
- Conduit and trunking sizes not stated: Submit proposals and calculations.

320 RIGID CONDUITGENERALLY
- Standard: To BS EN 50086-2-1.
- Manufacturer: Contractor's choice.
  - Product reference: Contractor's choice.
- Material: Steel.
- Mechanical properties:
  - Resistance to compression: Heavy.
  - Resistance to impact: Heavy.
  - Resistance to bending: Rigid.
  - Tensile strength: Heavy.
  - Suspended load capacity: Medium.
- Temperature range:
  - Lower temperature: +5°C.
  - Upper temperature: 60°C.
- Electrical properties: With electrical continuity properties.
- Ingress protection to BS EN 60529: Applicable.
- Resistance against corrosion: Class 4, galvanized.
- Resistance against flame propagation: Non flame propagating.
- Sizes (OD): 20 mm and 25 mm.

330 PLIABLE CONDUIT GENERALLY
- Standard: To BS EN 50086-2-2.
- Manufacturer: Contractor's choice.
  - Product reference: Contractor's choice.
- Material: uPVC.
- Mechanical properties:
  - Resistance to compression: Heavy.
  - Resistance to impact: Heavy|.
  - Resistance to bending: Pliable.
  - Tensile strength: Heavy.
  - Suspended load capacity: Medium.
- Temperature range:
  - Lower temperature: +5°C.
  - Upper temperature: 60°C.
- Electrical properties: With electrical insulating properties.
- Ingress protection to BS EN 60529 Applicable.
- Resistance against corrosion: Class 4.

- Resistance against flame propagation: Non flame propagating.
- Sizes (OD): 20 mm and 25 mm.
- Other requirements: None.

340 FLEXIBLE CONDUIT Generally

- Standard: To BS EN 50086-2-3.
- Manufacturer: Contractor's choice.
  - Product reference: Submit proposals.
- Material: Steel or uPVC.
- Mechanical properties:
  - Resistance to compression: Heavy.
  - Resistance to impact: Heavy.
  - Resistance to bending: Flexible.
  - Tensile strength: Heavy.
  - Suspended load capacity: Medium.
- Temperature range:
  - Lower temperature: +5°C.
  - Upper temperature: 60°C.
- Electrical properties: With electrical insulating properties.
- Ingress protection to BS EN 60529: Applicable.
- Resistance against corrosion: Class 4.
- Resistance against flame propagation: Non flame propagating.
- Sizes (OD): 20 mm and 25 mm.
- Other requirements: None.

350 BURIED CONDUIT Generally

- Standards: To BS EN 50086-2-4.
- Manufacturer: Contractor's choice.
  - Product reference: Contractor's choice.
- Material: Steel or uPVC.
- Mechanical properties:
  - Resistance to compression: Type 750.
  - Resistance to impact: Normal.
  - Resistance to bending: Rigid.
- Ingress protection to BS EN 60529: Applicable.
- Resistance against chemical attack: With protection.
- Resistance against corrosion: Class 4 or Class 4, galvanized.
- Sizes (OD): 20 mm and 25 mm.
- Other requirements: None.

360 TRUNKING AND DUCTINGGenerally

- Standard: To BS EN 50085.
- Manufacturer Contractor's choice.
  - Product reference: Contractor's choice.
- Material: uPVC.
- Resistance to impact: Heavy.
- Temperature properties:
  Storage and transport temperature (minimum): -5°C.
  - Installation and application temperature (minimum): +5°C.
  - Application temperature (maximum): +60°C.
- Resistance to flame propagation: Non flame propagating.
- Electrical properties: With electrical insulating properties.
- Ingress protection to BS EN 60529: Applicable.
- Resistance against corrosion:

- Internal finish: None.
- External finish: None.

- Sizes: Contractor's choice.
- Access method: With tools.

370 SLOTTED TRUNKING Generally

- Standard: To BS EN 50085-2-3.
- Manufacturer: Contractor's choice.
  - Product reference: Contractor's choice.
- Material: Metal.
- Temperature properties:
  - Storage and transport temperature (minimum): -5°C.
  - Installation and application temperature (minimum): +5°C.
  - Application temperature (maximum): +60°C.
- Resistance to flame propagation: Non flame propagating.
- Electrical properties:
  - Continuity: With electrical continuity properties.
  - Insulating: With electrical insulating properties.
- Resistance against corrosion:
  - Internal finish: Hot dip galvanized.
  - External finish: Hot dip galvanized.
- Sizes: Contractor's choice.
- Access method: Without tools.

380 STEEL SURFACE TRUNKING Generally

- Standard: To BS 4678-1.
- Manufacturer: Contractor's choice.
  - Product reference: Contractor's choice.
- Protection against corrosion: Class 4, galvanized.
- Sizes: Submit proposals.
- Compartments: 1, 2 or 3.
  - Cover Removable.
- Accessories and fittings: Factory made of the same material type and finish as steel surface trunking.
  Types: None.

390 STEEL UNDERFLOOR TRUNKING Generally

- Standard: To BS 4678-2.
- Manufacturer: Contractor's choice.
  - Product reference: Contractor's choice.
- Protection against corrosion Submit proposals.
- Sizes: Submit proposals.
- Compartments: 1, 2 or 3.
- Levelling devices: Screwed.
- Accessories and fittings: Factory made of the same material type and finish as steel underfloor trunking.
  - Types: None.

410 INSULATING TRUNKING Generally

- Standards: To BS 4678-4.
- Manufacturer: Contractor's choice.
  - Product reference Contractor's choice.
- Material: uPVC.
- Colour: White.
- Mechanical classification: Heavy.
- Temperature classification: -5.

- Electrical properties: With electrical insulating properties.
- Ingress protection to BS EN 60529 Applicable.
- Resistance against corrosion: High protection.
- Resistance against flame propagation: Non flame propagating.
- Sizes:
  - Width: Submit proposals.
  - Height: Submit proposals.
- Compartments: 2 or 3.
- Accessories and fittings: Factory made of the same material type and finish as insulated cable trunking.
  - Types: None.

450 PROPRIETARY TRUNKING Generally

- Manufacturer: Contractor's choice.
  - Product reference: Submit proposals.
- Material: Steel or uPVC.
- Finish and colour: Galvanised/white.
- Size: Submit proposals.
- Compartments: 1, 2 or 3.
- Screening: Earthed metal partitions.
- Mounting: Surface.
- Accessories and fittings: Factory made of the same material type and finish as cable trunking.
  - Type: None.
- Other requirements: None.

460 METALLIC CONDUIT FITTINGS

- Standard: To BS 50086-1.
- Manufacturer: Match conduit.
- Material: Malleable iron.
- Conduit boxes: Fit covers of same material and finish as boxes.
- Plugs: Slotted brass.
- Locknuts: Hexagonal malleable iron.

470 INSULATING CONDUIT FITTINGS

- Standard: To BS 50086-1.
- Manufacturer: Match conduit.
- Fittings: Heavy gauge, high impact rigid PVC fittings.
- Conduit boxes: Include brass earthing terminals.

**EXECUTION**

610 INSTALLING CONDUIT AND TRUNKING

- Standard: To BS 7671and in accordance with IEE Guidance note 1.
- Cable trunking: Provide when multiple conduits running in parallel exceed: 3.
- Preparation: Cut square.
  - Burrs and sharp edges: Make smooth.
- Cross-sectional area: Maintain throughout the conduit and trunking length.
- Arrangement: Position vertically and horizontally in line with equipment served, and parallel with building lines.
- Conduit in walls: Avoid concealed horizontal runs.
- Distance from other services running parallel (minimum):
  - Generally: 150 mm.
  - Above radiators: 150mm.
  - Steam services: 300 mm.

- Fire barriers: Provide to maintain integrity of fire compartments.
- Rewireable installations: Enable rewiring from accessible boxes or accessories only.
- Support: Independently fix and support conduit and trunking from building structure.
- Cleaning: Clean insides of conduit and trunking before installing cables.
- Cabling: Install when conduit and trunking enclosure is complete.
- Submittals: Submit manufacturer's technical information and drawings showing the proposed routes of conduit and trunking and the location of service outlets.

620 PROTECTION OF METALLIC CONDUIT AND TRUNKING

- Joints and ends: Remove grease, oil, dirt and rust before applying protective paint. Paint immediately following installation.
- Protective paint: Compatible with conduit and trunking finish.
  - Type: Galvanizing zinc rich paint, 2 coats.

630 INSTALLING CONDUIT GENERALLY

- Fixing: Fix securely. Fix boxes independently of conduit.
- Changes of direction: Conduit boxes or bends site formed by machine. Do not use elbows, tees or inspection bends.
- Joints: Manufacturer's jointing fittings.
  - Number of joints: Minimize.
  - Lengths of conduit: Maximize.
  - Open ends: Plug.
  - At movement joints in structure: Manufactured expansion coupling. Install adaptable boxes on both sides of joint at a maximum distance of 300 mm.
- Connections to boxes, trunking, equipment and accessories: Screwed couplings with rubber bushes at open ends.
- Conduit boxes: Install flush with finished surfaces. Provide extension rings if required.
  - Fixing screws: Countersunk, or round-headed screws.
  - Number of fixings (minimum): For conduit boxes use 2. Larger fittings use 4.
  - Lids: Fasten with brass slot pan head screws.
- Rear outlet boxes: Locate where surface conduits pass through walls to external equipment.
- Draw-in boxes:
  - Spacing (maximum): 10 m.
  - Number of bends between draw-in boxes (maximum): 2.
  - Floors: Do not install draw-in boxes in floors.
- Suspended ceiling installations: Fasten outlet boxes to structure above ceiling.

640 INSTALLING METAL CONDUIT

- Fixings: Distance saddle.
- Joints: Screwed.
- Threaded conduits: Tightly screw to ensure electrical continuity, with no thread showing.
- Conduit connections to boxes and items of equipment, other than those with threaded entries: Earthing coupling with male brass bush and protective conductor.

650 INSTALLING INSULATING RIGID CONDUIT

- Fixings: Distance saddle.
- Joints: Solvent.
- Conduit connections to boxes and items of equipment: Threaded bushed entries.

660 INSTALLING PLIABLE AND FLEXIBLE CONDUIT

- Fixings: Spacer bar saddle or Steel p-clip with PVC insert.
- Joints: Threaded.

- Connections to trunking: Female adaptors and externally screwed brass bushes.
- Connections to equipment: Threaded bush.

670 CONDUIT IN CONCRETE

- Fastening: Fasten conduit securely to reinforcement. Fix boxes to formwork to prevent displacement of boxes.
- Concrete cover to conduit: Same as cover to reinforcement.
- Conduit in structural slabs: Submit drawings showing proposed route and location.

680 CONDUIT CONNECTIONS TO EQUIPMENT

- Surface mounted equipment:
  - Concealed conduit: Conceal the final connection.
  - Exposed conduit: Contain the final connection from the conduit box within flexible metal conduit.
- Equipment subject to vibration: Flexible metal conduit terminating in swivel connectors.
  - Length of conduit: Adequate for removal of equipment for maintenance.
- Connections to external equipment: PVC covered flexible metal conduit.

690 INSTALLING TRUNKING GENERALLY

- Supports: Purpose made brackets or Suspension rods and steel channels.
- Joints: Manufacturer's jointing fittings. Maintain rigidity of trunking across joint.
  - Number of joints: Minimize.
  - Lengths of trunking: Maximize.
  - Open ends: Blank using manufacturer's removable end caps.
  - Metal edging: Protect with PVC edging strip.
  - Electrical continuity: Maintain at each joint with a copper link fitted on the outside of the trunking.
- Connections to conduit, boxes, equipment and accessories: Screwed couplings, adaptors, connectors and glands, with rubber bushes at open ends.
- Connections to trunking covers: Minimize. Submit proposals for lid removal.
- Electrical continuity of covers: Electrically continuous with the trunking or provide protective conductors.
- Access: Provide space around trunking to permit access for installing and maintaining cables. Set out access with covers on a continuous face to allow cabling to be laid in throughout its entire length.
- Trunking passing through building fabric openings: Provide fixed trunking covers. Extend covers 50 mm from both sides of the opening.
- Cable retaining straps: Required except when trunking cover is on top.

710 INSTALLING STEEL UNDERFLOOR TRUNKING

- Levelling devices: Screwed.
  - Levelling: Pack voids below trunking. Adjust height of service outlets and trunking accessories to provide a flush floor finish.
- Rewireable installation: Install underfloor trunking so cabling can be rewired without disrupting the building fabric or finishes. Connect underfloor trunking to an accessible point within the low voltage distribution system.
- Conduit connections: Install at accessible points only.

720 DRAINAGE OF CONDUIT AND TRUNKING

- Drainage outlets: Locate at lowest points in conduit and trunking installed externally, and where condensation may occur.

730 SPARE CONDUIT AND TRUNKING

- Conduit and trunking:
  - Services requiring future wiring: Structured Wiring.

- Draw wires: Required.
- Proposals: Submit.

• Draw wires: Install within spare conduit and trunking.
- Type: Nylon tapes.

740 CONDUIT AND TRUNKING ZONES

• Ceiling voids:
- Clear distance between underside of conduit and trunking and topside of ceiling (minimum): 250 mm.

750 INSTALLING SERVICE OUTLETS GENERALLY

• Setting out: As drawings.
• Complete installation: Clean and stable. Free from bounce and vibration.

760 INSTALLING RAISED ACCESS FLOOR SERVICE OUTLETS

• Position within floor tiles: Offset.
• Cable connections to raised access floor outlets: Use flexible metal conduit.
• Spare compartments: Install blank plates.

770 SUPPORTS AND FIXINGS

• Suspension systems: Proprietary, comprising channel sections with return lips and accessories.
- Finish and colour: Match conduit or trunking as appropriate.
• Supports and fixings: Select to prevent deterioration by electrolytic action.
• Supports and fixings in locations where moisture may occur: Corrosion resistant.

**COMPLETION**

910 CLEANING

• Electrical equipment: Clean immediately before handover.

920 INSPECTION AND TESTING

• Standard: To BS 7671.
• Electrical properties: Measure electrical continuity and insulating properties of conduit and trunking. Submit results.

930 DOCUMENTATION

• Drawings: Submit, showing the location of conduit, trunking and service outlets.
- Dimensions: Include sufficient to locate components accurately.

## Y63 Cable supports

To be read with Preliminaries/ General conditions.

**PRODUCTS**

310 SELECTION OF CABLE SUPPORTS

• Standard: To BS 7671 and in accordance with IEE Guidance note 1.
• Proposals: Submit drawings, technical information, calculations and manufacturer's literature.
• Sizes not stated: Submit proposals and calculations.
• Spare capacity: 20% free width.

320 CABLE BASKETS
FOR FIRE DETECTION AND ALARM SYSTEM WIRING,STRUCTURED WIRING

SYSTEMS
AND FINAL CIRCUIT WIRING.

- Manufacturer: Contractor's choice.
  - Product reference: Contractor's choice.
- Material: Steel wire.
  - Diameter: 3 mm.
- Coating material: Hot dip galvanized.
- Sizes:
  - Width: Submit proposals.
- Side height: 54 mm.
- Features:
  - Segregation: Not required.
  - Protective cover: Not required.

330 CABLE LADDERS FOR SUB-MAIN CABLING

- Standard: To BS EN 61537.
- Manufacturer: Contractor's choice.
  - Product reference: Contractor's choice.
- Material: Steel.
- Resistance against flame propagation: Non flame propagating.
- Electrical properties:
  - Continuity characteristics: With electrical continuity.
- Conductivity characteristics: With electrical conductive system component.
- Coating material: Hot dip galvanized.
- Temperature properties for transport, storage, installation and application:
- Minimum: -5°C.
- Maximum: +60°C.
- Mechanical properties:
  - Cable ladder free base area: Contractor's choice.
  - Resistance to impact: Up to 50 J.
- Width: Contractor's choice.
- Features:
  - Segregation: Not required.
  - Protective cover: Not required.

340 CABLE TRAYS FOR SUB-MAIN CABLING

- Standard: To BS EN 61537.
- Manufacturer: Contractor's choice.
  - Product reference: Contractor's choice.
- Material: Steel.
- Resistance against flame propagation: Non flame propagating.
- Electrical properties:
  - Continuity characteristics: With electrical continuity.
  - Conductivity characteristics: With electrical conductive system component.
- Coating material: Hot dip galvanized.
- Temperature properties for transport, storage, installation and application:
  - Minimum: -5°C.
  - Maximum: 60°C.
- Mechanical properties:
  - Cable tray free base area: Class Z.
  - Resistance to impact: Up to 50 J.
- Width: Contractor's choice.
- Features:
  - Flanged: Return flanged.
  - Segregation: Not required.
  - Protective cover: Not required.

350 CABLE SUPPORT COMPONENTS

- Components generally: Corrosion resistant where moisture may occur.
- Joints and expansion couplers: Use cable support manufacturer's products.

360 PROTECTIVE COVERS

- Type: Flanged.
  - Profile: Flat.

370 CABLE SUPPORT BRACKETS

- Standard: To BS 6946.
- Type: Contractor's choice.
- Finish: Match cable supports.

380 CABLE FASTENINGS

- Use and types:
  - Submain cables<95 mm2: Polyethylene one piece overlapping single fixing clamps.
  - Submain cables >95 mm2: Aluminium two piece twin fixing clamps.
  - Trefoil grouped submain cables: Aluminium trefoil single or twin fixing clamps.
  - Lighting final circuit cabling: Cable ties.
- Manufacturer: Contractor's choice.
  - Product reference: Contractor's choice.

385 CABLE CLEATS

- Type: Polyethylene one piece overlapping single fixing clamps.
- Manufacturer: Contractor's choice.
  - Product reference: Contractor's choice.

390 CABLE TIES

- Type: Wrap around self locking non-releasable.
- Manufacturer: Contractor's choice.
  - Product reference: Contractor's choice.
  - Material: Nylon.

395 CABLE BANDS

- Type: Perforated metal bands.
  - Material: Steel.
  - Protective covering: LSZH.
- Manufacturer: Contractor's choice.
  - Product reference: Contractor's choice.

**EXECUTION**

610 INSTALLING CABLE SUPPORTS

- Standard: To BS 7671and in accordance with IEE Guidance note 1.
- Preparation:
  - Burrs and sharp edges: Make smooth.
  - Cutting: Minimize. Cut square along an unperforated line. Make good edges.
  - Treatment of cut surface: Extend 25 mm beyond the cut. Match finish of cable supports.
- Width: Maintain throughout the cable support length.
- Access: Provide space around cable supports to permit access for installing and maintaining cables.
- Joints and expansion couplers: Locate between the bracket support and the quarter point.

- Number of joints: Minimize.
- Lengths of cable supports: Maximize.
- Ends: Blank with end plates

- Holes in cable supports for the passage of cables: Grommet.
- Fire barriers: Provide where required to maintain fire performance of fabric.
- Support: Independently fix and support from building structure.
  - Clearance from building fabric (minimum): 20 mm.
  - Proposals: Submit.
- Components: Avoid contact between dissimilar metals.
- Routing of cable supports: Submit drawings showing the proposed routes.

620 MULTIPLE CABLE RUNS

- Cable supports: Required when cables running in parallel exceed: 3.

630 INSTALLING CABLE TRAY AND CABLE LADDER

- Changes of size and direction: Manufacturer's accessories of the same material type, pattern, finish and thickness as cable supports.
  - Site-formed bends: Not permitted.
  - Cable bends: Gusseted.

640 INSTALLING CABLE BASKET

- Joints:
  - Cut: Adjacent cross basket wires.
  - Earth conductors: Connect across joints.
- Accessories: Form on site and connect with basket manufacturer's coupling components.

650 INSTALLING PROTECTIVE COVERS

- Location: Cables requiring mechanical protection.

660 CABLE INSTALLATION

- Cabling: Install when cable supports are complete.
- Preparation: Clear cable path of debris.
- Cable pulling: Submit method statement.
- Fastening: Secure cables, do not indent sheaths.
  - Spacing (maximum): 300 mm.

670 INSTALLING CABLE SUPPORTS ON ROOFS

- Location: Elevate above roof.
- Mounting: Load spreading supports.

680 INSTALLING BRACKETS FOR CABLE SUPPORTS

- Suspensions: Threaded rod fixed to channel with shake proof washers and hex nuts.
- Cable supports: Hold down with clamps and spring channel nuts.

690 CABLE SUPPORT ZONES

- Ceiling voids:
  - Clear distance between underside of cable supports and brackets and topside of ceiling (minimum): 250 mm.

**COMPLETION**

910 INSPECTION AND TESTING

- Standard: To BS 7671.
- Electrical properties: Measure electrical continuity and insulating properties of

cable supports. Submit results.

## Y65 Electrical accessories

To be read with Preliminaries/ General conditions.

**PRODUCTS**

310 PRODUCTS GENERALLY

- Standard: To BS 5733.
  - Switches: To BS EN 60669-1.

320 ELECTRICAL ACCESSORIES GENERALLY

- Manufacturer: MK.
  - Product reference: Contractor's choice.
- Plate:
  - Material: Plastics.
  - Finish: White.
  - Insert colour: Match plate finish.
- Mounting: Recessed.
- Earthing terminal: Required. Cable termination:
  - Method: Screw.
  - Arrangement: In line.

330 SURFACE AND CONCEALED WIRING ENCLOSURES

- Standard: To BS 4662.
- Enclosure:
  - Material: Pressed steel.
  - Finish: Galvanized.
- Enclosure depth (minimum): 25 mm.

340 LIGHT SWITCHES GENERALLY.

- Application: Internal.
- Ingress protection to BS EN 60529: IP 44.
- Rating: 15 A.
- Actuating method: Extra wide rocker bar.
- Mounting: Grid.
- Poles: Single pole.

360 FUSED CONNECTION UNITS GENERALLY

- Standard: To BS 1363-4.
- Control: Switched.
- Indicator lamp: Not required.
- Fuse carrier access: Screw.
- Poles: Double pole.
- Flex outlet: Base entry.

370 CABLE OUTLETS

- Outlet: Centre cable aperture.

380 STANDARD SOCKET OUTLETS GENERALLY

- Standard: To BS 1363-2.
- Type: Twin.
- Control: Switched.
  Indicator lamp: Not required.
- Accessories: Dual earth terminals.

390 SWITCHED SOCKET OUTLETS

- Switch position: Inboard.

400 INDUSTRIAL SOCKET OUTLETS GENERALLY

- Standards: To BS EN 60309-1 and BS EN 60309-2.
- Material: Polycarbonate.
- Voltage rating: 380–415 V.
- Current rating: 32 A.
- Ingress protection to BS EN 60529: IP 67.
- Pin configuration: 3 pole, neutral and earth.
- Mounting: Surface angle mount.
- Controls: Integral switch with interlock.

420 FAN ISOLATORS

- Standard: To BS EN 60947-3.
- Rating: 10 A.

430 ROUND PIN SOCKET OUTLETS

- Standard: To BS 546.

460 DOUBLE POLE SWITCHES

- Rating: 45 A.
- Indicator lamp: Not required.

470 COOKER CONTROL UNITS

- Standard: To BS 4177.
- Supply to cooker: 45 A.
- Switched socket outlet: Not required.
- Indicator lamp: Not required.

480 COOKER CONNECTION UNITS

- Individual terminal block capacity (minimum): 10 mm² stranded cable.

490 CEILING POWER SWITCHES

- Rating: 50 A.
- Poles: Double pole.
- Neon indicator: Required.
- Flag indicator: Mechanical on/ off indication.

500 CEILING LIGHT SWITCHES

- Standard: To BS EN 61058-2-1.
- Rating: 10 A.
- Configuration: One way.

**EXECUTION**

610 INSTALLING ELECTRICAL ACCESSORIES

- Standard: To BS 7671.

620 ARRANGEMENT

- Location: Coordinate with other wall or ceiling mounted equipment. Submit proposals.
- Positioning: Accurate and square to vertical and horizontal axes.
- Alignment: Align adjacent accessories on the same vertical or horizontal axis.
- Fixing: Secure, plumb and level.
- Mounting heights (finished floor level to underside of accessory):

- Light switches: 1200 mm.
- Single voltage shaver outlets: 1200 mm.
- Shaver supply units: 1200 mm.
- Socket outlets: 450 mm.
- Fan isolators: Adjacent fan.
- Cooker control units: 200 mm above worktop.
- Cooker connection units: 600 mm AFFL.

• Adjacent accessories: Separation distance (minimum): 30 mm.

630 GRID SWITCH PLATES

• Spare modules: Provide blank inserts.

640 INSTALLING LIGHT SWITCHES

• Multigang switches: Connect so that there is a logical relationship with luminaire positions.
  - Unused switch spaces: Fit with blanks.
  - Segregation: Internally segregate each phase with phase barriers. Include warning plates.

**COMPLETION**

910 FINAL FIX

• Accessory faceplates: Fit after completion of building painting.

920 SPARES

• Plugs (minimum): Supply 2 spare plugs for each socket outlet type.

# Appendix

## 1.0

Pricing Document

BUILDING SERVICES WORKS – ELECTRICAL SERVICES

**PROJECT:** Elms Bank Specialist College, Hydrotherapy Pool

**JOB NUMBER:** **180132**

THIS SHEET MUST BE COMPLETED IN FULL AND RETURNED WITH TENDER

The Contractor shall complete in the space below, the costs associated with the design, supply, delivery, installation, testing and commissioning of the following elements:-

| | **ELECTRICAL SERVICES** | |
|---|---|---|
| | | |
| **1.0** | **Preliminaries** | £ |
| | | |
| **2.0** | **Design and Drawing Production** | |
| 2.1 | Production of Working or Installation Drawings. | £ |
| 2.2 | Production of Builders Work drawings | £ |
| 2.3 | Production of Coordinated Drawings | £ |
| 2.4 | Strip Out works | £ |
| 2.5 | Contractor Design Elements | £ |
| | | |
| **3.0** | **Distribution** | |
| 3.1 | Works associated with electrical supplies from the main L.V. Switch panel to remote distribution board include MCCB | £ |
| 3.2 | Low Voltage Distribution Board | £ |
| | | |
| **4.0** | **Containment** | |
| 4.1 | Containment for Mains and ELV Cabling | £ |
| 4.2 | Structured wiring containment | £ |
| 4.3 | Fire detection and alarm wiring containment | £ |
| | | |
| **5.0** | **General Lighting/ Emergency Lighting Installation & Controls** | |
| 5.1 | Supply of Mains Luminaires | £ |
| 5.2 | Installation of Mains Luminaires | £ |
| 5.3 | Provision of Lighting Controls | £ |
| 5.4 | Installation of Lighting Controls | £ |
| 5.5 | Supply Emergency Lighting Luminaires | £ |
| 5.6 | Installation of Emergency Lighting Luminaires | £ |
| | | |
| **6.0** | **Intruder Alarm System** | |
| 6.1 | Design, Supply & Install | £ |
| | | |
| **7.0** | **PA (Public Address) VA (Voice Alarm) System** | |
| 7.1 | Design, Supply & Install | £ |
| | | |

| | | |
|---|---|---|
| **8.0** | **External and Amenity Lighting** | |
| 8.1 | Supply of External and Amenity Luminaires | £ |
| 8.2 | Installation of External and Amenity Luminaires | £ |

| | | |
|---|---|---|
| **9.0** | **General Small Power Installations** | |
| 9.1 | General small power including hand dryers | £ |
| | | |
| **10.0** | **Fire Safety Installations** | |
| 12.1 | Design, Supply and Installation of Fire Alarm System | £ |
| | | |
| **10.0** | **Access Control System** | |
| 10.1 | Design, Supply and installation | £ |
| | | |
| **11.0** | **CCTV** | |
| 10.1 | Design, Supply and Installation | £ |
| | | |
| **12.0** | **Structured Wiring system** | |
| 12.1 | Design and Installation only of the structured wiring system | £ |
| | | |
| **13.0** | **Disabled Toilet Alarm Systems** | |
| 13.1 | Design, Supply and installation | £ |
| | | |
| **14.0** | **Lightning Protection System** | |
| 14.1 | Design, Supply and installation | £ |
| | | |
| **15.0** | **Electrical Works for Mechanical Services** | |
| 15.1 | Containment for mechanical services wiring | £ |
| 15.2 | Electrical supplies to mechanical services plant | £ |
| | | |
| **16.0** | **Earthing Systems** | |
| 16.1 | Design and installation of Earthing and Bonding | £ |
| | | |
| **17.0** | **Testing and Commissioning** | |
| 17.1 | Testing and Commissioning – Low Voltage Electrical Installations | £ |
| 17.2 | Testing and Commissioning – Lighting & Emergency Lighting & Controls | £ |
| 17.3 | Testing and Commissioning – Intruder Alarm | £ |
| 17.4 | Testing and Commissioning – PA Installation | £ |
| 17.5 | Testing and Commissioning – External Lighting | £ |
| 17.6 | Testing and Commissioning – Small Power Installation | £ |
| 17.7 | Testing and Commissioning – Fire safety Systems | £ |
| 17.8 | Testing and Commissioning – Access Control System | £ |
| 17.9 | Testing and Commissioning – CCTV | £ |
| 17.10 | Testing and Commissioning – Structured Cabling System | £ |
| 17.11 | Testing and Commissioning – Disabled Toilet Alarm | £ |
| 17.12 | Testing and Commissioning – Lightning Protection | £ |
| 17.13 | Testing and Commissioning – Earthing & Bonding | £ |
| | | |
| **18.0** | **Record Drawings, Client Instruction, Operating and Maintenance Manuals and Log Book** | £ |
| | | |
| **19.0** | **Provision Of Maintenance and Spares during 12 months defect period** | |
| 19.1 | Lighting & Emergency Lighting & Controls | £ |
| 19.2 | Intruder Alarm | £ |
| 19.3 | PA Installation | £ |
| 19.4 | Fire safety Systems | £ |
| 19.5 | Access Control System | £ |
| 19.6 | Disabled Toilet Alarm | £ |
| | | |
| | | |
| **20.0** | **Information and Management Items** | |
| 20.1 | Post completion Support / Project De-Brief | £ |
| 20.2 | Electric Shock Notices | £ |
| 20.3 | Rubber Mats | £ |
| 20.4 | Building Log Book | £ |

| | | |
|---|---|---|
| 20.5 | Instructions and training to Staff | £ |
| | | |
| **21.0** | **Provisional Sums (add details)** | |
| 21.1 | Any unforeseen works | £ 5,000 |
| | | |
| | | |
| **22.0** | **Any Other Items not Mentioned Above (please identify)** | |
| 22.1 | | £ |
| 22.2 | | £ |
| | | |
| | | |
| **23.0** | **Sub-total Electrical Services Tender Sum -** | **£** |

# 2.0

## Distribution Board Schedules

# 3.0

## Hydrotherapy Pool Installation Details

# DISTRIBUTION BOARD SCHEDULE

| DISTRIBUTION BOARD REF | DB1 |
|---|---|

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| PROJECT REF/TITLE | Hydrotherapy Pool & Changing Facilities | | | SHEET | 1 | OF | 1 | ISSUE N°. | 01 |
| DIST^N BD LOCATION | Pool Equipment Store | | | 18 | | WAY TP&N TYPE B * | | 125 | AMP |
| FUNCTION | Lighting & Power | | | N° OF PHASES | 3 | NOMINAL VOLTAGE | | 400 | V |
| DIST^N BD SUPPLIED FROM | Main Swichgear | | | $Z_S$ | | Ω | $I_{PSCC}$ | | KA |
| SUPPLY CABLE | 6 | | | ASSOCIATED RCD (IF ANY) | | RATING | | | A |
| OVERCURRENT PROTECTIVE DEVICE FOR DIST^N BOARD | TYPE BS (EN) | 60947-2 | RATING (A) 125 | RCD N° OF POLES | | IΔn | | | mA |

CIRCUIT DETAILS - * The Installer shall make allowance for a minimum of 25% spare ways to be available upon completion of the works.

DIST^N BD SWITCH DISCONNECTOR RATING (A): 125

| CIRCUIT NUMBER & PHASE | | CIRCUIT DESIGNATION/LOCATION | CABLE/INSTALLATION DETAILS: CIRCUIT TYPE | TYPE OF WIRING (PHASE) | N°. OF CORES IN MULTICORE CABLE | CIRCUIT CONDUCTOR CSA: PHASE (MM²) | CIRCUIT CONDUCTOR CSA: CPC (MM²) | CPC TYPE | OVERCURRENT PROTECTIVE DEVICE: SHORT CIRCUIT CAPACITY (KA) 10 — BS (EN) | TYPE | RATING $I_n$ A | RCD/RCBO OPERATING CURRENT IΔn mA | BS 7671 REG 543.7 COMPLIANT (HIGH INTEGRITY EARTHING) | CIRCUIT DESIGN LENGTH [#] M |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | L1 | LCMs - Staff Change areas + Corridor + Lobby | LTG | C | - | 1.5 | 1.5 | X | 61009 | C | 10 | 30 | | |
| | L2 | Pool Lighting + Store Cct 1 - Hardwired | LTG | C | - | 1.5 | 1.5 | X | 61009 | C | 10 | 30 | | |
| | L3 | LCMs - Laundry + Office + Entrance + Dis. WC | LTG | C | - | 1.5 | 1.5 | X | 61009 | C | 10 | 30 | | |
| 2 | L1 | LCMs - Wet Change 1 + Wet Change 2 | LTG | C | - | 1.5 | 1.5 | X | 61009 | C | 10 | 30 | | |
| | L2 | Pool Lighting Cct 2 - Hardwired | LTG | C | - | 1.5 | 1.5 | X | 61009 | C | 10 | 30 | | |
| | L3 | LCMs - Dry Change 1 + Dry Change 2 + Plant Room | LTG | C | - | 1.5 | 1.5 | X | 61009 | C | 10 | 30 | | |
| 3 | L1 | LCM - Corridor | LTG | C | - | 1.5 | 1.5 | X | 61009 | C | 10 | 30 | | |
| | L2 | Pool Plant Areas - Hardwired | LTG | C | - | 1.5 | 1.5 | X | 61009 | C | 10 | 30 | | |
| | L3 | External Wall Lights (inc. timer) | LTG | C | - | 1.5 | 1.5 | X | 61009 | C | 10 | 30 | | |
| 4 | L1 | Spare | | | | | | | | | | | | |
| | L2 | Spare | | | | | | | | | | | | |
| | L3 | Spare | | | | | | | | | | | | |
| 5 | L1 | Spare | | | | | | | | | | | | |
| | L2 | Spare | | | | | | | | | | | | |
| | L3 | Spare | | | | | | | | | | | | |
| 6 | L1 | Fused connection unit - Disabled WC Alarm (staff change) | RAD | C | - | 2.5 | 2.5 | X | 60898 | B | 20 | | | |
| | L2 | Pool sockets | RNG | C | - | 2.5 | 2.5 | X | 61009 | B | 32 | 30 | | |
| | L3 | Access Control Panel | RAD | C | - | 2.5 | 2.5 | X | 60898 | B | 20 | | | |
| 7 | L1 | Fused connection unit - Disabled WC Alarm (Wet change) | RAD | C | - | 2.5 | 2.5 | X | 60898 | B | 20 | | | |
| | L2 | Fused connection unit - Door Access Controls | RAD | C | - | 2.5 | 2.5 | X | 60898 | B | 20 | | | |
| | L3 | Dado sockets (Office) + Laundry Ring Main | RNG | C | - | 2.5 | 2.5 | X | 61009 | B | 32 | 30 | | |
| 8 | L1 | Fused connection unit - Disabled WC Hand dryers (Wet change) | RAD | C | - | 2.5 | 2.5 | X | 60898 | B | 20 | | | |
| | L2 | Fused connection unit - HL Blinds (Pool) | RAD | C | - | 2.5 | 2.5 | X | 60898 | B | 20 | | | |
| | L3 | Fused connection unit - Door Access Control Panel | RAD | C | - | 2.5 | 2.5 | X | 60898 | B | 20 | | | |

| CPC TYPE | | | | | |
|---|---|---|---|---|---|
| W | Conduit/Trunking | X | Integral Core of Cable | | |
| Y | Armour/Sheath via Earth Tail Connection | Z | Separate Cu/LSF Cable | | |

BS(EN) Numbers: a) 60898 - MCB b) 61009 - RCBO c) 60947-2 - MCCB d ) BS 88 - HRC Fuselinks e) 61008 - RCD f) BS1361- HRC Fuselinks g) BS3036 - Rewireable Fuse

TYPE OF WIRING (PHASE)

| A | B | C | D | E | F | G | O (Other) |
|---|---|---|---|---|---|---|---|
| Cu/XLPE/LSF Twin and Earth Cables | Cu/PVC/PVC Twin and Earth Cables | Cu/LSF Singles in Metallic Trunking /Conduit | Cu/LSF Singles in Non-Metallic Trunking /Conduit | Cu/PVC/ SWA/ PVC Multicore Cables | Cu/XLPE/ SWA/ LSF Multicore Cables | FP200 Fire Rated Multicore Cables | |

| CIRCUIT TYPES | |
|---|---|
| LTG | Lighting Circuit |
| RAD | Radial Circuit |
| RNG | Ring Main Circuit |

Date of Print : February 21, 2018

UNLESS OTHERWISE DENOTED ALL DISTRIBUTION BOARDS SHALL INCLUDE AN INTEGRAL TP&SN SWITCH DISCONNECTOR.

# RING MAIN CIRCUIT LENGTHS ARE DENOTED AS THE OVERALL LOOP LENGTH.

# DISTRIBUTION BOARD SCHEDULE (Continued)

| DISTRIBUTION BOARD REF | DB1 |
|---|---|

| PROJECT REF/TITLE | Hydrotherapy Pool & Changing Facilities | SHEET | 2 | OF | 3 | ISSUE N°. | E |
|---|---|---|---|---|---|---|---|

| CIRCUIT NUMBER & PHASE | | CIRCUIT DESIGNATION/LOCATION | CABLE/INSTALLATION DETAILS | | | | | | OVERCURRENT PROTECTIVE DEVICE | | | RCD/RCBO OPERATING CURRENT IΔn | BS 7671 REG 543.7 COMPLIANT (HIGH INTEGRITY EARTHING) | CIRCUIT DESIGN LENGTH [#] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | CIRCUIT TYPE | TYPE OF WIRING (PHASE) | N°. OF CORES IN MULTICORE CABLE | CIRCUIT CONDUCTOR CSA | | CPC TYPE | SHORT CIRCUIT CAPACITY (KA) | | 10 | | | |
| | | | | | | PHASE ( MM²) | CPC (MM²) | | BS (EN) | TYPE | RATING $I_n$ A | mA | | M |
| 9 | L1 | Fused connection unit - Door Access Controls (Wet change) | RAD | C | - | 2.5 | 2.5 | X | 60898 | B | 20 | | | |
| | L2 | Fused connection unit -Extractor Fans (Chemical Stores) | RAD | C | - | 2.5 | 2.5 | X | 60898 | B | 20 | | | |
| | L3 | Fused connection unit -Disabled WC Alarm (Dry Change) | RAD | C | - | 2.5 | 2.5 | X | 60898 | B | 20 | | | |
| 10 | L1 | 20A Isolator - Air Handling Unit - Wet change | RAD | C | - | 2.5 | 2.5 | X | 60898 | B | 20 | | | |
| | L2 | Fused connection unit -Sump Pump (Pool Plant Room) | RAD | G | - | 2.5 | 2.5 | X | 60898 | B | 20 | | | |
| | L3 | Spare | | | | | | | | | | | | |
| 11 | L1 | Fused connection unit - Fan convector units (Wet change) | RAD | C | - | 2.5 | 2.5 | X | 60898 | B | 20 | | | |
| | L2 | 20A Isolator - Air Handling Unit - Wet change | RAD | C | - | 2.5 | 2.5 | X | 60898 | B | 20 | | | |
| | L3 | Fused connection unit - Fan convector units (Dry change) | RAD | C | - | 2.5 | 2.5 | X | 60898 | B | 20 | | | |
| 12 | L1 | Cleaners Sockets | RNG | C | - | 2.5 | 2.5 | X | 61009 | B | 32 | 30 | | |
| | L2 | Spare | | | | | | | | | | | | |
| | L3 | 63A Isolator - Mechanical Control Panel | RAD | F | - | 25.0 | 16.0 | X | 60898 | B | 63 | | | |
| 13 | L1 | - | | | | | | | | | | | | |
| | L2 | 32A TPN Isolator - Pool Control Panel | RAD | F | - | 16.0 | 10.0 | X | 60898 | B | 32 | | | |
| | L3 | - | | | | | | | | | | | | |
| 14 | L1 | | | | | | | | | | | | | |
| | L2 | | | | | | | | | | | | | |
| | L3 | | | | | | | | | | | | | |
| 15 | L1 | | | | | | | | | | | | | |
| | L2 | | | | | | | | | | | | | |
| | L3 | | | | | | | | | | | | | |
| 16 | L1 | | | | | | | | | | | | | |
| | L2 | | | | | | | | | | | | | |
| | L3 | | | | | | | | | | | | | |
| 17 | L1 | | | | | | | | | | | | | |
| | L2 | | | | | | | | | | | | | |
| | L3 | | | | | | | | | | | | | |
| 18 | L1 | | | | | | | | | | | | | |
| | L2 | | | | | | | | | | | | | |
| | L3 | | | | | | | | | | | | | |

| CPC TYPE | | | | | |
|---|---|---|---|---|---|
| W | Conduit/Trunking | X | Integral Core of Cable | | |
| Y | Armour/Sheath via Earth Tail Connection | Z | Separate Cu/LSF Cable | | |

BS(EN) Numbers: a) 60898 - MCB b) 61009 - RCBO
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f) BS1361- HRC Fuselinks g) BS3036 - Rewireable Fuse

TYPE OF WIRING (PHASE)

| A | B | C | D | E | F | G | O (Other) |
|---|---|---|---|---|---|---|---|
| Cu/XLPE/LSF Twin and Earth Cables | Cu/PVC/PVC Twin and Earth Cables | Cu/LSF Singles in Metallic Trunking /Conduit | Cu/LSF Singles in Non-Metallic Trunking /Conduit | Cu/PVC/ SWA/ PVC Multicore Cables | Cu/XLPE/ SWA/ LSF Multicore Cables | FP Gold Fire Rated Multicore Cables | |

| CIRCUIT TYPES | |
|---|---|
| LTG | Lighting Circuit |
| RAD | Radial Circuit |
| RNG | Ring Main Circuit |

Date of Print : February 21, 2018

UNLESS OTHERWISE DENOTED ALL DISTRIBUTION BOARDS SHALL INCLUDE AN INTEGRAL TP&SN SWITCH DISCONNECTOR.

# RING MAIN CIRCUIT LENGTHS ARE DENOTED AS THE OVERALL LOOP LENGTH.

BARR + WRAY

**Pools Filtration**

**Technical Details**

Technical Proposal

B+W Reference – SLP2012-101

29/01/18

# SLP2012

# Swimming Pool and Spa Pool

# Elms Bank High School

# Table of Contents

# 1. Introduction

## 1.1. Consultants Design Reference Drawings & Documents

The following documents outline the overall system design and supplement the Consultant technical specification:

**SLP1738 - Document Register**

SLP2012.00.01 – Overall Plan and Sections
SLP2012-01.01 – Heating Control Schematic
SLP2012-01.02 – Filtration Schematic
SLP2012-20.01 - Typical Myrtha Pool Details
SLP2012-20.02 – Typical Balance Tank Installation Detail
SLP2012-21.01 – Mechanical Service Notes

SLP2012-004 – Electrical Charactersitics

## 2. Treated Water Systems

This specification covers the following systems:

### 2.1. System Name

System 1 - Hydrotherapy Pool

## 3. Pool Contractors Drawing and Documentation Requirements

All design & development planning is undertaken separately within the **Pool Sub-Contractor** Management System. Upon award of the tender the **Pool Sub Contractor** will supply the Design team with a full set of shop drawings for “Approval” both for the mechanical and electrical installation of the filtration systems. After comments have been received the **Pool Sub Contractor** will issue a full set for “Construction” drawings. The required number of drawing & Document sets will be set by the Design Team

**Pool Sub Contractor** will supply Technical Specification & Material Specification & Samples as deemed necessary for approval as part of the tender package.

**Pool Sub Contractor** will supply a full list of Pipe Test certificates showing pipe tested to 2bar for 1 Hour minimum. For buried pipework all pipes tested after pipe installation before backfilling of pipe trench immediately after backfilling. A third test may be required if deemed necessary by design team. One test required in Plant room pipework after installation

**Pool Sub Contractor** will supply a full list of Method Statements, Risk Assessments Material Safety Data sheets, COSHH sheets

**Pool Sub Contractor** will supply on completion of the project an Operating Manual, Commissioning Handover Certificates & “As Fitted” Drawings giving full details of the systems and the service requirements of the equipment. No. of sets required will be set by the Design Team.

## 4. Purpose

The primary purpose of the Consultant Specification is to collate information acquired from various sources such that product requirements are clearly defined. The specification + drawings provide the minimum requirements of the design.

Inputs include, for example, the Client's brief, Consultant's notes, enquiry/tender/performance specifications, project drawings, design and development review and the results of meetings and correspondence.

The pool water treatment sub-contractor must comply with this design specification.

It defines the system content, design capability and relevant detail of each significant item of plant and is therefore the ultimate reference for equipment set-up and performance validation.

The final version is to be incorporated in the pool water contractor's user Operating Manual as the official record of **Pool Sub Contractor** scope of supply.

# 5. Design

## 5.1. Responsibility

**Pool Sub Contractor** is responsible for the final design + installation of this system. Interpretation of inputs and for preparation and communication of the detailed design outputs that ensure system performance matches customer expectations. All as per the contract terms + conditions.

## 5.2. Standards

The system(s) is designed to achieve satisfactory water quality in terms of recognised comfort, appearance, chemical and microbiological parameters, this being conditional on continuous operation of the treatment plant and equipment in accordance with the instructions given in the user Operating Manual issued by the **Pool Sub Contractor** Design values and equipment selection are made through specific reference to the minimum standards put forward in the **Pool Water Treatment Advisory Group (PWTAG)** publication, PAS 39, EN 13451 as well as other such standards, codes of practice and relevant guidance tempered by subjective judgement based on substantial experience. System performance is to be validated at commissioning when the adjustments needed to achieve the desired water quality are made and the resultant settings recorded.

## 5.3. Pipework

All pool circulating and plant room pipework is to be manufactured from Unplasticized Polyvinyl Chloride (uPVC) material (9bar Minimum) The fittings are to be of the solvent weld type and at connecting points to valves and equipment galvanised mild steel backing rings are to be supplied. Pipework fixing to be fitted using Galvanised unirax frame and pipe clamp supports.

Pipework is to be sized on the following water velocities:

| | |
|---|---|
| Suction Pipework: | 1.5 m/s |
| Discharge Pipe: | 2 – 2.5m/s |
| Supplier | IPS Equal or approved |

## 5.4. Pool Fittings

Inlet and outlet fittings must be 316L St St. For Number and sizes see pool drawings. They must achieve efficient distribution of water in each of the pools under all operating conditions and must take into account the following velocities:

| | |
|---|---|
| Inlets: | 1.0 – 2m/s |
| Outlets: | 0.5m/s |
| Supplier | Certikin/Fluidra Equal or approved |

## 5.5. Pool Handrails

316L Stainless Steel handrail required. Design TBC

## 6. Swimming Pool – Filtration & Water Treatment Plant

| | |
|---|---|
| **Pool Details** | Dimensions: 8. x 5m<br>Depth: 1.2m<br>Volume: 48 $m^3$<br>Pool Temperature: 35<br>Level deck type with Automatic Top Up<br><br>Inlets: 6no. DN 50 wall inlet<br><br>Outlets: 2no.Grille & frame 550 x 350 mm<br><br>*Pool attractions have not been identified. Any attractions that may be added will require additional plant not detailed in this specification.* |
| **Plant Details** | Turnover: 1.5 hours<br>Plant Flow: 32 $m^3$/hr<br>Bather Load : 18 |
| **Plant Type** | Vertical pressure, medium rate sand filtration with the treatment of the water being achieved using the dual disinfection process incorporating UV and Calcium Hypochlorite with pH correction by means of Acid solution addition. |
| **Vessels** | No. and Size: 1 x 1.4m diameter<br>Type: Medium Rate<br>Material: GRP<br>Backwash: 38.5m3/h<br>Model: Astral - equal or approved |
| **Main Circulating Pumps** | No. Off: 2 x 100% - Duty/ Standby<br>Model: NB50-200/213<br>Power: 3.3 kw, 3Phase, 50hz<br>Model: Grundfos - equal or approved |
| **Instrumentation** | **Compound Gauge (Suction Header)**<br><br>Qty: 1<br>Type: 100 mm dia. st st, Bourdon type, glycerine filled<br>Range: -10 to +10 m $H_2O$<br><br>**Temperature Gauge (Suction Header)**<br><br>Qty: 1<br>Type: 100 mm diameter, bimetal with G ½" st st pocket<br>Range: -20 to +60°C<br><br>**Pressure Gauge (Pump Discharge)**<br><br>Qty: 1<br>Type: 100 mm diameter, Bourdon type, glycerine filled<br>Range: 0 to +40 m $H_2O$ |

| | |
|---|---|
| **Flow Meter** | Qty: 1<br>Type: Averaging pitot tube with 150 mm diameter dp gauge assembly for DN 80 pipe<br>Max calibrated flow: 70 $m^3/h$<br>Gauge mounting: Wall adjacent to pipework |
| **Primary Disinfection** | UV: WF-115-3<br>Power: 0.75kw, 3Phase, 50hz<br>Supplier: ATG equal or approved<br><br>Complete with Inline Strainer on UV outlet.<br><br>Qty: 1<br>Type: In-line conical top-hat strainer<br>Materials: Stainless steel<br>Size: DN 80<br>Mesh Size: 20 mesh (0.9 mm)<br>Mounting: In horizontal discharge piping |
| **Calcium Hypochlorite System** | A chemical disinfection system to provide breakpoint chlorination is required as follows:<br><br>Qty: 1<br>Manufacturer: Gaffey Technical Services<br>Pellet-Pro PP10E-15/15<br>for use with Hypro-70 or HTH Easiflo tablets<br>Hopper capacity: 10 kg<br>Dosing solution strength: 0.5 – 1.0 % w/w $Cl_2$ |
| **C02 Ph Regulator** | A complete liquid $CO_2$ system, is required.<br>The system comprises:<br>Qty: 1 x 100% duty<br>Type: AC/1 Swimming Pool pH Control System<br>Manufacturer: Messer UK or similar<br>Output Range: 0.6 - 5.0 litres per minute |
| **Pool Heating** | A by-pass plate heat exchanger, booster pump, piping and valves are provided. The primary control equipment is provided by others.<br><br>**Heating:**<br><br>Duty: 28kW<br>Inlet Temperature ℃ – 80.0 / 60.0 TBC by MEP Contractor<br><br>NOTE: Above sizes are subject to confirmation at tender addendum |
| **Pool Heating Booster Pump** | Duty: 3.2$m^3$/Hr @ 100% duty<br>Pump Model: NB 32-160.1/137 @ 5MTH<br>Power: 0.25kW / 3 Phase<br>Model: Grundfos/ Lowara/ Waterco - equal or approved |

| | |
|---|---|
| **Pool Attractions** | Five body massage jets are supplied in the wall of the pool.<br>The features are activated by a locally mounted colour-change illuminated switch, and is supplied complete with pump and all necessary interconnecting piping, fittings and valves<br><br>Pump:<br>Qty: 1<br>Maker: Grundfos or Equally Approved<br>Model: NB32-125/106<br>Duty range: 13m$^3$/h @ 12 mTH<br>Motor size: 1.1kw<br>Connections: DN50 Suction DN32 Discharge |
| **Level Control** | The balance tank is provided with a sight glass located within the plant-room.<br><br>Water levels are detected by adjustable sensors located alongside the sight-glass and make-up operation is enabled by switching-relays mounted in the electrical control panel.<br><br>QTY: 3<br>Sensor Type: Proximity, capacitive<br>Maker: Omron<br>Model: E2K, NC, complete with mounting brackets |
| **CWS Make-Up** | Evaporation loss, filter backwashing and bather drag-out is automatically replenished by fresh water introduced to the balance tank through a solenoid actuated make-up valve.<br><br>The make-up valve pre-assembly, incorporating strainer, by-pass and isolating ball valves, is wall-mounting in the plant-room and the piping between the MUV and the balance tank is provided.<br><br>Qty: 1<br>Type: Burkett 0290 230V/50Hz, 2/2-way NC solenoid valve, servo assisted, coupled diaphragm/armature assembly<br>Item No: 045293<br>Size: G 1" – 10.0 m$^3$/h (Kv)<br>Materials: Brass body, NBR seals<br>Approvals: WRAS<br>Pressure: 6 bar max |
| **Under Water Lighting** | 8no. Underwater LED Light with ABS faceplate to be provided by pool sub-contractor.<br><br>Qty: 8<br>Type: PAR 56 Multicolour LED Light with ABS faceplate<br>Manufacturer: Astral or Equal & Approved<br>Model: 37159 |

| | |
|---|---|
| **Electrical Control Equipment** | Type: Wall mounted / Free standing<br>Manufacturing: Factory built, prewired and assembled to BS 5486 Part1 |
| **Wiring** | Pool contractor is responsible for supply of control panel and all outgoing wiring with local isolators. Main contractor is responsible for the supply of mains power into plant room control panel. All main Filtration and features to be interlocked with the Circulating Pumps |
| **Pool Cover** | A roller-type heat retention cover is supplied and fitted by Pool Sub-Contractor at the location indicated on drawings. Wall mounting-plates and a suitably rated, RCD protected, local electrical supply terminating in a lockable isolator in the position and details given on the assembly drawing, to be provided by the Build Contractor.<br><br>Qty: 1<br>Type: Wall mounted, radio control-motorised<br>Maker: Forge Leisure<br>Pool cover construction: Light blue UV stabilised PE coated fabric laminated to 5 mm PE foam with an underside PE embossed laminate complete with spool tapes, tow ropes and lanyards<br>Storage spool/roller: 316 st st<br>Mounting brackets: Galvanised steel with white GRP housing covers<br>Complete with: Control box incorporating contactor, overload protection and isolator |
| **Electrical Supply** | Total Connected Load: See Electrical Characteristics Sheets SLP2012-004 |

## 7. Plant room & Pool Area System Requirements

| | |
|---|---|
| **Plant Space** | Adequate provision must be made for safe daily operator access & for effective and efficient service maintenance of the entire system |
| **Ventilation** | 4No. Air changes required in the plant pit. Temperature in the plant pit should not fall below 10°C or rise above 25°C |
| **Chemical Room Ventilation** | 4No Air changes required with forced mechanical ventilation to atmosphere. Chemical ventilation must be kept separate until atmosphere. |
| **Electrical Supply per Feature to Filtration Control Panels (Total Connected Load)** | As Per Individual systems above |
| **Sound proofing** | Plant room structures to incorporate all acoustic requirements for sound insulation, deafening and vibration. |
| **Filter Backwash** | Backwash drainage connection(s) required in plantroom c/w adaptor couplings suitable for industrial pipework and capable of a flow of:-<br><br>a) swimming pool filter 38.5m3/hr, 90mm O.D. pipe |
| **System Water Supplies** | Cold water supply adequately sized to the latest local water by-laws. It is generally required that a water storage tank and with type A-F air gap(British Standard) c/w pump set are supplied to ensure that pool water cannot contaminate drinking water supply. To supply the following systems<br><br>Swimming Pool, 28mm connection, 5.0$m^3$/hr. |
| **Chemical Room Water Supplies** | 1No. 15mm bib tap & hose supply to each Hypo and c02 rooms |
| **Initial Pool Fill Up Water Supply** | No. 28mm bib tap and hose local to each pool c/w 6m of hose pipe |
| **Safety Shower Water supply ( If Fitted )** | 1No. 28mm at 2 bar local to chemical rooms safety drench shower |
| **Hot & Cold water Supply** | Hot & Cold water supply local to plant room sink |
| **Temporary Pipe Test Water Supply** | Required local to Pool & Plant room area complete with 20m hose & ½"BSP female connection required capable of supplying 2bar pressure |
| **Plant Removal** | As Per Detail Drawings |
| **Floor Gulleys** | Floor Gulleys should be provided local to the Circulation Pumps, Filters, Sample Board, Chemical Area and Sink area. |
| **Concrete Plinths** | Plinths to be provided for the following –<br>Circ Pumps, Filter Vessels, Booster Pump and UV. |
| **Electrical Supply** | Incoming electrical supply to the electrical control panel isolator by main contractor. Outgoing wiring and local isolators for all electrical plant items by pool contractor. |

| | |
|---|---|
| **Setting Out** | Main contractor site engineer required to provide the following setting out locations.<br>1. Pipe Locations as marked on technical drawings in pool area<br>2. Pool structures & all build in pipe positions<br>3. Balance tanks & all build in pipe positions<br>4. Datum Levels<br>5. Pipe trenches |
| **Balance Tank** | GRP 10,000L Ø1.25m x 9.125 |
| **Lighting** | Adequate lighting must be provided in all areas during installation and commissioning |
| **Safety Shower** | This is a recommendation to be provided local to chemical rooms (by MEP contractor) |
| **Hazard Warning Signs** | To be provided as per local H&S guidelines |
| **Commissioning (Including commissioning chemicals)** | Commissioning of the water filtration & Feature systems requires that that cleaning & disinfecting of the pools & balance tanks. Filling with potable water, During this time provision of power, heat by main contractor & commissioning chemicals are provided by pool contractor |

# 8. General Exclusions and Attendances

## 8.1. Swimming Pool Filtration Plant and associated Equipment

The following items are EXCLUDED from Pool Contractor supply unless specifically stated otherwise in each of the preceding Engineering Specifications. All Points are subject to contract conditions.

1. All foundation, civil and builder's work such as, but not limited to, plinths, drains etc. and installation of build-in pipes passing through the structure.
2. Connections between town mains and plant rooms as well as DB in the plant rooms
3. Any earth bonding of equipment.

Unloading, storage, cranage and scaffolding

## 8.2. Attendances Required

1. Provision of suitable and adequate lock fast storage.
2. Provision of suitable office accommodation including lighting and power.
3. Provision of 230 volt power supply for tools.
4. Provision of 400 volt power supply for testing.
5. Provision of a water supply on site for pressure testing of our pipes, etc.

Provision of skips on site for the disposal for rubbish.

## 8.3. Commissioning

1. Water and Electricity to be made available free of charge to pool contractor.
2. The plant will be considered handed over when it has completed two days operation under design conditions. During this period the Pool Contractor will instruct the clients Attendant in the operation of the plant.

## 8.4. General

1. Supervision of Pool Contractor works would be carried out by a Lead Engineer on site.
2. Supervision of any Sub-contract installation included within our works would be carried out by our Sub-contractors Lead Engineer on site.

# 9. Approved Vendors

## 9.1. Filter Vessels

**ASTRALPOOL UK**
Europe
United Kingdom: UNITS 30-32, PALMERSTON BUSINESS PARK
NEWGATE LANE, FAREHAM HANTS PO14 IDJ
Tel: +44 1329 514000
Fax: +44 1329 514036
e-mail: sales@astralpooluk.com
web: www.astralpool.co.uk

**Certikin International Ltd**
Witan Park, Avenue 2, Station Lane Industrial Estate
Witney,
Oxfordshire
OX28 4FJ
enquiries@certikin.co.uk

## 9.2. Pumps

**Grundfos Pumps Ltd**
Grovebury Road
Leighton Buzzard
Beds LU7 4TL
Tel - 01525 850000
Emial -grundfosuk@grundfos.com

## 9.3. Primary Dosing

**ATG UV Technology:**
Genesis House, Richmond Hill, Wigan WN5 8AA
United Kingdom
**Telepho**ne: +44 (0) 1942 216 161
**Email:** info@atguv.com

## 9.4. Chemical treatment

**Grundfos Pumps Ltd**
Grovebury Road
Leighton Buzzard
Beds
LU7 4TL
Tel: 01525 850000
Email:grundfosuk@grundfos.com

**Gaffey Technical Services**
Unit 3a Huncoat Business Park,
Newhouse Rd,
Accrington
BB5 6NT

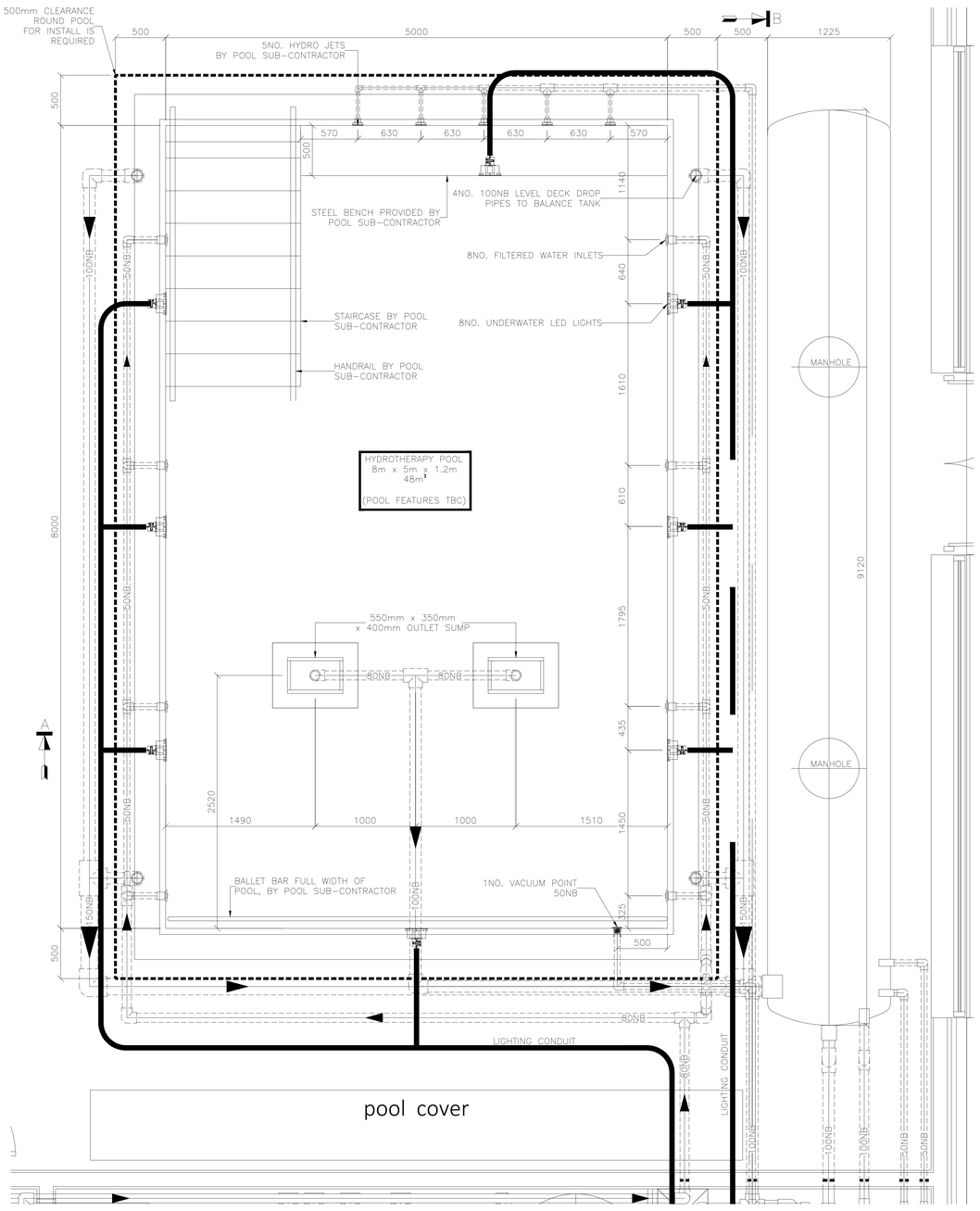
### 9.5. Pipe Work

**IPS Flow Systems**
Seaham Grange Industrial Estate,
Seaham
SR7 0PT

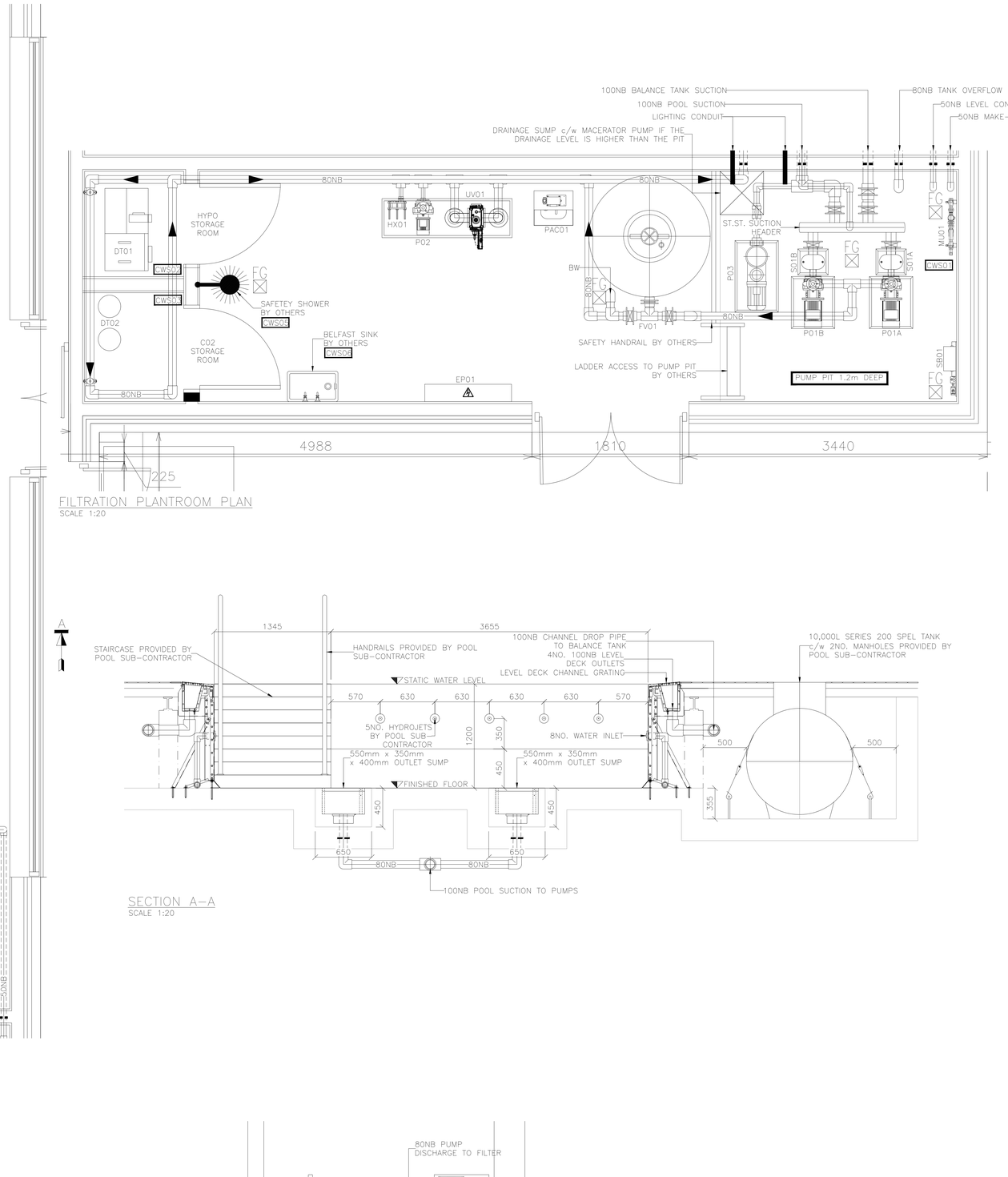
### 9.6. Heat Exchangers

**SPX/ APV**
Building A, Compass House
Manor Royal
Crawley West Sussex, RH10 9PY
United Kingdom

**Aquaden**
2 Crescent Way South
Forest Hall
NEWCASTLE UPON TYNE
Tyne & Wear
NE12 9AS
Tel: 0191 2189706
Mobile: 07860 961140
Fax: 0191 2663232
Email: dennis@aquaden.co.uk




POOL PLAN
SCALE 1:20




FILTRATION PLANTROOM PLAN
SCALE 1:20




SECTION A–A
SCALE 1:20




SECTION B–B
SCALE 1:20

SYSTEM 1 – HYDROTHERAPY POOL

AREA: 40m²
VOL: 48m³
TURNOVER: 1.5 hours
PLANTFLOW: 32m³/hr
BACKWASH FLOW: 38.5m³/hr

FILTRATION PLANT IDENTIFICATION TABLE

| ID | DESCRIPTION |
|---|---|
| P01A+B | MAIN CIRCULATING PUMPS |
| P02 | HEAT BOOSTER PUMP |
| P03 | FEATURE PUMP |
| S01A+B | CIRC. PUMP STRAINER |
| FV01A+B | Ø1.4m GRP FILTER VESSEL |
| UV01 | UV UNIT |
| HX01 | PLATE HEAT EXCHANGER |
| DT01 | PELLET PRO UNIT |
| DT02 | CO2 CYLINDERS |
| EP01 | ELECTRIC CONTROL PANEL |
| PAC01 | FLOCCULATION STATION |
| SB01 | SAMPLE BOARD |
| MU01 | CWS MAKE-UP ASSEMBLY |

PLEASE NOTE:

- FEATURES HAVE YET TO BE CONFIRMED. A SMALL SPACE HAS BEEN ALLOWED FOR ADDITIONAL FEATURE PUMPS. THIS WILL NEED TO BE REVIEWED DEPENDING ON WHAT FEATURES ARE CHOSEN
- PIPEWORK IS INDICATIVE AND WILL REQUIRE CO-ORDINATION WITH ARCHITECT AND ALL OTHER RELEVANT PARTIES.
- PLEASE READ IN CONJUNCTION WITH THE FOLLOWING DETAILS:

- SLP2012–01.01 – HEATING CONTROL SCHEMATIC.
- SLP2012–01.02 – FILTRATION SCHEMATIC.
- SLP2012–20.01 – TYPICAL MYRTHA POOL DETAILS.
- SLP2012–20.02 – TYPICAL BALANCE TANK INSTALLATION DETAIL.
- SLP2012–21.01 – MECHANICAL SERVICE NOTES

| | | |
|---|---|---|
| A | INITIAL ISSUE | 26/01/18 |
| | RP | |

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Project Name: ELMS BANK HIGH SCHOOL
Project No: SLP2012
Status: FOR INFORMATION
Drawing Title: OVERALL PLAN AND SECTIONS
Scale: AS SHOWN @A0
Date: 26/01/18
Drawn: RP
Approved: CL
Drawing No: SLP2012-00.01
Revision: A

# Barr + Wray Ltd

## Electrical Characteristics

BARR + WRAY

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Project No.: SLP2012
Project Name: Elms Bank High School
System Name: System 1 26/01/2018
Consultant:
Drawings to be completed by: R.Pennie

| Item | Model | Qty | | Supply Voltage | Power (kW) | FLC (Amps) | Sub-total FLC | Starter Type | Comments |
|---|---|---|---|---|---|---|---|---|---|
| | | Duty | S/by | | | | | | |
| Circulating Pumps | NB50-200/213 | 1 | 1 | 415 | 3.00 | 5.00 | 5.00 | | See note 2) |
| Heat Exchanger Booster Pump | NB 32-160.1/137 | 1 | | 415 | 0.25 | 1.00 | 1.00 | DOL | See note4 and 6) |
| Feature Pump | 32-125/106 | 1 | | 415 | 1.10 | 2.00 | 2.00 | | |
| Ultra Violet Unit | WF-115-3 | 1 | | 230 | 1.50 | 4.00 | 4.00 | - | See notes 8) & 11) |
| PAC Dosing Pump | DDE-61-5 | 1 | | 230 | 0.02 | 1.00 | 1.00 | - | See note 7 |
| Raw Water Make-up Valve | Burkett 0290 | 1 | | 230 | 0.10 | 1.00 | 1.00 | - | See note 9) |
| Sample Board | Bayrol Analyt | 1 | | 230 | 0.00 | 1.00 | 1.00 | - | See note 5) |
| Hypo Dosing | Pellet Pro | 1 | | 230 | 0.10 | 1.00 | 1.00 | | |
| CO2 Dosing | DDE-61-5 | 1 | | 230 | 0.00 | 1.00 | 1.00 | | |
| Underwater Lights | Par 56 | 8 | | 24 | 0.02 | 1.00 | 8.00 | | |
| Level Control | Proximity Sensors | 1 | | 24 | 0.00 | 0.00 | 0.00 | | |
| Pool Cover | | 1 | | 230 | 0.37 | 1.00 | 1.00 | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | Totals: | 26.0 | | |

Notes:

1) Control panel to be manufactured in accordance with EN 60439-1/1999 - Low Voltage Switchgear and Controlgear Assemblies.
2) Duty, Standby circ pumps to be interlocked to prevent standby pump operating while duty pump is in operation.
3) Common Fault Volt Free relay to BMS.
4) Shrouded relay controlled by heat exchanger booster pump for primary heating engineer.
5) Chemical dosing controller to be interlocked with circulating pumps via a volt free contact fed from chemical dosing controller.
6) Heat exchanger booster pump to be interlocked with circulating pumps.
7) PAC Dosing to be interlocked with circulating pumps.
8) Ultra Violet Unit to be interlocked with circulating pumps.
9) Fire Alarm Emergency Stop relay to drop out all controls with the exception of raw water make-up, raw water make-up valve and chemical dosing control panel.
11) Ultra Violet Unit 3 Phase
13) Testing

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Project Name: Elms Bank High School
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| Item | Model | Qty | | Supply Voltage | Power (kW) | FLC (Amps) | Sub-total FLC | Starter Type | Comments |
|---|---|---|---|---|---|---|---|---|---|
| | | Duty | S/by | | | | | | |

All control panel wiring shall be works checked prior to dispatch for loose connections, correct terminations and compliance with wiring diagrams. In addition, functional checks shall be carried out in the works to ensure that all interlocking and sequencing is in accordance with the performance requirements of the specification. The Engineer shall be given notice of such tests so that he may attend if they so desire.

With all control circuits disconnected but with all isolators closed and power fuses fitted the panels shall be subjected to a pressure test of 2.5kV for one minute across the following points:

a) Phase to phase
b) Phase to neutral
c) Phase to earth
d) Neutral to earth

This test shall be followed by an insulation resistance test with an approved type of 500V testing instrument.

With all electronic components and timeswitches removed and with all isolators closed and protective circuit devices fitted an insulation resistance of not less than 20 Megohms shall be obtained between each of the following points:

a) Phase to phase
b) Phase to neutral
c) Phase to earth
d) Neutral to earth