



Museum of Oxford Hidden Histories

Building Services Specification

16/11/2018

project no. 1620002535

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Project definition

101 The Project

- **Project reference:** 1620002011
- **Project title:** Oxford Town Hall Museum of Hidden Histories
- **Project description:**

110 Project documents

- **Document type:** Refer to Ramboll Document Issue sheets for details of all project documentation.

Works terminology

110 Terminology

- **Meaning:** Terms, derived terms and synonyms used are as defined in this section or in the appropriate referenced document.

210 Description terminology

- **Ancillaries:** All specified fittings, accessories, inserts, test points, bracketing, terminal equipment connected to and installed in the engineering services system.
- **Attendance:** Provision of temporary works and facilities to a third party. If not detailed in the contract, to be as described in RICS NRM coverage rule 10.4.
- **Building Manual:** A document containing information of use to subsequent building owners, occupiers and users about the requirements and procedures for effective operation, maintenance, decommissioning and demolition of the building.
- **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 in England & Wales / Building Standards in Scotland.
- **Competent Person:** A person who, by reason of theoretical and practical training or actual experience or both, is competent to perform the task or function or assume the responsibility in question and is authorised to perform such a task or function.
- **Concealed Services:** Includes installations within ducts, trenches or cavities.
- **Construction Work:** Permanent work together with temporary work.
- **Contractor:** The party who undertakes to perform the services, supply goods or carry out work defined in a contract. Includes Main Contractor, Prime Contractor, Supplier, Service provider, Builder, etc. which may be defined terms in certain contracts.
- **Contractor's choice:** Selection delegated to the Contractor. Liability for quality and compliance with performance requirements rests with the Contractor.
- **Contractor's design:** Design to be carried out or completed by the Contractor, supported by appropriate contractual arrangements, to correspond with specified requirements.
- **Cost:** The amount paid or given by one party to another in exchange for goods, work or services.
- **Designer:** A person carrying out design on a project.
- **Deviation:** Difference between a specified dimension or position and the actual dimension or position.
- **Drawings:** The Tender Drawings or those drawings which accompany this specification. Refer to the Drawing Issue Sheet for a full list of the drawings. Refer also to the Drawing Definitions given below.
- **Elsewhere:** Detailed or specified elsewhere in other clauses, sections, shown on the drawings or contained in the specification or conditions of contract.
- **Employer:** The party to the Contract for whom the goods, work or services are provided. Includes Client (in consultancy contracts and CDM Regulations), the Employer, Building owner or Purchaser (in construction contracts), the Developer (in development agreements and funding agreements), which may be defined terms in certain contracts

- **Estimate:** An approximate evaluation of either time or cost of part or the whole of a project.
- **Execute:** To complete a task fully and put into effect. To fix, apply, install or lay products securely, accurately, plumb and in alignment.
- **Exposed Services:** Includes installations outdoors or unprotected within service or occupied areas.
- **Fastener:** Device for mechanically attaching something to something else.
- **Manufacturer and Product reference:** Manufacturer - the body under whose name the particular product, component or system is marketed.
Product reference - the proprietary brand name and/ or reference by which the particular product, component or system is identified.
References are as specified in the manufacturer's technical literature current on the date specified.
- **Manufacturer's standard:** Where used in conjunction with a specified proprietary product, accessories and installation methods to be those recommended by the product manufacturer.
- **Permanent Work:** Work to be constructed and completed in accordance with the Contract.
- **Plant:** An item of mechanical or electrical equipment used either permanently or temporarily in the work, typically of a significant physical size.
- **Price:** An indication of the amount required to be paid by one party to another in exchange for goods, work or services.
- **Product:** Material, both manufactured and naturally occurring, goods and accessories for permanent incorporation into the Works.
- **Requirements:** A description in outline or detailed form of the development, or a part of it, which one party requires another to design and/or build.
- **Schedule of rates:** The subdivision of product and execution prices by a pre-determined unit basis.
- **Schedule of Work:** The subdivision of work items by a pre-determined classification. Can form the basis of a pricing document where Bills of Quantities are not used.
- **Schematic:** A drawing of a system showing components, products, systems and their interconnections.
- **Service Areas:** Includes areas within a building with limited finishes such as loading bays, car parks etc.
- **Service Duct:** An enclosed space specifically intended for the distribution of services, with direct access for personnel.
- **Services:** Services means the inclusion of one or more system.
- **Site equipment:** The Contractor's apparatus, appliances, machinery, vehicles or things of whatsoever nature required in or about the construction for the execution and completion of the Works and the remedying of defects.
Includes Appliances, vehicles, consumables, tools, temporary work, scaffolding, cabins and other site facilities.
Excludes: Temporary work, Employer's products and equipment or anything intended to form or forming part of the permanent Works.
- **Specification:** Written description of requirements.
- **System:** Products, components, equipment, accessories, controls, supports and ancillary items, including installation, necessary for that section of the work to function.

- **Temporary work:** Incidental work to undertaken during construction but not intended to form part of the completed work.
- **Terminal Units:** Terminal units such as radiators, convectors, fan coil units, induction units, variable or constant volume air boxes and other like equipment.
- **Trench:** A covered horizontal service space in the floor or ground with access from above.

310 Activity terminology

- **Advise:** See 'Communicate'.
- **Agree:** See 'Communicate'.
- **Approve:** Record conformance of work to specified criteria by giving formal or official sanction.
- **Communicate:** Includes advise, inform, agree, confirm, notify, seek or obtain information, consent or instructions, or make arrangements.
- **Confirm:** See 'Communicate'.
- **Design Process:** All the activities necessary to convert design input into design output.
- **Ease:** Adjust moving parts of designated products, systems or work to achieve free movement and good fit in open and closed positions.
- **Fix:** Receive, unload, handle, store, protect, place and fasten in position; dispose of waste and surplus packaging; to include labour, materials and site equipment for that purpose.
- **Give notice:** Communicate in writing to the person administering the Contract at the address listed therein.
- **Inform:** See 'Communicate'.
- **Keep for recycling:** As 'keep for use' but relates to a naturally occurring material rather than a manufactured product.
- **Keep for reuse:** Do not damage designated products, systems or work. Clean off bedding and jointing materials. Stack neatly, adequately protect and store until required by the Employer or Purchaser, or for use in the Works as instructed.
- **Make good:** Execute local remedial work to designated work. Make secure, sound and neat.
- **Match existing:** Provide products and work of the same appearance and features as the original, excluding ageing and weathering. Make joints between existing and new work as inconspicuous as possible.
- **Notify:** See 'Communicate'.
- **Quote:** Use 'Estimate'.
- **Recycle:** Collect, sort, process and convert discarded or recovered components into raw materials for use in the creation of new products.
- **Refix:** Fix previously removed products.
- **Remove:** Disconnect, dismantle as necessary and take out the designated products or work, together with associated accessories, fixings, supports, linings and bedding materials. Dispose of unwanted materials. Removal of a system includes this work.
- **Remediate:** Action or measures taken to lessen, clean-up, remove or mitigate the existence of hazardous materials existing on a property; in accordance with standards, specifications or requirements as may be required by statutes, rules, regulations or specification.

- **Repair:** Execute remedial work to designated products. Make secure, sound and neat. Excludes redecoration and replacement.
- **Replace:** Supply and fix new products matching those removed. Execute work to match the original new state of that removed.
- **Reuse:** Recover components to be fixed or used in the project or other buildings without the requirement for recycling.
- **Review:** Give notice and submit details to the CA for his comment and review, which shall be granted in writing only. In the event of the CA not accepting that submitted, resubmit alternative details for review or modify that submitted in accordance with the CA comments. Review of any submittal by the CA shall not mean that the CA is responsible for the correctness of the submittal or its suitability for purpose and does not relieve any contract responsibilities.
- **Submit:** Deliver an item in a specified format to a specified person within a specified timeframe.
- **Submit proposals:** Submit information in response to specified requirements.
- **Supply and fix:** Supply of products, components or systems to be fixed, together with their fixing.

410 A Technical Bodies

- **BSRIA:** The Building Services Research and Information Association.
<http://www.bsria.co.uk/>
- **BRE:** Building Research Establishment. <http://www.bre.co.uk/>
- **BREEAM:** Building Research Establishment Environmental Assessment Method.
<http://www.breeam.org/>
- **CIBSE:** The Chartered Institution of Building Services Engineers.
<http://www.cibse.org/>
- **HSE:** The Health and Safety Executive. www.hse.gov.uk/
- **IET:** The Institution of Engineering and Technology. www.theiet.org/
- **IOP:** The Institute of Plumbing. <http://www.plumbers.uk.com/site/iop.html>
- **LPC:** The Loss Prevention Council.

510 A Technical Documents

- **General:** The definitions of technical terms associated with the engineering services installations are those included in the latest editions of the following documents:
- **CIBSE Guides:** Guidance documents published by CIBSE. Includes Design Guides, Commissioning Codes, Technical Memoranda, Building Energy Codes, Lighting Guides and Application Manuals.
- **Plumbing Guides:** Guidance on the design and installation of plumbing systems published by the IOP.
- **BSRIA Documents:** Technical publications published by BSRIA.
- **LPC Publications:** Technical and guidance documents published by the LPC.
- **IET Wiring Regulations:** The wiring regulations as published by the IET.
- **BS's / BS-EN's:** British Standards and / or European Standards.
- **Statutory Acts:** Statutory Documents published by the Government of the country in which the Project is being undertaken, or those Statutory Documents which have been accepted in writing as being appropriate to follow in lieu of those in force in the country in which the Project is being undertaken. In the UK these will typically be

the Building Regulations and other statutory documents except in Scotland where the Building Standards will be used.

610 A Drawing & Document Definitions

- **General:** The following definitions describe the various drawings which will be produced at various stages of the design process.
- **Responsibility:** The parties responsible for producing the various drawings are as defined in the responsibilities matrix which has been produced for this project.
- **The Tender Drawings:** Drawings produced to enable those tendering to interpret the design and to submit a tender for executing all or any part of the Works as defined elsewhere.
- **Sketch Drawings:** Refer to the definition given in BSRIA BG6/2012 document entitled "A Design Framework for Building Services, 3rd Edition".
- **Sketch Schematic Drawings:** Refer to the definition given in BSRIA BG6/2012 document entitled "A Design Framework for Building Services, 3rd Edition".
- **Detailed Schematic Drawings:** Refer to the definition given in BSRIA BG6/2012 document entitled "A Design Framework for Building Services, 3rd Edition".
- **Technical Design Drawings:** Refer to the definition given in BSRIA BG6/2012 document entitled "A Design Framework for Building Services, 3rd Edition".
- **Detailed Design Drawings:** Refer to the definition given in BSRIA BG6/2012 document entitled "A Design Framework for Building Services, 3rd Edition".
- **Coordinated Working Drawings:** Refer to the definition given in BSRIA BG6/2012 document entitled "A Design Framework for Building Services, 3rd Edition".
- **Installation Drawings:** Refer to the definition given in BSRIA BG6/2012 document entitled "A Design Framework for Building Services, 3rd Edition".
- **Installation Wiring Diagram:** Drawing showing the interconnection of electric components, panels etc in accordance with the design intent indicated in the schematic drawings and incorporating the details provided on manufacturer's certified drawings. Indicate the following: maximum electrical loading for each supply cable; cable termination facilities; and cable identification and all terminal numbers.
- **Manufacturers Drawings:** Refer to the definition given in BSRIA BG6/2012 document entitled "A Design Framework for Building Services, 3rd Edition".
- **Manufacturers Certified Drawings:** Drawing 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.
- **Shop Drawings:** Drawing prepared by a fabricator or supplier unique to the project. Including supplier's drawings for ductwork, pre-fabricated pipework, sprinkler systems, control and switchgear panels and associated internal wiring.
- **Builderswork Information:** Refer to the definition given in BSRIA BG6/2012 document entitled "A Design Framework for Building Services, 3rd Edition".
- **Builderswork Details:** Refer to the definition given in BSRIA BG6/2012 document entitled "A Design Framework for Building Services, 3rd Edition".
- **Record Drawings:** Refer to the definition given in BSRIA BG6/2012 document entitled "A Design Framework for Building Services, 3rd Edition".
- **Plantroom Schedules & Schematics:** Good quality plant and switch room drawings, schedules, schematics and instructions which are to be hung in the respective plant room or any other appropriate location or where directed by the CA using suitable fixings and provide backboards if necessary. Protect surfaces of such

information by framing under glass or other rigid, transparent, cleanable and protective surface. A sample shall be submitted for approval to the CA prior to commencing production.

Plantroom Schedules & Schematics will be provided by the Contractor and will include:

- Schematic drawings of circuit layouts showing:
 - Location, identification and duties of equipment
 - Location of controls devices
 - Circuit layout
- Valve schedules in the form of printed sheets showing the number, type, location, application/service and symbol, and normal operating position of each valve.
- Control schematics.
- Location of mechanical and electrical plant and equipment items.
- First aid instructions for treatment of persons after electric shock.
- Location of isolating switch for electricity supply.
- Location of main incoming gas valve serving gas meter and isolation point.
- Location of main incoming water main and isolation point.
- Location of sprinkler fire main control valve.
- Emergency operating procedures and telephone numbers for emergency call out service applicable to any system or item of plant and equipment.
- All other items required under Statutory or other regulations.

710 A Building Information Model Definitions

- **General:** The various terms associated with BIM are not defined here. This section is intended to clarify the extent of information included within the MEP model at any given stage.
- **BIM Strategy Document:** For specific details of the level of development and extent of modelling included for any given stage refer to the Ramboll document entitled "M&E BIM Outline Strategy".
- **Initial Concept Model:** Refer to the definition given in Ramboll document entitled "M&E BIM Outline Strategy".
- **Design Development Model:** Refer to the definition given in Ramboll document entitled "M&E BIM Outline Strategy".
- **Technical Design Model:** Refer to the definition given in Ramboll document entitled "M&E BIM Outline Strategy".
- **Production Information Model:** Refer to the definition given in Ramboll document entitled "M&E BIM Outline Strategy".
- **Installation Model:** Refer to the definition given in BSRIA BG6/2012 document entitled "A Design Framework for Building Services, 3rd Edition".
- **As Built Model:** Refer to the definition given in BSRIA BG6/2012 document entitled "A Design Framework for Building Services, 3rd Edition".

Project location

110 Project location

- **Details:** Refer to Main Contract Documents.
- **Address:**
 - **Street:** Refer to Main Contract Documents.
 - **City:** Refer to Main Contract Documents.
 - **Post code:** Refer to Main Contract Documents.
- **Site Ordnance Survey grid reference:** Refer to Main Contract Documents.
- **Site altitude to Ordnance Datum:** Refer to Main Contract Documents.

130 Existing buildings on, or adjacent to the site

- **Details:** Refer to Main Contract Documents. and Refer to Health & Safety Risk Assessments.

150 Surrounding land and building uses

- **Surrounding land uses or activities:** Refer to Main Contract Documents. and Refer to Health & Safety Risk Assessments.

170 Access

- **Details:** Refer to Main Contract Documents. and Refer to Health & Safety Risk Assessments.
- **Limitations:** Refer to Main Contract Documents. and Refer to Health & Safety Risk Assessments.

190 A Maintenance of Existing Services

- **General:** Be aware of, protect and fully maintain all existing services to existing premises during the progress of the Works.
- **Provide to the CA prior to commencement of the works:** - A method statement outlining the method and procedures to be used for the maintenance of the existing services
 - A planned maintenance programme for the existing services
 - Details of permit to work procedures
- **Include for:** - Any additional work and materials necessary to maintain these services at all times during the duration of the contract works.
 - Reinstatement of any existing services disturbed by the Works fully in accordance with the standards of quality defined in the specification and to the satisfaction of the CA.
 - Making all connections to existing services out of normal working hours.

Works Contract Content

110 Preparatory work by others

- **Work:** Carried out by others and not forming part of this Contract work.
- **Details:**
- **Timescale:**

110 A Details of Contract

- **General:** This specification should be read in conjunction with the Main Contract Documents. The Contractor (including any and all Sub-Contractors) should make themselves aware of all clauses and requirements detailed within the Main Contract Documents and allow for full compliance with them. All requirements identified within this Specification are in addition to those identified elsewhere within the Main Contract Documents.

130 Work by others concurrent with the Contract

- **Details:**
- **Timescale:**

135 Outline description of Contractor's responsibilities

- **General:** Notwithstanding the additional requirements described elsewhere in this Specification and the Main Contract Documents, this section defines in brief summary the works required to be undertaken by the Contractor for the Mechanical and Electrical Services systems and installation.
- **Responsibilities matrix:** Refer to the completed BSRIA Responsibilities Matrix included elsewhere in the Tended / Contract Documents for further details of the division of responsibilities for this project.
- **The works:** The Contractor will design (where defined elsewhere in this specification), procure, programme, manage, co-ordinate, install, test, commission, set to work, demonstrate, warranty and service the whole of the mechanical and electrical services systems as described within this specification.
- **Information Provided by others:** Instructions, drawings, or other information required to be provided by the CA will be provided in due time upon written request provided always that such information is not requested unreasonably distant from nor unreasonably close to the date upon which it is necessary. Provide written request to the CA in good time for any information required.
- **Provide everything necessary:** Provide everything necessary for the proper execution and completion of the contract works to the true intent and meaning of the contract documents. Details of construction or materials which have not been referred to in the contract documents but the necessity for which may reasonably be implied or inferred from the said documents or which are usual or essential to the completion of the Works, shall be installed with no additional cost.
- **Co-ordination of trades:** Allow for co-ordinating the contract works with the works of other trades and installations which may be on site during the period of the contract.
- **Co-operation with others:** Ensure that the contract works integrates with that of others and that full co-operation is maintained during the execution of the Works with that of others. Co-operate with the Contractor, other subcontractors, suppliers,

local authorities and statutory undertakings in the execution of the Works. In the event of any extra costs being caused by failure to programme and arrange the execution of the Works so that it fully integrates with that of others, the installer of the Works may be liable for any additional costs thereby incurred.

- **Design Warranty:** The Contractor will be required to complete a form of warranty in favour of the Employer prior to the commencement of the design stage. This will apply for all elements of the Contractor's design.
- **General obligations:** Undertake responsibility for all works defined in the work sections and shown on the drawings, and in particular the following:
 - Using the Ramboll drawings and specification as a basis of information, carry out the final Coordinated Working and Installation Drawings of all mechanical and electrical services installations within the building to comply fully with the requirements of each system.
 - Undertake the responsibility for resolving final spatial co-ordination
 - Check the provisions for, and adequacy of builder's work information previously issued prior to the award of the contract
 - Co-ordinating the engineering services, with each other and with the building structure and fabric
 - Undertake the role of lead co-ordinator and agree principles of co-ordination with all parties concerned. Incorporate details provided by others into the design development and installation information
 - Provide the following drawings as defined elsewhere:
 - Co-ordination
 - Installation
 - Manufacturing
 - Manufacturer's certified
 - Shop drawings
 - Installation wiring drawings
 - Provide builders work details based on the installation, manufacturing and shop drawings.
 - Negotiate with public and other authorities for provision of necessary incoming services.
 - Obtain final approvals of any appropriate authority.
 - Prepare such reports, calculations and details as required for submission to any appropriate authority including the coordination of such information by suppliers, specialists, etc needed to be included in any submission.
 - Fully re-evaluate and take full responsibility for all parts of the design and building elements that may be affected by acceptance of alternative plant selections
 - Undertake specific detailed design tasks as defined in this work section
 - Undertake all on-site co-ordination with all other trades, disciplines, manufacturer's and suppliers
 - Provide suitable accommodation, workshops, stores and clearance on completion.
 - Supply, deliver to site, unload, store, protect and co-ordinate movement of all plant, equipment and materials required for the works including lifting and hoisting.
 - Fix and install correctly all plant, equipment and materials and ensuring that all associated works are correctly executed
 - Undertake the fire stopping of all holes associated with the works
 - Install fire barriers where a fire rated partition is penetrated
 - Inspect all plant, equipment and materials as delivered or where specified at the manufacturer's works
 - Inspection and/or tests to be carried out at the works jointly with the CA for equipment as defined elsewhere
 - Include for the travel and other expenses of the CA for the inspection and/or tests

carried out at the works

- Include for the preparation of the operating and maintenance manuals, planned maintenance schedules.
- Appoint a specialist responsible for the preparation of the operating instructions and maintenance manual
- Include for the preparation of log books in accordance with Building Regulations / Standards and the relevant BREEAM requirements using CIBSE TM 31 template as a minimum standard benchmark.
- Undertake the testing and commissioning of the works.
- Appoint an independent commissioning specialist responsible for the testing and commissioning of the works in strict compliance with CIBSE commissioning codes and in accordance with the relevant BREEAM requirements.
- Provide a commissioning report in accordance with Building Regulations / Standards.
- Carry out building fabric works comprising air permeability test and all necessary remedial works in accordance with CIBSE code TM 23 and the relevant Building Regulations / Standards. Also provide certification of air leakage testing of ductwork and leakage test certificates in accordance with DW143

- **The Contractors design responsibilities:** Detailed design responsibilities shall include the activities listed below, in addition to those activities normally undertaken through the custom and practice of the industry. Responsibility of the suitability and correctness of the design or other obligations as defined in the contract documentation will not be affected by comments of the CA.

The Contractors design responsibilities shall include:

- Provide all necessary builderswork information indicating all holes and penetrations necessary to facilitate the installation of the M&E services.
- Detail the final or supplementary builder's work information based on manufacturer's information. Provide fully dimensioned drawings.
- Detail all access requirements including access to false ceilings and ducts for maintenance. Provide fully dimensioned and annotated drawings.
- Location of drain and vent points and pipework gradients.
- Detailed design and locations of brackets and supports. Submit details of all types of brackets and supports including fixing details prior to installation. Also submit load calculations prior to installation.
- Detailed design and location of expansion anchors and guide locations. Submit details of all expansion anchors and guides, including fixing details, load and thrust calculations for comment prior to installation.
- Final valve and damper locations.
- Calculating all pump system resistances based on the final equipment selection and co-ordinated installation drawings.
- Calculating all final fan system resistances based on the final equipment selection and co-ordinated installation drawings.
- Calculating system water capacities and quantities of chemical additives
- Design and selection of sound attenuation equipment to satisfy the particular performance requirements of the specification and the defined spatial allowances.
- Acoustic design or modification of equipment to attain the particular performance requirements of the specification.
- Final selection of all anti-vibration mountings to suit the particular application of the mounts.
- Detailed design and sizing of refrigerant pipework between items of equipment provided as part of the works.
- Preparing detailed electrical wiring diagrams of all equipment supplied showing all interconnections between equipment to enable all necessary wiring to be

undertaken.

- Capacity, location, routes and design of electrical conduit systems including trunking where used in lieu of multi-conduit installation.
 - Detailed design of automatic controls systems insofar as it is required to meet with operational and spatial requirements of the specification. The installer shall be responsible for ensuring the full compatibility of the plant and equipment with the specified function and for the design and incorporation of all interfaces (including relays or other devices or modifications to hardware or software)
 - Dimensioning of, and final installation details of, automatic control panels to suit the detailed requirement of the agreed supplier of the controls equipment. The installer shall be responsible for ensuring that control panel cable entry/exits are possible in the final location and that safe operating and maintenance clearances are provided
 - Final locations of test points, control sensors, detectors, thermostats, gauges and all other such equipment as may be required.
 - Sizing of cable terminations for all items of equipment appropriate for the rating of fuses installed in plug tops for the rating of the connected equipment.
 - Design of cable or cable containment terminations on to electrical equipment.
 - Dimensioning of and final installation details of electrical switchgear including the cable entry details for the selected location and provision of adequate safe operating and maintenance clearances.
 - Detailed design of earthing and bonding requirements for mechanical engineering services, electrical engineering services, architectural elements and structural elements
 - Ensuring cable size selections as specified are not invalidated by the selection of alternative routes during installation or selection of alternative manufacturer's
 - Final detailed design of fire alarm system component and cabling requirements to meet with the particular manufacturer and the engineering specification requirements.
 - Detailed design, supply and installation of duct platforms access covers, gratings, and ladders.
- **Alternative equipment:** Where the CA has accepted proposed alternative equipment or materials prior to the award of the contract and which subsequently varies the main works and/or the Works in any way whatsoever, then:
 - Be responsible for meeting all the additional costs and technical requirements arising from such a change (including such reasonable fees as may be incurred by Ramboll or others in assessing the appropriateness of such equipment or materials).
 - No claim for additional costs or delay to the completion of the works will be allowed.
 - Undertake the redesign of all engineering services and builder's work affected by these equipment changes at no additional cost or extension or delay to the programme.
 - Should any alternative item proposed not carry appropriate certification, ensure independent testing is carried out to confirm compliance at no additional cost.
 - With regards to lighting, any alternative lighting and luminaires should meet the equal and approved guidelines set down in the Lighting Equal and Approved Statement included elsewhere in this Specification.
 - **Coordination of services:** All aspects of the works require detailed co-ordination to avoid any possible clash or conflict with other trades and disciplines. Undertake such co-ordination in relation to the works. No extra cost or claim will be allowed due to conflict of works or installations, where full liaison with other trades and disciplines would have prevented such an occurrence.

When any new, revised or updated architectural, structural or services information is issued by the CA under the authority of an instruction, examine such information and if necessary modify the works accordingly to prevent any clashes or abortive work due to such instruction. No extra cost or claim will be allowed to cover any clashes or abortive work that result from not requesting an explanation or seeking clarification in respect of any such revision.

No extra cost or claim will be allowed due to conflict of works or installations, where full liaison with other trades and disciplines would have prevented such an occurrence.

- **Post-contract design amendments:** Following issue of the Contract Drawings, the Contractor will be responsible for incorporating minor changes to the design by revising the Coordinated Working Drawings, Installation Drawings or Record Drawings accordingly. Such minor changes may include (but are not limited to) the following:

Changes to the Architects layouts which could include:

- moving of doors which necessitate relocation of light switches or such like;
- re-naming of rooms or spaces;
- minor adjustments of ceiling heights (where such adjustment does not significantly affect the services coordination);
- changes to FF&E layouts which may affect floor boxes, socket outlet positions, coordination with radiators and such like;
- changes to the setting out of suspended ceilings or raised access floors which necessitate adjustments to diffusers, luminaires, smoke detectors, floor boxes, etc;
- changes in position of sanitaryware which necessitate adjustment to the pipework serving the sanitaryware;
- changes to external landscaping which require adjustment to service routes, position (but not number) of external lighting fitments, etc;
- other architectural amendments which introduce the need to adjust the position of (as opposed to re-design) services or fitments.

Changes to the Structural layouts which could include:

- adjustment in position of beams, columns, lintels, etc which necessitate adjustment in the position of services but that do not necessitate fundamental re-design, significant re-coordination or undermine the intent of the services strategy
- minor changes to the slab or screed levels;
- the introduction or modification of secondary steelwork (whether for supporting M&E services or otherwise) which necessitate the adjustment of the position of services or fitments

Minor changes to the M&E design which could include;

- items described in an authorised Instruction, Variation Order or other Contract amendment which, whilst not necessitating significant redesign, could require adjustment in the location, specification or number of fitments. An example might be to replace one radiator with two radiators of similar combined output and the associated adjustment of the pipework arrangement needed to serve the two radiators. Another example might be to replace a conventional wall mounted light switch with a ceiling mounted PIR;
- changes brought about by way of the Consultant's acceptance of a Contractor's Change Request, where the change (whether significant or not) has been instigated by the Contractor for whatever reason

- **Co-ordination of services on site:** Allow for co-ordinating the contract works with the works of other trades and installations which may be on site during the period of the contract either during or prior to their incorporation into the works. Where minor clashes of services occur on site that were not foreseeable at the design or co-ordination drawing stage then these clashes or minor co-ordination matters shall be resolved by discussion and agreement with other trades and disciplines. The CA shall be informed of the action to be taken by an approved means. No instructions will be issued to cover such minor clashes.
- **Surveys:** Ascertain the nature of the site and all local conditions and restrictions likely to affect the execution of the Works. Before commencing work, carry out a survey and examination of buildings, structure and engineering services (including those underground) affected by the works. Examine all available drawings of the engineering services and report any discrepancies to the CA.
- **Site dimensions and levels:** Install all engineering services using a laser levelling system wherever possible and co-ordinate the measurements with all other trades and disciplines to prevent any clashes. Obtain all dimensions and levels on site for the actual setting out of the works.

As the development advances, measure on site all works by others that may foreseeably affect the works. These dimensions shall be incorporated into the installation drawings or marked up on revised drawings if already issued. No extra cost or claim will be allowed for any errors arising from inaccurate setting out or failure to check actual site dimensions. Reimbursement will be sought for any abortive expenditure.

- **Maintainability:** Demonstrate that all plant and equipment incorporated into the Works can be safely and easily maintained in full compliance with:
 - Health and Safety legislation.
 - CDM requirements.
 - British Standards (or other local equivalent standards)

Ensure that adequate space is provided for future replacement of plant or parts and that all access panels/doors are unobstructed.

- **Terminal unit locations:** The positions of all connection points, accessories, apparatus, equipment and other room terminals shown on the tender drawings are approximate and for guidance in the preparation of the tender. Agree, with the CA, which terminals are subject to final positioning on site. Allow for the movement of all such terminals up to a radius of 2 m from the positions shown on the drawings. Mounting heights if given indicated in the tender documents are for tender purposes only. Confirm mounting heights with the CA before commencing work on site.
- **Co-operate:** Co-operate with the contractor, other subcontractors, suppliers, local authorities and statutory undertakings in the execution of their work. In particular, the following works will require close and careful co-ordination and liaison and co-operation with any appointed specialists by the Client and/or Main Contractor. Also refer to individual specification sections for further details of Mechanical / Electrical Contractor's responsibilities:
 - ICT (Data and Telecoms) specialist designer/installer
 - FF&E specialist / supplier
 - Kitchen / catering specialist contractor
 - Pool system designer / specialist (if appropriate)
 - Any other specialist designer or subcontractor who may be employed (whether by the Contractor or by others) in the delivery of the works.

- **Statutory authorities:** Orders for the incoming utility services shall be included in this contract. Liaise with the Statutory Authorities and provide any test notices required to ensure final connections are made in accordance with the requirements of the programme.

135 A Additional responsibilities under Design & Build Contracts

- **The Contractor will also be responsible for:**
- **In addition, the Contractor will also:**

137 A Outline scope of works

- **The engineering services included in the works include:**
- **Extent of the mechanical works:**
- **Extent of the public health works:**
- **Extent of the fire protection works:**
- **Extent of the electrical works:**
- **Utilities:**
- **Other systems:**

140 Completion work by others

- **Details:**
- **Timescale:**

160 Products provided by, or on behalf of employer

- **General:** Details of products to be fixed by the Contractor are given in the work sections. Use for no other purpose than the Works.
- **Handling:** Accept delivery, check against receipts and take into appropriate storage.
- **Surplus products:** Keep safe and obtain instructions.

190 Work by Local Authority

- **Item:**
- **Description of work:**
- **General attendance:**

200 Work by statutory undertakers

- **Item:**
- **Description of work:**
- **General attendance:**

250 Other contract work

- **Details:**

300 Provisional sum for defined work

- **Details:**
- **Provisional Sum:**
- **General attendance:**

310 Provisional sum for undefined work

- **Details:**
- **Provisional Sum:**
- **General attendance:**

320 Prime Cost sum

- **Details:**
- **PC sum:**
- **Contractor's percentage addition for incidental costs, overheads and profit.:**

Works Contract Procurement

110 Compliance with Tender rules

- **Compliance:** Failure to comply may result in Tenders being rejected at the sole discretion of the Employer.
- **Costs:** No liability is accepted for costs incurred in the preparation of a Tender.

120 Preliminary Enquiry

- **Details:** Refer to Main Contract Documents.

130 Tenders to be invited

- **Number of tenders to be invited (maximum):** Refer to Main Contract Documents.

135 Project Team Agreement

- **Execution:** Refer to Main Contract Documents.

140 Framework Agreements

- **Agreements in place:**
 - **Details:** Refer to Main Contract Documents.

150 Tender Programme

- **Details:** Refer to Main Contract Documents.
- **Key dates:** Refer to Main Contract Documents.

160 The Invitation to Tender

- **Form:** Refer to Main Contract Documents.
- **Location of Tender documents:** Refer to Main Contract Documents.

165 Tender acceptance

- **Tender acceptance period:** Refer to Main Contract Documents.

170 The Tender documents

- **The Tender documents:** Refer to Main Contract Documents. and Refer to the Ramboll Document Issue Sheet(s).
- **Number of hardcopy documents provided:** Refer to Main Contract Documents. and Only electronic copies will be provided.

180 Tender queries

- **Notification requirements:** Refer to Main Contract Documents.

190 Tender instructions

- **Qualifications:** Do not amend or alter documents without written instruction.
- **Confidentiality:** Do not reveal details of parts of the Tender or supporting

documents (except for the necessary purposes of preparing that Tender) without the Employer's express written permission.

- **Interpretation of the tender documentation:** Should there be any doubt about the precise meaning of any item for any reason whatsoever, the tenderer must inform the office of issue of the tender documents in writing in order that the correct meaning may be given. Any clarification of the meaning or intent shall be issued in writing only and no other means of communication shall be valid. All Tenderers will be notified of any such explanation. No liability will be admitted, nor claim allowed, in respect of errors in a tender due to mistakes that should have been rectified in the manner described above.
- **Alternatives:** Alternative equipment, specialists or methods of carrying out the works in addition to those described in the tender documents may be submitted. Alternative offers shall be indicated on the appropriate document in the Tender Return Summary and must include:
 - Details of the alternative equipment, specialist or method proposed.
 - Full technical data for each such alternative together with details of any consequential amendments to the design and/or other parts of the works.
 - A detailed breakdown of any omissions or additions to the basic tender sum indicated on the appropriate document.
 - Include for all necessary measures to ensure alternative manufacturer's equipment and the total installation is equivalent to that specified.
 - The Tenderer shall include the costs necessary for re-sizing and reselection of associated equipment (including pipework, ductwork and cable sizes) resulting from the proposed alternative together with all resulting design and coordination.

Alternative offers will only be considered if accompanied by a compliant tender.

- **Procurement of materials:** Allow for the procurement of materials and equipment from suppliers at such a time, and in such a manner as may be necessary to allow for the completion of the Works in accordance with the contract programme. Clearly state in the tender submission any foreseen difficulties with delivery periods for selected equipment or proposed alternatives.

No additional costs resulting from non-compliance will be accepted, nor will alternative materials or equipment requested as a result of a failure to verify delivery periods during the tender period.

- **Subletting:** Where it is proposed to sublet any portion(s) of the Works a schedule must be submitted with the tender on the appropriate document in the Tender Return Summary. The schedule should define such portion(s) and give for each the details of the proposed company.

210 Pricing

- **Pricing:** Price and extend each item individually as instructed. Do not group items together.
- **Currency:** Pounds sterling.

220 Site visit

- **Nature of the site:** Ascertain before Tendering, including access thereto and local conditions and restrictions likely to affect the execution of the Work. Inspect any existing installations relevant to the works and study any relevant existing records. No claims will be allowed after submission of a tender for lack of information or other reasons which could have been resolved by such a visit to the site.

- **Arrangements for visit:** Refer to Main Contract Documents.

230 Return of Tender

- **Return of Tender:**
 - **Destination:** Refer to Main Contract Documents.
 - **Time and date:** Refer to Main Contract Documents.
 - **Format:** Refer to Main Contract Documents.
 - **Special procedures:** Refer to Main Contract Documents.
- **Documents to be returned with the Tender:** Refer to Main Contract Documents.; Completed and priced Elemental Tender Summary schedule; Schedule of alternative equipment; Schedule of sub-let portions; and Statement of full tender compliance (unqualified).
- **Inability to tender:** Advise immediately if the work as defined in the Tender documents cannot be tendered. Define those parts, stating reasons for the inability to tender.

310 Assessment

- **Assessment of Tenders:**
 - **Number to be assessed in detail:** Refer to Main Contract Documents.
 - **Assessment criteria:** Refer to Main Contract Documents.
 - **Assessment model details:** Refer to Main Contract Documents.
- **Alternative Tenders:**
 - **Submission:** Permitted in conjunction with compliant tender.
 - **Basis:** Refer to Main Contract Documents.

320 Error resolution

- **Arithmetical errors:** Tender price will prevail. An opportunity will be given to confirm the Tender or withdraw.
- **Technical errors:** The Tender is deemed to meet or exceed the requirements of the Tender documents. Amendment of the Tender to reflect this will not constitute a variation and no claim for additional costs will be accepted.
- **Corrections:** An endorsement will be added to the priced documents indicating that rates or prices (excluding preliminaries, contingencies, Prime cost and Provisional sums) inserted therein will be adjusted in the same proportion as the corrected total differs from that stated incorrectly.

340 Post-Tender negotiations

- **Negotiations:** Refer to Main Contract Documents.
- **Details:** Refer to Main Contract Documents.

410 Notification to Tenderers

- **Notification method:** Refer to Main Contract Documents.

Works Contract Establishment

ACCESS

110 Access to the site

- **Details:** Refer to Main Contract Documents.
- **Limitations:** Refer to Main Contract Documents.
- **Use of the site:** Refer to Main Contract Documents.
- **Working area:** Refer to Main Contract Documents.

150 Storage, accommodation, mechanical plant, temporary works and services

- **Position:** Submit proposed details of intended siting.
- **Maintenance:** Alter, adapt and move as necessary. Remove when no longer required and make good.

GENERAL INFORMATION

195 Environmental targets

- **BREEAM targets:**
 - **CO2 or energy arising from site activities:** Refer to and comply with the requirements of the latest BREEAM Assessment / Pre-assessment.
 - **CO2 or energy arising from transport to and from site:** Refer to and comply with the requirements of the latest BREEAM Assessment / Pre-assessment.
 - **Water consumption arising from site activities:** Refer to and comply with the requirements of the latest BREEAM Assessment / Pre-assessment.
 - **Air (dust) pollution arising from the site:** Refer to and comply with the requirements of the latest BREEAM Assessment / Pre-assessment.
 - **Water (ground and surface) pollution occurring on the site:** Refer to and comply with the requirements of the latest BREEAM Assessment / Pre-assessment.
 - **Site timber:** Refer to and comply with the requirements of the latest BREEAM Assessment / Pre-assessment.
- **Monitoring:** Check progress against each target as the work proceeds.
- **Frequency and format of reporting:** Refer to Main Contract Documents.

245 A Programme

- **Requirements:** Provide a detailed programme(s) clearly illustrating how the overall programme will be achieved within the contract period and demonstrate compliance with the Main Contract programme.

Provide the detailed programme within one month of the award of the contract.

Due allowance is to be made in the programme(s) for, but not limited to, the

following:

- The latest dates for release of final information required from the CA.
- Required method statements.
- Ordering dates and manufacturing periods. The proposed delivery to site for each item of major plant to be clearly defined.
- The period required for the production, approval and issue of builder's work information, co-ordination drawings, installation drawings and shop drawings. Allow adequate time for the examination and approval by the CA. Actual activities of production, adjustment, resubmission and review must be identified
- Installation periods for each system
- Work resulting from instructions issued in respect to the expenditure of provisional sums.
- Concurrent work by other trades.
- Any temporary works necessary for the completion of the engineering services installations.
- Period required for operating the systems, load simulation tests and final adjustment.
- Environmental load testing.
- Period for instructing the Employer training.
- Pre-commissioning, commissioning and performance testing of the engineering services installations.
- The period required and latest dates for the production, approval and issue of record drawings and operating and maintenance instruction manuals.
- Provide programme information as a critical path network.
- Provide a separate and detailed commissioning programme for agreement with the CA. Make due allowance for commissioning, demonstration and instruction procedures; provision of written notice before each (or series of) test, inspection, commissioning or demonstration procedures are to be carried out, not less than 10 working days and demonstration to the CA that test instruments and equipment are accurate.
- **Ordering schedule:** Prepare an ordering schedule for submission to the CA that shall indicate the following data:
 - Item of material or plant
 - Manufacturer
 - Date of order and reference number
 - Acknowledgement of order and reference
 - Delivery period quoted
 - Date required on site
 - Allowable programme float
 - Date delivered to site

Update and modify and submit the ordering schedule on a regular basis as agreed with the CA. Indicate on the schedule any possible problems and when delivery to site has been achieved.

- **Continuity of works:** No undertaking is given that the works will necessarily be able to proceed continuously. No claim will be allowed for discontinuity of work due to the necessity to conform to the contract programme.
- **Drying out:** Make due allowance in the sequence of the work to provide heat for drying out. This activity shall not relieve any responsibilities to hand over the installation in good order. The interim period from the time of commencement of use for drying out to the handover shall not be considered as constituting any part of the defect liability period.
- **Method and sequence of works:** Refer to Main Contract Documents.

280 Start of work on site

- **Notice:** Refer to Main Contract Documents.

HEALTH AND SAFETY INFORMATION

320 A Health and Safety Requirements

- **Health and Safety Risk Assessments:** Refer to Main Contract Documents. and Obtain, refer to and make all necessary allowances for the content of the Ramboll Health and Safety Risk Assessments.
- **General:** - Refer to the Main Contract Preliminaries for the requirements of safety, health and welfare.
 - Conform to all safety rules, regulations and codes of practice.
 - Check that facilities provided by others fulfil the obligations and advise accordingly.
 - Provide all necessary first aid facilities.
 - Appoint a Competent Person on the site to manage health and safety during construction.
 - Ensure, so far as is reasonably practicable, that all persons employed on, or visiting, the site are adequately informed, instructed, trained, supervised and equipped such that they are able to carry out their duties safely.
 - Ensure that safety helmets and other necessary protective clothing are available to site visitors.
 - All safety helmets and protective clothing must comply with the latest British Standards.
 - Ensure that only authorised persons are allowed into any construction area.
 - Ascertain the accuracy and sufficiency of information provided by the Employer or the CA to ensure the safety of all persons and the Works.
 - Wherever possible, labour saving lifting devices shall be used and materials sized to allow easy manual lifting.
- **CDM Regulations:** The management of health and safety is to be undertaken in conformity with the requirements of the Construction (Design and Management) Regulations (CDM Regulations) and the corresponding Approved Code of Practice. The Contractor must comply with the requirements of the CDM Regulations by:
 - Compiling risk assessments
 - Preparing method statements
 - Providing information on the contract works that might affect the health and safety of any person
 - Providing all necessary input to the health and safety plan
 - Providing all necessary input to the health and safety file
 - Supply any method statements and comply with all CDM procedures required by the CDM Coordinator and the Principal Contractor.
- **Health and Safety plan:** The tender stage health and safety plan provides information required by the CDM Regulations and highlights significant risks to health and safety identified during the design stage. The Contractor must develop the tender stage health and safety plan in accordance with the requirements of the CDM Regulations prior to the commencement of works on site. The development of the health and safety plan shall not be limited to those particular risks identified in the tender stage health and safety plan but shall include consideration of all reasonably foreseeable risks

The health and safety plan must be adequately developed, as far as is reasonably practicable allowing for any phasing of works, etc., in sufficient time to allow it to be submitted for approval prior to the commencement of any works on site. In the case of phased works the health and safety plan relating to the work content of any phase must be adequately developed and submitted for approval prior to the commencement of any work within that phase of the project. Where design activities are undertaken or there is involvement in the design of any elements of the contract works co-operate with and provide information to the CDM Coordinator in accordance with the designer's duties under the CDM regulations.

Ensure that all sub-contractors are issued with copies of the health and safety plan prior to the submission of their tenders and that they price for compliance. Ensure that all sub-contractors complete appropriate assessments of the risks to health and safety in respect of their works as required under applicable statutory legislation, including the latest Management of Health and Safety at Work Regulations and the Control of Substances Hazardous to Health Regulations. The health and safety plan shall be reviewed and revised as necessary in line with any information received or any changes in the requirements of the contract works. Any changes shall be promptly advised to all relevant parties. Ensure, so far as is reasonably practicable, that all sub-contractors, employees and self employed persons who are at work on the construction of the project conform with the requirements of the health and safety plan

- **COSHH Regulations:** Comply with the latest edition of the Control of Substances Hazardous to Health Regulations. Provide with the tender an assessment of the risks in undertaking the contract works. Provide with the tender, a method statement on the steps proposed to meet the requirements of the Regulations. Undertake COSHH assessments for all activities and substances provided or used on site to assess their potential health hazards.

Copies of all relevant COSHH assessments must be issued to the operatives concerned and strictly monitored. Particular attention must be given to the use of glues and sealant. Where the use of substances falling within the scope of the Regulations forms part of the contract works notify the CA in writing, together with the additional costs, if any, of use of non-hazardous alternative. Ensure during the course of the contract works, and under all circumstances, that all substances falling within the scope of the Regulations are positively so identified at all times and that they are transported, handled, stored, used and disposed of in strict accordance with their manufacturer's/supplier's recommendations. Where use of substances falling within the scope of the Regulations are required for the operation and maintenance of the completed contract works, ensure that:

- Suitable facilities are available for the on site storage of such substances and that all necessary warning/instruction notices are provided at the point of their storage and use
 - Provision of any special protective clothing, eye protection and similar safety equipment for the operation and maintenance of the Works and in sufficient quantity for 1 year operation
 - Employers' staff have been fully trained in the use, handling, storage, transport and disposal of the substances concerned prior to handover.
 - The type, use and control of the substances have been fully and correctly identified in the operating and maintenance manuals/health and safety file.
- **Asbestos:** No material or goods containing asbestos shall be incorporated in the contract works. Be responsible for certifying at practical completion of any section of

the contract works that no asbestos or asbestos related materials have been incorporated or by any sub-contractor employed.

- **Risks to Health and Safety:** Submit a statement with the tender describing any significant and unavoidable risks which may arise as a result of carrying out the contract works and the measures proposed to safeguard the health and safety of operatives and of any person who may be affected by the contract works.

340 Preconstruction information

- **Availability:** Integral with the project specification, including but not restricted to the following:
Description of project.
Client's consideration and management requirements.
Environmental restrictions and on-site risks.
Significant design and construction hazards.
The Health and Safety File.

350 Execution hazards

- **Common hazards:** Not listed. Control by good management and site practice.
- **Significant hazards:** Refer to Main Contract Documents and the Ramboll Health and Safety Risk Assessments.
- **Hazard:** Refer to Main Contract Documents and the Ramboll Health and Safety Risk Assessments.
- **Precautions assumed:** Refer to Main Contract Documents and the Ramboll Health and Safety Risk Assessments.

360 Product hazards

- **Hazardous substances:** Site personnel levels must not exceed occupational exposure standards and maximum exposure limits stated in the current version of HSE document EH40: Guidance Notes: Environmental Hygiene (EH): Workplace exposure limits. Containing the list of workplace exposure limits for use with the Control of Substances Hazardous to Health Regulations 2002 (as amended).
- **Common hazards:** Not listed. Control by good management and site practice.
- **Significant hazards:** Refer to Main Contract Documents and the Ramboll Health and Safety Risk Assessments.
- **Hazard:** Refer to Main Contract Documents and the Ramboll Health and Safety Risk Assessments.

MANAGEMENT AND STAFF

400 Management and staff – Contract minimum requirement

- **Details:** Allow for compliance with contract obligations.
- **Cost significant items:**

410 Management and Staff – Additional requirement

- **Dedicated staff role:** M&E Coordinator.

TEMPORARY ACCOMMODATION

430 Temporary accommodation – Contract minimum requirement

- **Details:** Allow for compliance with the Contract obligations.

480 Parking

- **Requirement:** Refer to Main Contract Documents.

TEMPORARY SERVICES

500 Temporary Services – contract minimum requirement

- **Details:** Allow for compliance with Contract obligations.

510 Water

- **Supply:** The availability, metering and charges associated with the provision of utilities to the site are as described in the Main Contract Documents.

520 Water restrictions

- **Emergency legislation:** If the water supply is or is likely to be restricted, inform without delay and ascertain the availability of water from alternative sources.
- **Suitability:** Check pH value of water from a proposed new source and ensure that it is suitable for the plants, soil and turf being watered.
- **Cost:** Refer to Main Contract Documents.

530 Gas

- **Supply:** The availability, metering and charges associated with the provision of utilities to the site are as described in the Main Contract Documents.

540 Lighting and power

- **Supply:** Provide electric power and equipment. Make temporary arrangements for power distribution about the site. and The availability, metering and charges associated with the provision of utilities to the site are as described in the Main Contract Documents.

550 Telephones

- **Temporary on site telephone:** Provide as soon as practicable after the start on site for joint use by the Contractor, Subcontractors and those acting on behalf of the Employer.
- **Responses:** Make arrangements (e.g. call diverts) to ensure that incoming calls are answered promptly.
- **Employer's call charges:** Allow for the cost of a modest number of calls made by those acting on behalf of the Employer.

570 Fax installation

- **General:** As soon as practicable after the start on site provide a suitable on site fax installation, with a separate dedicated telephone line, for use by the Contractor, Subcontractors and those acting on behalf of the Employer.
- **Employer's call charges:** Allow for the cost of a reasonable number of transmissions made by those acting on behalf of the Employer.

580 E-mail and internet facility

- **General:** As soon as practicable after the start on site provide a suitable e-mail facility on site, with a separate dedicated connection, for the use of the Contractor, Subcontractors and those acting on behalf of the Employer.
- **Use on behalf of Employer:** Allow for the cost of a reasonable number of transmissions made by those acting on behalf of the Employer.

585 Photocopier

- **General:** Provide reasonable access to and limited free use of an on-site photocopier, which may be located in the Contractor's own site offices.

590 Meter readings

- **Charges for service supplies:** Where to be apportioned ensure that: Meter readings are taken by relevant authority at possession and/ or completion as appropriate.
Copies of readings are supplied to interested parties.

TEMPORARY SECURITY

600 Security – contract minimum requirement

- **Details:** Allow for compliance with Contract obligations.

TEMPORARY SAFETY AND CONTROL

630 Safety and environmental protection – contract minimum requirement

- **Details:** Allow for compliance with Contract obligations.

710 Beneficial use of installed systems

- **Permanent systems:** Unless specific permission is given by the Employer and installer, do not use for any purpose other than running in, testing and commissioning.
- **Other uses:** If permission is given for any other use of a system before Practical Completion of the Works, it must be subject to a separate written agreement between the parties.

730 Mechanical plant – contract minimum requirement

- **Details:** Allow for compliance with Contract obligations.

TEMPORARY WORKS

760 Temporary works – contract minimum requirement

- **Details:** Allow for compliance with Contract obligations.

790 Name boards and advertisements

- **Name boards and advertisements:** Refer to Main Contract Documents.

840 Personal protective equipment

- **General:** Provide for the sole use of those acting on behalf of the Employer, in sizes to be specified, the following:
- **Safety helmets:**
 - **Standard:** To BS EN 397, neither damaged nor time expired.
 - **Number required:** Refer to Main Contract Documents.
- **High visibility waistcoats:**
 - **Standard:** To BS EN 471, Class 2.
 - **Number required:** Refer to Main Contract Documents.
- **Safety boots:**
 - **Standard:** To BS EN ISO 20345, with steel insole and toecap.
 - **Number of pairs required:** Refer to Main Contract Documents.
- **Disposable respirators:**
 - **Standard:** To BS EN 149.FFP1S.
- **Eye protection:**
 - **Standard:** To BS EN 166.
- **Ear protection:**
 - **Standard:** Muffs to BS EN 352-1, plugs to BS EN 352-2.
- **Hand protection:**
 - **Standard:** To BS EN 388, 407, 420 or 511 as appropriate.

Works Contract Management

GENERALLY

100 A General

- **Information provided by others:** Instructions, drawings, or other information required to be provided by the CA will be provided in due time upon written request provided always that such information is not requested unreasonably distant from nor unreasonably close to the date upon which it is necessary.

Provide written request to the CA in good time for any information required.

- **Supply of information:** The CA will provide supplementary information from time to time as may be necessary to enable the completion of the Works in accordance with the contract conditions. Allow for such progressive release of further information by the CA during the course of executing the Works.
In order to facilitate the orderly and timely production of all further information that shall be considered necessary, submit to the CA for approval a programme indicating the progressive release of such information to enable the completion of the Works in accordance with the contract conditions.

SUPERVISION, COOPERATION AND COORDINATION

130 Supervision

- **Requirement:** The whole of the contract work and any significant parts must be under the close control of competent trade supervisors to ensure maintenance of satisfactory quality, progress and coordination.
- **Evidence:** Provide names, CV's, qualifications and any other documentary evidence.
- **Submittal date:** Within one week of request.
- **Replacement of supervisory personnel:** Give maximum possible notice before changing supervisory personnel.
- **Site staff:** Refer to the Main Contract preliminaries, also:
 - Employ a competent full-time site based project manager/engineer and supporting team dedicated full time to the project and not involved in the installation of the Works who shall have full authority to act in connection with the contract works.
 - Staff of sufficient number and competence in the opinion of the CA, shall be provided as necessary for design, drawing and technical information production, programming and administration to ensure efficient and satisfactory execution of the contract works.
 - Provide all necessary superintendence during the execution of the contract works. The said staff shall be in attendance on site during the whole time that work is in progress.
 - Employ on the site suitable qualified engineering staff to be in charge of the contract works from commencement to completion. The said staff shall be in attendance on site during the whole time that work is in progress.
 - Responsibility for all drawings and technical information production shall be undertaken by a nominated engineer
 - Any change made to the appointment of staff during the contract works shall be

agreed with the CA with maximum notice being provided.

- If the CA is of the opinion that any member of the site staff has been guilty of a serious breach of his duties, he may by notice require that person to be replaced within one week of the notification.
- **Design management:** The Contractor will employ a design manager throughout the design process who shall have the full authority to make decisions. The design manager shall be suitably qualified to the satisfaction of the CA. The design manager shall attend all design team meetings as required and be a participating member of the overall team during the development of the design. Once construction has commenced the design manager shall be involved until such time as all the production information has been completed and the Works are generally under construction.

Also:

- Appoint the appropriate staff and necessary skills to undertake the design activities to the satisfaction of the CA.
- Submit with the tender curriculum vitae of all key design staff.
- Any change made to the appointment of design staff shall be agreed with the CA with maximum notice being provided.
- Throughout the design stage be actively involved with the Employer's design team
- Undertake and prepare any such design information required by other design team members to enable their element of the work to be detailed.
- During the design and production information stages the CA will monitor by such means considered necessary the performance in the development of design and in the production of the detailed design and co-ordination drawings.
- Should any part of the design not meet the required standard of the CA then modify and re-issue such work to the required standard at no additional cost or delay to the programme.
- On completion of the contract design stage activities and prior to commencing the production information submit to the CA a statement of compliance that the design of the systems will meet the specification design and performance intent.
- Submit a statement to the CA signed by a Competent Person prior to commencement of works on site that the systems can be properly prepared and commissioned and agrees with the intent of the design.

PROGRESS

170 Contractor's progress report

- **General:** At regular intervals as agreed with the CA, provide progress reports during the execution of the contract works in addition to any other similar information required by the contract conditions.
- **Requirement:** The report must include the following.
- **Content:**
 - Particulars of materials and equipment on site, or installed
 - Site labour employed
 - Progress of the works
 - Record progress of the Works weekly on a copy of the programme.
- **Photographs:** Provide progress colour photographs of the contract works. The frequency, location, and photograph size shall be agreed with the CA. All photographs shall be dated and location stated. The number of prints of all photographs to be submitted to the CA shall be agreed as required to suit the work in progress. No unauthorised photographs of the site or the Works or any part

thereof shall be taken except with the permission in writing of the CA. Photographs shall not be published or otherwise circulated without the permission of the CA.

- **Maintenance of up to date record drawings:** Mark up for inspection and record purposes a set of the latest drawings as the works progress. The progress drawings shall be available for inspection by the CA at any time.
- **Progress statement:** Detailing matters materially affecting the regular progress of the Works including suppliers' progress reports.
 - **Information:** Requirements for further drawings or details or instructions to fulfil obligations under the Conditions of Contract.

OPERATION

200 Employer's representatives inspections

- **Access:** Provide at reasonable times.
- **Inspections:** Agree dates and times several days in advance, to enable affected parties to be present.
- **Safety:** Submit details in advance of safety provisions and procedures (including those relating to materials, which may be deleterious), which will require compliance of the Employer and Employer's representatives when visiting the site.
- **Provide:** Protective clothing and/ or equipment site for the Employer, the Employer's representatives and other visitors to the site.

205 A Notice of Operations

- **General:** Work that requires interruption or interference with the operation of any existing services or buildings shall not be commenced without prior written permission of the CA. 10 working days notice of intention to proceed with such works shall be given to the CA.

210 Removal or replacement of existing work

- **Extent and location:** Agree before commencement.
- **Execution:** Carry out in ways that minimize the extent of work.

230 Measurement

- **Covered work:** Give notice before covering work required to be measured.

290 Occupied premises

- **Extent:** Existing buildings will be occupied and/ or used during the Contract.
- **Details:**
- **Works:** Carry out without undue inconvenience and nuisance and without danger to occupants and users.

300 Access control

- **Controlled areas:** To be agreed with the Client.
- **Control type:** To be agreed with the Client.
- **Authorized persons:** Submit a list of the names of persons requiring access together with other related information reasonably required.

- **Return of equipment:** On request or on completion of the work to which it relates.

310 Occupier's rules and regulations

- **Occupier's rules and regulations:** To be agreed with the Client. Contractor to comply with all reasonable rules and regulations.

315 A Other rules and regulations

- **Police regulations:** Ascertain and comply with any Police regulations or requirements as may affect the contract works.
- **Confidentiality:** No information related to the contract works shall be given to the press or other media without the written permission of the CA or Employer.
- **Advertising:** No form of advertising will be allowed on any part of the site or the Works without written CA approval.
- **Patent rights:** Indemnify against all claims, costs or expenses in connection with any patented, copy righted or protected articles supplied and used on or in connection with the Works. Any payments or royalties payable in one sum or by instalments shall be included in the contract price and paid to whom so ever they may become due. In the event of any claim being made in connection with such patented or protected articles, conduct any negotiations or litigation in connection with such claim at own expense.
- **Statutory Authority approvals:** Make full and formal submissions to Building Control/District Surveyor at the earliest opportunity to ensure the approval of the Statutory Authorities for the proposed installation works. Notify the District Surveyor, Building Control Officer and Fire Officer directly in respect of all tests and demonstrations relevant to life safety installations, and include for all necessary attendance, documentation, etc., to ensure full Statutory Authority approval of the installation. Include for all fees and charges legally required under such Act of Parliament, Regulations or By-Laws in respect of the Works.
- **Authority notices:** Documents requiring the Employer's signature shall be forwarded to the CA in time to meet the contract works programme in order for the necessary test and supply arrangements to be made. No additional costs or extension to programme shall be allowed due to reconnections, revisits etc by supply authorities or failure to programme the works.
- **Bye-laws, notices, etc:** Observe and comply with the requirements of all Statutes and Bye-Laws. Serve notices on the Authorities having control of the road surfaces before the same are broken up and likewise serve notices on the owners of sewers, drains, water, gas or other mains, electric cables, tramways and other services which may in any way be affected by the execution of the Works. Inform all necessary parties when work necessitates such notices to be given.

320 Mobile telephones and portable electronic equipment

- **Restricted area:** Refer to Main Contract Documents.
- **Restriction:** Refer to Main Contract Documents.

330 Working precautions and restrictions

- **Hazardous areas:**
 - **Description:** Refer to Main Contract Documents.
 - **Precautions:** Refer to Main Contract Documents.
- **Permit to work:**

- **Area:** Refer to Main Contract Documents.
- **Procedures:** Refer to Main Contract Documents.

PROTECTION FROM

390 Noise control

- **Noise control:** In accordance with BS 5228-1, and the Main Contract Documents.
- **Equipment:** Fit compressors, percussion tools and vehicles with effective silencers of a type recommended by manufacturers of the compressors, tools or vehicles.
- **Restrictions:** Obtain consent before using pneumatic drills and other noisy appliances.
Do not use radios or other audio equipment or permit employees to use in ways or at times that may cause nuisance.

410 Fuel, lubricants and hydraulic fluids

- **Restrictions:**
 - **Storing, handling and refuelling:** On hard standing or other approved areas. Keep away from watercourses, drains, soil, planting and grassed areas.
 - **Vehicles and equipment:** Prevent leakage or spillage. If it occurs, inform immediately and take emergency action.

430 Nuisance

- **Duty:** Prevent nuisance from smoke, dust, rubbish, vermin and other causes.
- **Surface water:** Prevent hazardous build-up on site, in excavations and to surrounding areas and roads.

440 Asbestos containing materials

- **Requirement:** Report immediately suspected materials discovered during execution of the Works. Do not disturb and agree methods for safe removal or encapsulation.

445 Antiquities

- **Requirement:** Report immediately fossils, antiquities and other objects of interest or value discovered during execution of the Works.
- **Preservation:** Keep objects in the exact position and condition in which they were found.
- **Special requirements:**

450 Fire prevention

- **Requirement:** Prevent personal injury or death, and damage to the Works or other property from fire.
- **Standard:** Comply with Fire prevention on construction sites: The joint code of practice on the protection from fire of construction sites and buildings undergoing renovation. 7th edition.

460 Smoking on site

- **Smoking on site:** Not permitted.

480 Moisture

- **Wetness or dampness:** Prevent, where this may cause damage to the Works.
- **Drying out:** Control humidity and the application of heat to prevent:
Blistering and failure of adhesion.
Damage due to trapped moisture.
Excessive movement.

510 Waste

- **Includes:** Rubbish, debris, spoil, containers and surplus material.
- **Requirement:** Keep the site and Works clean and tidy. Remove rubbish, dirt and residues before closing voids and cavities in the construction.
- **Waste:** Remove frequently and dispose off site in a safe and competent manner as approved and directed by the Waste Regulation Authority.
- **Recyclable material:** Sort and dispose at a Materials Recycling Facility approved by the Waste Regulation Authority.
- **Documentation:** Retain waste transfer documentation on site.

520 Electromagnetic interference

- **Duty:** Prevent excessive electromagnetic disturbance to apparatus outside the site.

540 Power actuated fixing systems

- **Use:** Not permitted.

PROTECTION OF

630 Existing features

- **Protection:** Prevent damage to existing buildings, fences, gates, walls, roads, paved areas and other site features, which are to remain in position during execution of the Works.

635 A Works Generally

- **Protection:** Provide adequate and safe protection for all materials and products after installation. Ensure all items are protected against ingress of water and dust, formation of condensation, extremes and rapid changes of temperature, building works and operations of others. Protect during erection all easily damaged materials with hardboard covers or heavy duty polythene sheet. Such items include but are not limited to:
 - control panels,
 - switchboards,
 - distribution boards,
 - heater batteries,
 - finned pipework,
 - gauge glasses,

Protect all finished items from damage and paint splashes. Install items such as grilles, diffusers, lighting fittings, switches, accessories etc. as near to completion as practicable. Only install filter media when the plant items concerned are being

commissioned and tested. Cover all plant items with polythene sheeting except when being worked upon. Cap all open ends of pipes, ducts, conduit and trunking etc except when being worked upon. Leave plant and equipment in a ready to paint condition where specified as part of the Works or to be carried out by others. Paint parts liable to corrosion immediately after removal of any temporary protection.

Replace material, plant or equipment where deterioration or damage has occurred prior to handover.

640 Existing work

- **Protection:** Prevent damage to existing work, structures or other property during the execution of the Works.
- **Removal:** Minimum amount necessary.
- **Replacement work:** To match existing.

690 Protection of subcontract work

- **Protection:** Check regularly.
Inform Main Contractor if inadequate.

METHOD AND SEQUENCE

750 Existing structures

- **Duty:** Check proposed methods of work for effects on adjacent structures inside and outside the site boundary.
- **Supports:**
 - **Standards:** In accordance with BS 5975 and BS EN 12812.
 - **Requirements:** Provide and maintain incidental shoring, strutting, needling and other supports as may be necessary to preserve stability of existing structures on the site or adjoining, which may be endangered or affected by the Works.
Do not remove until new work is strong enough to support existing structure.
Prevent overstressing of completed work when removing supports.
- **Adjacent structures:** Monitor and immediately report excessive movement.

760 Materials for recycling or reuse

- **Duty:** Sort and prevent damage to stated products or materials, clean off bedding and jointing materials and other contaminants.
- **Storage:** Stack neatly and protect until required by the Employer or for use in the Works as instructed.

780 Use or disposal of materials

- **Deleterious or prohibited materials:** No acoustic insulation or thermal insulation or sound attenuation materials shall be manufactured with any form of animal hair. All materials supplied shall be a type that will not support bacteria.

Deleterious materials shall not be utilised on any part of the Works. Deleterious materials include but are not limited to:

- halon/CFC's

- asbestos or products containing asbestos
- urea formaldehyde or materials which may release formaldehyde
- materials comprised in whole or part of man-made and/or naturally occurring mineral fibres which have a diameter of 3 microns or less and a length of 200 microns or less or which contain fibres not sealed or otherwise not stabilised to ensure that fibre migration is prevented
- lead where the metal or its corrosion products may be directly ingested, inhaled or absorbed
- any other substances generally known to be deleterious at the time of installation
- any substances containing CFC's or HCFC's either within their make-up or used during manufacture.

Any insulating materials with an ozone depletion potential (ODP) greater than zero and a global warming potential (GWP) of 5 or greater. All jointing materials shall be of a type approved by the respective authority.

Ensure that the selection or use of materials is in compliance with the requirements and objectives of the latest BREEAM Assessment or Pre-assessment for the Project. The Contractor must not prejudice BREEAM credits by the selection or use of materials which will remove the ability to claim BREEAM credits.

Warrant that deleterious materials are not incorporated in the Works.

- **Asbestos:** No material or goods containing asbestos shall be incorporated in the contract works. The Contractor will be responsible for certifying at practical completion of any section of the contract works that no asbestos or asbestos related materials have been incorporated or by any sub-contractor employed.

790 Working hours

- **Specific limitations:** Working hours will be as defined within the Main Contract Documents.

Works Contract Verification

STANDARDS OF PRODUCTS AND EXECUTIONS

110 Substitute products

- **Details:** If products of different manufacture to those specified are proposed, submit details with the tender giving reasons for each proposed substitution. Substitutions which have not been notified at tender stage may not be considered.
- **Compliance:** Substitutions accepted will be subject to verification requirements detailed in the specification.

120 Substitution of products

- **Products:** If an alternative product to that specified is proposed, obtain approval before ordering the product. The Engineer reserves the right to seek payment from the Contractor to compensate for reasonable time spent reviewing the suitability of any proposed substitutions. By submitting proposals for a substitute product the Contractor is agreeing to pay such reasonable costs to the Engineer.
- **Reasons:** Submit reasons and relevant information for the proposed substitution. Where substitutions are proposed because the delivery period of the original product would compromise the programme, the Contractor must demonstrate that this has not been brought about by a failure by the Contractor to place an order in good time. Where this can not be demonstrated, the substitution will not be allowed.
- **Information to be submitted:** Manufacturer and product reference.
Cost.
Availability.
Relevant standards.
Performance.
Function.
Compatibility of accessories.
Proposed revisions to drawings and specification.
Compatibility with adjacent work.
Appearance.
Copy of warranty or guarantee.
- **Alterations to adjacent work:** If needed, advise scope, nature and cost.
- **Manufacturers' guarantees:** If substitution is accepted, submit before ordering products.

DOCUMENTS AND INFORMATION

150 Currency of documents

- **Currency:** References to published documents are to the editions, including amendments and revisions, current on the date of the Invitation to Tender.

160 Incomplete documentation

- **Products and executions:** Where and to the extent that products or executions are not fully documented, they are to be as follows.

- **Requirements:**
 - **Standard:** Of a kind and quality appropriate to the nature and character of that part of the Works where they will be used.
 - **Suitability:** Suitable for the purposes stated or reasonably to be inferred from the project documents.
- **Contract documents:** Omissions or errors in description and/ or quantity shall not vitiate the Contract nor release the Contractor from obligations or liabilities under the Contract.

180 Code for Sustainable Homes

- **Assessment Information:**
 - **Scope and content:** Refer to Main Contract Documents.

190 Environmental assessment information

- **Scheme type:**
- **Assessment Information:**
 - **Scope and content:** Refer to Main Contract Documents.;
Obtain and review the latest version of the project BREEAM Pre-Assessment. Ensure compliance with all Credits identified as being achieved.;
and Do not compromise the ability to achieve the overall target BREEAM score for the project..

210 Record drawings and information

- **Record drawings:**
 - **Drawings scope:** Refer to Main Contract Documents and Refer to the completed BSRIA BG6/2012 responsibilities matrix for the Project.
 - **Drawings format:** Refer to Main Contract Documents;
Full size (A0 or A1) paper copies folded to A4 size with the title block visible and provided in individual 4 hole punched clear plastic sleeves (maximum 1 drawing per sleeve).;
Digital PDF copy at natural drawing size.;
and Digital DWG copy, editable and prepared using the latest version of Autocad. All X-References relevant to the drawing must be bound to each drawing..
- **Record specification:**
 - **Specification format:** NBS.
 - **Submittal date:** At least two weeks before date for completion.

220 Technical information

- **Retain:** Available on site for reference by supervisory personnel.
- **Information:** Manufacturer's current information and relevant British Standards, relating to products to be used in the Works.

230 Compliance

- **Compliance:** Retain on site evidence that the proprietary product specified has been supplied.
- **Submit:** Evidence of compliance with performance specifications, including test reports indicating properties tested, pass or fail criteria, test methods and

procedures, test results, identity of testing agency, test dates and times, identities of witnesses and analysis of results.

PRODUCTS AND EXECUTION

240 Workmanship skills

- **Operatives:** Appropriately skilled and experienced for the type and quality of work.
- **Registration:** With Construction Skills Certification Scheme.
- **Evidence:** Operatives must produce evidence of skills and qualifications when requested.

245 A Quality control

- **Quality control:** Prepare and submit to the CA a method statement to indicate fully the quality control programme for the contract works within 4 weeks of contract appointment.
- **Workmanship and materials:** All materials, articles and workmanship shall be of the best quality and execution as detailed in the specification and drawings. All equipment and materials to be installed shall be new unless otherwise indicated. All equipment shall be installed in accordance with the manufacturer's written instructions and recommendations. All materials considered by the CA to be unsound or not in accordance with the specification shall immediately be removed and properly replaced to the satisfaction of the CA at no additional cost. All work carried out imperfectly or with faulty materials must be immediately removed and properly replaced to the satisfaction of the CA at no additional cost. The manufactured articles specified shall serve as a quality standard. Where manufactured items are not specified by name submit with the tender all necessary details of proposed articles. The CA shall approve these articles before their use is permitted.
- **Defects:** Agree with the CA a system of recording defects that should include:
 - A reference to identify the defect
 - Description of the defect
 - Remedial works proposed
 - Agreement to remedial works proposed
 - Confirmation of defect clearance

250 Quality of products

- **Generally:** New.
- **Supply:** Each product from the same source or manufacturer.
- **Quantity:** Whole quantity of each product required to complete the Works of a consistent kind, size, quality and overall appearance.
- **Submittal date:** Evidence of source of supply when requested.
- **Recycling:** Proposals for recycled products may be considered.
- **Rationalisation of components:** Similar items of apparatus and equipment shall be made and provided by the same manufacturer where practicable and corresponding parts of all apparatus and equipment shall be interchangeable to reduce the need for different attention and spares.

- **Supply of computer hardware and software:** Obtain on behalf of the end user all appropriate licences, permissions, copyright waivers, rights of use and the like from the owners of the software rights. Ensure that the end user is properly registered with the software supplier for support and appropriate updating. Ensure that application software is written in compliance with BS 7649. Provide back up copies of all software at handover to the Client.
- **Equipment guarantees:** Plant and equipment guarantees shall commence at the date of practical completion and run for a minimum of 12 months after this date. Any costs associated with this requirement shall be included in the contract price.

260 Quality of execution

- **Generally:** Fix, apply, install or lay products securely, accurately, plumb, neatly and in alignment.
- **Colour batching:** Do not use different colour batches where they can be seen together.
- **Dimensions:** Check on-site.
- **Finished work:** Not defective, damaged, disfigured, dirty, faulty, or out of tolerance.
- **Appearance:** Adjust joints open to view so they are even and regular.
- **Site modifications:** Site modifications to assemblies shall not be made without written approval of the CA.
Where site modifications to assemblies are authorised, undertake in accordance with manufacturer's certified drawings and instructions.
Ensure that all modifications undertaken comply with the relevant standards and all test certification obtained.

270 Inspections

- **Standard:** Inspection, or other action, of products or executions must not be taken as approval unless confirmed in writing including the following:
Date of inspection.
Part of the work inspected.
Respects or characteristics which are approved.
Extent and purpose of the approval.
Associated conditions.

290 Manufacturer's recommendations and instructions

- **General:** Comply with manufacturer's printed recommendations and instructions current on the date of the Invitation to Tender.
- **Submit:** Details of changes to recommendations or instructions.
- **Execution:** Use ancillary products and accessories supplied or recommended by main product manufacturer.
- **Products:** Comply with limitations, recommendations and requirements of relevant valid certificates.

SAMPLES AND APPROVALS

330 Samples

- **Generally:** Provide free of charge, samples of material and workmanship proposed to be used in the Works.
Samples shall include all alternative finishes available if required.
In the case of articles of special construction:
 - drawings may be temporarily substituted for the samples
 - drawings when approved will be retained until the articles concerned are supplied, as a sample

The samples submitted and approved, shall remain the property of the Employer until the completion of the contract. Approval of the CA shall be obtained before equipment is placed on order. The CA will undertake to approve samples within 4 weeks from receipt. Include all alternative finishes available for the samples.
- **Samples to be provided:** To be confirmed.
- **Products or executions:** Comply with specification requirements and in respect of the stated or implied characteristics:
To an express approval.
To match a sample expressly approved as a standard for the purpose.

340 Approval of products

- **Programme:** Undertake or arrange submissions, samples, inspections and tests to suit the Works programme.
- **Approval:** Relates to a sample of the product and not to the product as used in the Works. Do not confirm orders or use the product until approval of the sample has been obtained.
- **Retain:** Complying sample in good, clean condition on site. Remove when no longer required.

350 Approval of execution

- **Programme:** Undertake or arrange submissions, samples, inspections and tests to suit the Works programme.
- **Approval:** Relates to the stated characteristics of the sample. (If approval of the finished work as a whole is required this is specified separately). Do not conceal, or proceed with affected work until compliance with requirements is confirmed.
- **Retain:** Complying sample in good, clean condition on site. Remove when no longer required.

ACCURACY AND SETTING OUT GENERALLY

370 Accuracy of instruments

- **Measurement:** Use instruments and methods described in BS 5606, Appendix A.

380 Setting out

- **General:** Submit details of methods and equipment to be used in setting out the Works. Where installations are dependent upon site dimensions ensure that these are available before proceeding with the Works. Dimensions should not be scaled from drawings. Where dimensions are indicated on drawings check these on site, as

appropriate, to ensure building construction tolerances and manufacturing tolerances can be accommodated.

Equipment should not be ordered or manufactured using dimensions indicated on the Tender drawings.

- **Levels and dimensions:** Check and record the results on a copy of drawings. Notify discrepancies and obtain instructions before proceeding.
- **Completion of setting out:** Give notice before commencing construction.

400 Critical dimensions

- **Critical dimensions:** Set out and construct the Works in accordance with the critical dimensions and tolerances stated.

410 Setting out records

- **Record drawings:** Include details of grid lines, setting-out stations, benchmarks and profiles. Retain on site throughout the Contract and hand over on completion.

SERVICES GENERALLY

430 Services regulations

- **Services:** New and existing services must comply with the Byelaws or Regulations of the relevant Statutory Authority.

440 Water regulations and byelaws notification

- **Requirements:** Notify Water Undertaker of work carried out to or which affects new or existing services. Submit required plans, diagrams and details.
- **Consent:** Allow adequate time to receive Undertaker's consent before starting work. Inform immediately if consent is withheld or is granted subject to significant conditions.

450 Water regulations and byelaws Contractor's certificate

- **Content:**
 - **Installation:** Describe the new installation and/ or the work carried out to an existing installation, including the address.
- **Statement:** Confirm that the installation complies with the relevant Water Regulations or Bylaws.
 - **Inspection:** Provide the Contractor's name and address, the name and signature of the individual responsible for checking compliance and the date on which the installation was checked.
- **Submit:** Certificate on completion of the work, include a copy to the Water Undertaker.

460 Electrical installation certificate

- **Certification:** The original certificate is to be lodged in the Building Manual at the completion of relevant electrical work.

470 Gas, oil and solid fuel appliance installation certificate

- **Content:**
 - **Installation:** Describe the new installation and/ or the work carried out to an existing installation including the address.
 - **Safety:** Include special recommendations or instructions for the safe use and operation of appliances and flues.
- **Statement:** Confirm that the installation complies with the appropriate safety, installation and use regulations.
 - **Inspection:** Provide the Contractor's name and address, the date on which the installation was checked and the name, qualifications and signature of the competent person responsible for checking compliance.
- **Submit:** Before the completion date stated in the contract.
- **Certificate location:** Building Manual.

480 Mechanical and electrical services

- **Final tests and commissioning:** Carry out so that services are in full working order at completion of the Works.
- **Confirmation:** Provide a Building Regulations notice, signed by a suitably qualified person, to Building Control that systems have been commissioned in accordance with approved procedures.
- **Records:** A copy to be lodged in the Building Manual.

490 Air permeability

- **Method:** Pressure test in accordance with the ATTMA publication: TS 1: Measuring Air Permeability of Building Envelopes.
- **Requirement:** Refer to Main Contract Documents. and The air permeability of the building must be no worse than that defined within the Energy Strategy. Obtain, review, understand and comply with the requirements of this strategy.
- **Results:**
- **Copy:** Include in the Building Manual.

500 Continuity of thermal insulation

- **Record and report:** Confirm that work to new, renovated or upgraded thermal elements has been carried out to conform to the Specification.
 - **Content:** Address of premises, the Contractor's name and address, the name, qualification and signature of a competent person responsible for checking compliance and the date on which the installation was checked.
- **Submit:** Before completion of the Works.
- **Copy:** Include in the Building Manual.

520 Energy performance certificate

- **Assessment:** Undertaken by a member of an approved accreditation scheme. Submit details of scheme name and evidence of qualifications when requested.
- **Certificate to be provided by:** Contractor.
- **Building type:**
- **Method:** Dynamic System Modelling (DSM).

- **Format:**
- **Certificate:** Include in the Building Manual.
- **Report:**
- **Submittal date:**

QUALITY CONTROL

536 A Inspection before concealment

- **General:** Whenever work requiring inspection or testing is subsequently to be concealed give the following notice to the CA so that inspections may be made or tests witnessed before concealment.
- **Notice period:** 5 working days.

540 Proposals for rectification of non-compliant products and executions

- **Non-compliant items:**
 - **Opening up, inspection, testing, making good, adjustment of the Contract Sum, or removal and re-execution:** Submit proposals
 - **Submittal date:** So soon as possible after discovery of items which are or appear to be non-compliant.
- **Acceptability:** Such proposals may be unacceptable and contrary instructions may be issued.

550 Measures to establish acceptability

- **General:** Wherever inspection or testing shows that the work, materials or goods are not in accordance with the Contract and measures (e.g. testing, opening up, experimental making good) are taken to help in establishing whether or not the work is acceptable, such measures will be at the expense of the Contractor and will not be considered as grounds for revision of the completion date.

Works Contract Administration

USE OF DOCUMENTS

140 Dimensions

- **Dimensions:** Do not scale.

DOCUMENT AND DATA INTERCHANGE

200 Electronic Data Interchange (EDI)

- **Types and classes of communication:** Refer to Main Contract Documents and Where BIM is to be used, refer to BIM Strategy Document and all associated protocols.

DOCUMENTS PROVIDED BY CONTRACTOR

230 Additional copies of drawings and schedules

- **Additional copies:** In addition to those listed in the Main Contract Preliminaries the following will be provided in accordance with a programme to be agreed with the Contractor.
- **Details:**

300 Attendances

- **General attendance:** Listed in Main Contract Documents.
- **Special attendance:** Details of additional requirements by the Contractor must be submitted with the Contract tender.

380 Method statements

- **Method statements:** Prepare describing how and when the following procedures are to be carried out.
- **Procedures:** Refer to Main Contract Documents and Provide Method Statements for all risks identified within the Health and Safety Risk Assessment.
- **Submittal date:** With the tender.

420 Design documents

- **Scope:**
 - **Design drawings:** As defined within the completed BSRIA BG6/2012 responsibilities matrix.
 - **Technical information:** As defined within the completed BSRIA BG6/2012 responsibilities matrix.
- **Submittal date:** At the appropriate stage as defined within the completed BSRIA BG6/2012 responsibilities matrix and the programme. and Submit within the

timescales defined in the agreed Information Release Schedule and in any case not less than four weeks prior to installation of that part of the works.

430 Proposed manufacturers/ suppliers

- **Scope:** List details of products, equipment and plant.
- **Content:** Items for which the choice of manufacturer or supplier is at the discretion of the Contractor.
- **Submittal date:** Within one week of request.

460 Health and safety statement

- **Content:** Describe any significant and unavoidable hazards which may arise as a result of carrying out the work and the measures proposed to safeguard the health and safety of operatives and of any person who may be affected by the work.
- **Submit:** With the tender.

480 Health and safety file information

- **Information:** Provide as required by CDM Coordinator and Provide also information as defined elsewhere within this Specification.

650 Sub Contractors

- **List:** Details of portions of subcontract works to be sublet and names and addresses of proposed Subcontractors.
- **Submittal date:** With the tender.

680 Proposed manufacturers and/or suppliers

- **General:** Prepare a list, identifying all items for which the choice of manufacturer and/or supplier is at the discretion of the Contractor. Include details of choice and/or selection.
- **Submittal date:** With the tender.

INFORMATION

740 Proposed instructions

- **Estimates:** If a proposed instruction requests an estimate of cost, submit without delay and in any case within 5 working days.

750 Design and production information

- **General:** Complete the design and detailing of parts of the Works as specified.
- **Provide:**
 - **Production information:** Based on the drawings, specification and other information.
- **Liaison:** Ensure coordination of the work with related building elements and services.
 - **Additional information:** Request as necessary and provide information in time to meet the programme.

- **Submission to Contractor:** Until confirmed that resubmission is not required, resubmit for further checking and comment, and incorporate necessary amendments.
- **Design and production information:** Submit two copies, one can be returned with comments. Ensure that necessary amendments are made without delay.
- **Subcontractor's changes:** Support request for substitution or variation to requirements with relevant information.
- **Contractor's amendments:** If considered to involve a variation to the requirements, which has not already been acknowledged as a variation, notify without delay (maximum period 5 working days), and do not proceed until instructed. Claims for extra cost, if made after it has been carried out, may not be allowed.
- **Submittals:** Prior to any orders being placed the CA shall review all drawings and manufacturer's details. Submittals shall be in a clear, definable and easily read format with the specified technical details, notes, performance data and calculations where applicable all in the English language. Where drawings are to be examined, the manufacturer's details shown on the drawings must have been previously approved.

Include all costs for attending meetings associated with the submittal review procedure. Meetings will be held at intervals to be agreed. Agree with the CA where samples of materials offered for review are to be sent. Issue progressively drawings, calculations and submittals as agreed in advance with the CA for review. The timescale for review or comment or otherwise on all submittals shall be 10 working days from the date of receipt by the Mechanical and Electrical Services Consultant

- **Schedule of drawings and submittals:** Provide a schedule of all proposed drawings and submittals required for comment. The schedule shall be provided not more than 4 weeks from contract appointment and will indicate as a minimum the following information:
 - Drawing number and revision number
 - Drawing title and service
 - Scale
 - Latest date required on site and/or for manufacturing purposes
 - Date required for final comment
 - Date for submission for comment
 - Date of commencement of drawing production

The schedule shall be updated as necessary on a regular basis at intervals agreed with the CA during the contract period. The programme for production of drawings and other submittals should include the necessary time for:

- Submission
- Examination
- Alterations and re-submission in the event of the initial submission not being accepted
- Final issue

Allow adequate time in the programme in order not to cause delays. The full extent of all submittals shall be indicated in the schedule. Group submittals for a particular part of the building or building engineering service as agreed with the CA.

- **Review of submittals:** Submittals will be examined for compliance in principle with the design intent. Such examination shall not relieve any responsibilities and

obligations under the contract. Examination of any submittal by the CA shall not mean that the CA is responsible for the correctness of the drawing or submittal or its suitability for purpose. These responsibilities shall remain as defined elsewhere and as the contract. Allow adequate time in the programme for submittals with due allowance for incorporation of comments and resubmission in order not to cause delays.

Each package shall contain all drawings, design calculations, support information, manufacturer's literature, etc necessary to facilitate examination by the CA. Revised items on drawings shall be clearly indicated and annotated with a revision number/letter. All such revisions will be "clouded"

Submittals will be returned indicating "A", "B" or "C" action.

"A" action means that the submittal has been examined and the Examiner has no comments to make. The Contractor may proceed with the works as defined subject to the definition of responsibilities noted above.

"B" action means that the submittal has been examined and the Examiner has made some comments of a relatively minor nature. The Contractor may proceed with the works as defined subject to the definition of responsibilities noted above providing the comments made by the Examiner are incorporated into the design prior to the execution of the works.

"C" action means that the submittal has been examined and the Examiner has made some comments that are of a major nature. The Contractor may not proceed with the works but must instead amend the submittal in accordance with the Examiner's comments and re-submit the corrected submittal to the Examiner.

Drawings and submittals with "B" or "C" action shall be adjusted/revised for comments immediately and re-submitted to the CA within 10 working days or earlier if site progress dictates.

Where drawings are revised and updated during the construction stage these shall be issued to the CA for examination of the revision only, the revision being clearly marked.

Builder's work information and installation drawings shall not be examined in detail but shall be examined by the CA for general suitability. Record drawings are to be prepared as the contract works progress and shall be examined in the same manner as for other submittals.

The timescale for review or comment or otherwise of record drawings shall be 10 working days from the date of receipt by the Mechanical or Electrical Services Consultant.

- **Mistakes in submittals:** Examination and/or issue on a CA instruction of submittals shall not be deemed to remove any duties, obligations and responsibilities under the contract. The Contractor remains responsible for any error, discrepancy or omission in any submittal, presentation or drawing prepared or where others have prepared these for submittal. The said indemnity shall be subject to the proviso that such error, discrepancy or omission is not due to any inaccurate data, drawing or information provided by the employer or by the CA on his behalf.
- **Calculations:** All calculations must be presented in a logical format and prepared to a recognised and agreed format and be suitably indexed. All software programs used in the preparation of designs shall be agreed with the CA prior to commencement of design activities. The use of unverified software must be declared and the initial outputs justified by full and complete hand calculations.

Calculations that are preliminary in nature, i.e. do not form part of the final

submittal, are to be referenced independently and clearly indicated 'Preliminary'. State the methodology, formulae, design criteria, assumptions and all design margins used in the calculations. Where necessary, calculation sheets shall be accompanied by an annotated layout drawing identifying terminals, fittings and the particular sections of ductwork or pipework. Each calculation sheet, drawing or schedule shall clearly identify the originator, date of production, checker (who signs or initials) and date of check.

The timescale for review or comment or otherwise on all submittals shall be 10 working days from the date of receipt by the Mechanical and Electrical Services Consultant

- **Equipment performance details:** Details of the equipment selected for inclusion into the Works shall be provided, including the following information:
 - Plant item description, reference identification and serial number.
 - Electrical input rating - kVA, Volts, Phase.
 - Operating mode - duty, standby, generator etc.
 - Starting characteristics - starter type, current, starts/hour and starting time.
 - Performance characteristics - (full load current and power factor).
 - Noise level.
 - Weight.

The format of the information shall be as agreed with the CA.

755 A Format and number of submittals to be provided

- **All submittals will be issued to the:** CA and Engineer.
- **Design documents:** Agree with the CA, a document numbering system prior to preparing any documents. All drawings shall be prepared using a computer aided draughting (CAD) system and the software used to produce drawings shall be approved prior to commencement of drawing production. Each service shall be represented by a separate layer/overlay, for subsequent easy modification. Prior to commencement of drawing production agree the sequence of layers, pen colours and sizes.
- **Format:** The medium for transfer of information shall be paper and electronic CAD copies. AutoCAD drawing files shall be DWG format. Drawing plots shall be "A" size to British Standard, with an agreed logo/title block.
The standard drawing size is to be A1 and A0
Scales used on drawings shall be selected to convey clearly the proposals.
Building Information Models may be required as defined elsewhere in this Specification and the BIM Execution Plan.
- **Builderswork information:** Take responsibility for confirming and amplifying such information.
- **Provide initial copies for comment:** PDF format; comply with BS EN ISO 13456-1 and 13456-2.
- **Final copies for distribution:** PDF format; comply with BS EN ISO 13456-1 and 13456-2.

880 Defects in existing work report

- **Undocumented defects:** When discovered, immediately give notice. Do not proceed with affected related work until response has been received.
- **Documented remedial work:** Do not execute work which may hinder access to defective products or executions, or be rendered abortive by the remedial work.

- **Defects liability period:** Refer to Main Contract Documents and in any case will not be less than 12 months from the date of issue of the practical completion certificate for the works.
- **Defects liability:** If it is necessary to replace or renew any portion of the contract works as part of liability for defects, the defects liability period in respect of that portion of the contract Works shall be deemed to commence from the date of such replacement or renewal. The CA may require that new tests be carried out to demonstrate that the plant is continuing to work satisfactorily if the replacement or renewal may affect the efficiency of the Works or any portions thereof. In the remedying of defects in the contract Works, take all necessary precautions to minimise the risk of damage to the buildings, the decorations, the fittings and the equipment. In the event of such damage occurring bear the cost of replacement or making good, subject to the proviso of being granted the benefit of any settlement in respect of such damage accepted by the insurers under the insurance policies taken out in accordance with the requirements of the contract.

Agree with the CA a programme for the carrying out and the completion of any work not finally finished at the time of the contract Works being offered for acceptance and which does not prejudice the issue of a practical completion certificate. This work may be requested to be executed out of normal hours and no additional costs will be accepted for this action.

Prior to practical completion, submit a method statement for the approval of the CA outlining how the defects which arise during the defects liability period will be rectified to ensure that disruption to the use of the building is kept to a practical minimum. No additional costs will be accepted for undertaking works executed out of normal hours.

- **Right of access during defects liability period:** Right of access will not be unreasonably withheld, at all reasonable working hours and at own risk and expense, to any part of the contract works for the purpose of inspecting the working of the installations or to the records of the working and the performance thereof. Subject to CA approval, that shall not be unreasonably withheld, undertake any tests considered necessary at own risk and expense. During the defects liability period and all necessary remedial works and/or rectification of defective materials and equipment liaise closely with the Employer's staff. All such work shall be carried out in such a manner as to avoid or minimise shut-down time and inconvenience to the Employer.

900 Commissioning programme

- **Submittal date:** Four weeks (minimum) before commissioning commences.
- **Format:** Provide a detailed commissioning plan including; commissioning programme; method statements; statement of compliance with BSRIA and CIBSE commissioning guidance; details of the commissioning specialist to be employed (including details demonstrating their competence); details of interfaces with other sub-contractors; and qualifications and competency of the Commissioning Expert, specifically demonstrating compliance with BREEAM requirements.
- **Commissioning manager:** Submit proposals and Employ a specialist Commissioning Manager to oversee the commissioning process and to ensure that the BREEAM credits associated with commissioning can be achieved.

910 Performance testing programme

- **Submittal date:** Four weeks (minimum) before performance testing commences.
- **Format:** Undertake performance testing in accordance with the BSRIA Soft Landings principles;
Undertake seasonal re-commissioning and adjustment in accordance with BSRIA and CIBSE guidance;
and Ensure that the BREEAM credits associated with seasonal commissioning can be achieved.
- **Commissioning manager:** Submit proposals.

920 Maintenance instruction and guarantees

- **Components and equipment:** Obtain or retain copies, register with manufacturer and hand over when requested before completion of the Works.

Works Contract Completion

230 The Building Manual

- **Content:** The Contractor is wholly responsible for preparing the Building Manual.
- **Preparation:** Employ a competent specialist to create the Building Manual.
- **Latest date for submission;:** Not less than 4 weeks prior to the Handover date identified in the Master Programme.
- **Format:** Prepare the Building Manual in a paper format. and Prepare the Building Manual in an interactive electronic format, intuitively laid out and with appropriate hyperlinks between sections.
- **Number of copies:** 3.

231 A The Building User Guide

- **Content:** The Contractor is wholly responsible for preparing the Building User Guide.
- **Requirements:** The Building User Guide will be prepared in strict compliance with the contents and approach laid out in the BREEAM guidance appropriate to the Project.
- **Preparation:** Employ a competent specialist to create the Building User Guide.
- **Latest date for submission;:** Not less than 4 weeks prior to the Handover date identified in the Master Programme.
- **Format:** Prepare the Building User Guide in a paper format. and Prepare the Building User Guide in an interactive electronic format, intuitively laid out and with appropriate hyperlinks between sections.
- **Number of copies:** 3.

235 A Record Documentation

- **Standards:** Provide operating and maintenance manuals, system records and full documentation in accordance with the following standards:
 - BS EN 50131 / PD6662 - Intrusion systems.
 - BS 5839 - Fire detection and alarms in buildings.
 - BS 6651 - Protection of structures against lightning.
 - BS 7671 - Requirements for electrical installations (IEE Wiring regulations)
 - BS EN 12170 - Heating Systems with a trained operator
 - BS EN 12171 - Heating Systems not requiring a trained operator
 - Building Regulations / Building Standards
 - NACOSS requirements
 - ACPO requirements
 - Other relevant standards
 - Comply with the requirements of the CDM Regulations in providing the appropriate input to the health and safety file for the contract works.
- **Record documents:** Provide:
 - Record drawings and schedules.
 - Plant room and switch room drawings, schedules and schematics.
 - Operating and maintenance manuals.
 - Blank maintenance logs.
 - Log books in compliance with the Building Regulations (Approved Document Part L2A) and in accordance with CIBSE Technical Memorandum TM 31.

- Ensure record documents clearly record the arrangements of the various sections of the Works as actually installed and identify and locate all component parts.
 - Ensure record documents make it possible to comprehend the extent and purpose of the Works and the method of operation thereof.
 - Ensure record documents set out the extent to which maintenance and servicing is required and how, in detail, it should be executed.
 - Ensure record documents provide sufficient, readily accessible and proper information to enable spares and replacements to be ordered.
 - Correlate record documents so that the terminology and the references used are consistent with those used in the physical identification of the component parts of the installations.
 - Demonstrate as required throughout the execution of the contract works that complete and accurate records are being maintained and that the record documents are being progressively compiled as the work on site proceeds.
 - Ensure that building log books contain all the information necessary to comply with the Building Regulations Part L2A.
- **Record drawings and schedules:** Prepare record drawings and schedules based on the As Installed Drawings maintained on site during the progress of the contract works. The scale of the drawings shall be not less than 1:50.

Each record drawing shall be endorsed "Record Drawing" and will show the following information:

- The name of the contract and, where appropriate, the zone or floor designation.
- Description of drawing, drawing reference and scale.
- Name and address of the installer and the consultant.

Where agreed with the CA certain detailed information may be provided in schedule form. Where portions of the work are to be concealed, draft copies of record drawings shall be supplied to the CA before the work is concealed in order to facilitate checking and examination.

Prepare electrical drawings in accordance with BS EN 61082.

Issue at practical completion the complete approved package of record drawings in the following format, the number of sets required corresponding to the number of Building Manuals specified above:

- CAD format on CD disk. Each CD shall be labelled and the CD jewel cases shall be labelled identifying project title, issue date and index of contents.
- Provide reduced scale copies for inclusion in the operating and maintenance manuals as stated elsewhere.

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, emergency shut-off isolation locations, pressure and/or other relevant information.
- Disposition and depth of all underground systems.
- Schematic drawings of each system indicating principal items of plant, equipment, zoning, means of isolation, etc in sufficient detail to make it possible to comprehend the system operation and the inter-connections between various systems.
- Details of the principles of application of automatic controls and instrumentation.
- Diagrammatic dimensioned plans and sections of each system or service showing sizes and locations of all ancillaries, plant, equipment controls, test points, and means of isolation etc. including any items forming an integral part of the

engineering systems provided by others (such as plenum ceilings, builders' work shafts, chimneys etc.).

- Identification of all terminals/cables etc. by size/type and duty/rating as recorded from the approved commissioning results.
- Detailed wiring drawings/diagrams/schedules for all systems, including controls, showing origin, route, cable/conduit size, type, number of conductors, length, termination size and identification, and measured conductor and earth continuity resistance of each circuit. Ensure routes indicate if cable/conduit is surface mounted, concealed in wall chase, in floor screed, cast in-situ, above false ceiling etc.
- Details of co-ordination of wiring and connections with cable core identification, notation of fire alarm, security, control and instrumentation and similar systems provided as part of the Works.
- Details to show inter-connections between the Works and equipment or systems provided by others to which wiring and connections are carried out as part of the Works.
- Location and identity of each room or space housing plant, machinery or apparatus.
- Dimensioned plans and sections (to at least 1:50 scale) of plantrooms, service subways, trenches, ducts and other congested areas where in the opinion of the CA smaller scale drawings cannot provide an adequate record. Indicate the location, identity, size and details of each piece of apparatus.
- Manufacturer's drawings of equipment indicating general arrangement and assembly of component parts which may require servicing as well as 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.
- 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.

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 etc
 - alarm priority
 - control specification reference
 - any other such applicable parameters
 - each spare input and output point including reference, type of input/output and space for future entry of appropriate parameters as listed above.
- **Plant room and switchroom drawings, schedules and schematics:** Provide good quality plant and switch room drawings, schedules, schematics and instructions and hang in the respective plant room or any other appropriate location or where directed by the CA. Protect surfaces of such information by framing under glass or other rigid, transparent, cleanable and protective surface. Hang using suitable fixings and provide backboards if necessary. A sample shall be submitted for approval to the CA prior to commencing production.

Provide:

- Schematic drawings of circuit layouts must show the location, identification and duties of equipment, the location of controls devices and circuit layouts as a minimum.
- Valve schedules in the form of printed sheets showing the number, type, location, application/service and symbol, and normal operating position of each valve.
- Control schematics.

Identify:

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

Prepare electrical drawings in accordance with BS EN 61082.

- **Presentation of the Operating and Maintenance Manuals:** Agree format and contents with the CA. Provide the operating and maintenance manuals in the following form:
 - Encase the manuals in A4 size, plastic-covered, loose leaf, four ring binders with hard covers, each indexed, divided and appropriately cover- titled. Fold drawings larger than A4 and include in the binder so that they may be unfolded without being detached from the rings.
 - Electronic format stored on CD

Provide a draft copy of the operating and maintenance manual to the CA for comment not less than 4 weeks before the contract completion date. The draft copy of the manual shall conform to the final format required by the specification to enable all relevant comments to be made by the CA.

- **Operation and Maintenance Manuals:** The operating and maintenance manuals must include:
 - A full description of each of the systems installed, written to ensure that the Employer's staff fully understand the scope and facilities provided.
 - A description of the mode of operation of all systems including services capacity and restrictions.
 - Diagrammatic drawings of each system indicating principal items of plant, equipment, valves etc.
 - A photo-reduction of all record drawings together with an index. Reduced size of drawings to be 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 maintenance agreements offered by subcontractors and manufacturer's.
- Copies of insurance and inspecting Authority certificates and reports.
- Starting up, operating and shutting down instructions for all equipment and systems installed.
- Control sequences for all systems installed.
- Schedules of all fixed and variable equipment settings established during commissioning.
- Procedures for seasonal change-overs and/or precautions necessary for the care of apparatus subject to seasonal disuse.
- Detailed recommendations for the preventative maintenance frequency and procedures which should be adopted by the Employer to ensure the most efficient operation of the systems.
- Details of lubrication for lubricated items including schedules of lubricant type, frequency, etc.
- Details of regular tests to be carried out (e.g. water analysis for pseudomonas.)
- 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 programmes.
- 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.
- Contractual and legal information including but not limited to
 - details of local and public authority consents
 - details of design team, consultants, installation contractors and associated subcontractors
 - start date for installation, date of practical completion and expiry date for the defects liability period
 - details of warranties for plant and systems including expiry dates, addresses and telephone numbers.

250 Completion and Handover

- **General:** This Clause details the requirements and procedures for completion and handover.
- **Handover requirements:** As a pre-requisite to Practical Completion in respect of the contract works or part thereof, demonstrate to the satisfaction of the CA that:
 - All the contract works are complete with the exception of minor snags or limited defects as agreed with the CA that could be reasonably completed within an agreed

programme without causing disruption to the Employer's use of the building or part thereof.

- All spares, keys, tools and other consumables as stated elsewhere have been supplied and handed over to the Employer.
- The instruction of the Employer's staff in the use and correct operation of the installation has been completed satisfactorily. In particular, safety devices and controls demonstration.
- All commissioning and testing completed including the issue of a final commissioning report signed by an approved competent person
- A complete demonstration of the contract works with fully functional operational controls tested has been undertaken in the presence and to the satisfaction of the CA.
- All necessary certification by the Employer's insurers has been completed.
- All approved record documentation including record drawings, operation and maintenance manuals, etc is issued
- All information required for the health and safety file is issued to the satisfaction of the CDM Coordinator.
- All necessary Statutory Authority approvals have been undertaken and written confirmation established
- Completion and issue of log books in accordance with Building Regulations / Standards and in accordance with CIBSE TM 31 Building Log Book Toolkit (standard templates)
- Air permeability test certificate has been provided in accordance with Building Regulations.

Should adequate record documentation not be available Practical Completion will not be granted.

- **Reading of meters:** Record readings of all water, gas, and electricity meters immediately on completion of the Works and forward to the CA.
- **Recommended spare parts:** Not less than 4 weeks before Practical Completion, submit to the CA a schedule of spare parts as stated elsewhere and recommend any that should be obtained and kept in stock by the Employer for maintenance of the installations included in the Works. State against each item the manufacturer's current price, including packaging and delivery to site. Identify those items that are additional to those specified for inclusion as stated elsewhere.
- **Initial supply of additional spare parts:** Within 4 weeks of request, submit to the CA a quotation, priced in detail, for the initial supply to the Employer of the additional spare parts identified elsewhere and including for:
 - Checking that each spare part is suitable for the replacement of the corresponding part supplied with the item of plant or equipment.
 - Checking receipt, marking and numbering in accordance with the schedule of spare parts.
 - Referencing to the plant and equipment list in the operation and maintenance manual.
 - Painting, greasing, etc. and packing to prevent deterioration during storage.
- **Recommended tools:** Not less than 4 weeks before Practical Completion submit to the CA a schedule of tools and portable instruments as stated elsewhere and recommend any that should be obtained and kept in stock by the Employer for maintenance of the installations included in the Works. State against each item the manufacturer's current price, including packaging and delivery to site. Identify those items that are additional to those specified for inclusion as stated elsewhere. Submit to the CA a quotation, priced in detail, for the initial supply to the Employer of the additional tools identified under the clause headed 'recommended tools'.

Include for the following.

- Checking that each item is suitable for the intended application.
- Checking receipt, marking and identifying.
- Referencing, where appropriate, to the plant and equipment list in the Operation and Maintenance Manual.
- Protecting, greasing, etc. and packing to prevent deterioration.
- Providing a suitable means of storing and securing same.

- **Supply of tools:** Not less than 4 weeks before Practical Completion provide all tools, keys and portable instruments as detailed elsewhere prior to practical completion and additional items if so instructed by the CA.

- **Inspection by Employer's Insurers:** Where indicated elsewhere, installations, equipment, plant or materials are to be inspected by a representative acting for the Employer's insurers.

The installations, equipment, plant or materials shall satisfy the insurance company's requirements in all respects. Make provision to:

- Inform the CA when the installation or equipment is ready for examination
- Provide a programme for the inspection and certification by the Employer's insurers.
- All necessary information shall be provided to enable the insurers to approve the design before manufacture.
- Arrange for the attendance of the insurance company's representative at agreed stages of manufacturer and installation.
- All necessary attendance, access and facilities for inspecting and testing as is required shall be provided.
- Certification shall have been received from the insurers before equipment or installations subject to inspection and certification will be accepted on behalf of the Employer.

The order with the insurance company will be placed by the Employer. All insurance company charges will be paid for by the employer but included in the contract price. All other costs associated with such inspections shall be included in the contract price.

- **Training of Employer's staff:** Not less than 4 weeks before Practical Completion, explain and demonstrate the purpose, function and operation of the installations including all items and procedures listed in the operation and maintenance manual to the Employer's maintenance staff and to the operational staff. Submit to the CA for approval, a detailed programme for the training of the Employer's staff.

Employ the services of relevant specialists and suppliers for the purpose of training and instruction. Provide each person with a comprehensive set of teaching notes and diagrams. Be responsible for the correct operation and maintenance of the installation during such periods of instruction. All costs associated with the instruction of the Employer's personnel and required attendance following practical completion shall be included in the contract price.

Following practical completion and occupation be available for a period as agreed with the CA to assist the Employer's personnel in the operation of the various systems together with the:

- controls specialist
- commissioning specialist
- fire alarm specialist
- intruder alarm specialist
- lighting controls specialist

- disabled alarms specialist
- induction loop specialist
- emergency voice communication specialist
- lightning protection specialist

Training

Number of persons to be included for training is a minimum of 4. Include for not less than indicated number of operating days for this purpose and demonstrate the safe day to day running and maintenance of all systems, plant and equipment. Provide training for the operation of the controls, monitoring or BMS installations as follows. Carry out initial training at the works of the controls supplier and 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 all appropriate reference and training manuals and complete initial instruction prior to commissioning of the installed system. Provide site instruction on the installed system.

250 A Maintenance

- **General:** The Contractor will submit a cost for undertaking all maintenance for the works under a separate contract to be entered into directly with the Client or another nominated party. The maintenance contract may or may not be entered into, however the Contractor will prepare a comprehensive maintenance offer for all installations forming part of the works.
- **Contract start:** The maintenance contract will (if entered into) commence on the date that the certificate of Practical Completion was issued.
- **Contract duration:** 12 months.
- **Type of service:** Planned preventative maintenance.
- **Scope of service:** The maintenance works shall include:
 - Planned preventative maintenance to maintain the installations in efficient working order including routine checks, adjustments, lubrication and replacement of consumable spares, etc
 - Preparation of work schedules and recording activities
 - Providing breakdown and emergency cover
 - Planning and undertaking shut-downs for maintenance works
 - Employing of all necessary specialist maintenance
 - Attendance on and supervision of specialist maintenance
 - Carrying out all necessary safety checks
 - Carrying out system proving of the works to include the measuring, recording, evaluating and reporting on the seasonal performance of the systems against their design values
 - Water sampling including laboratory analysis and monitoring of heating, chilled, domestic water systems
 - Liaison with the employer
- **Standards:** Maintenance will be undertaken in accordance with industry best practice and recommendations for the relevant system or equipment.
- **Response times:** Not more than 6 hours.

Above-ground wastewater drainage system with internal stacks

System outline

Above-ground wastewater drainage system with internal stacks

- **Description:** All services with the exception as listed below and as noted on the drawings shall be isolated, stripped out and made safe, prior to the demolition. The redundant equipment shall be stripped out and safely removed and disposed, and/or handed back to the Client.
All services stripped out to the area demarcation line to be made safe at this point. The redundant services should not pose a health and safety risk. All cable containment and pipes shall be capped off at this point.
The Contractor should ensure no sharp edges.
All circuits to be disconnected from the point of the origin and clearly labelled as redundant. Other areas are to be retained in use during the course of the works. It is therefore imperative that these systems are maintained through out these works and any downtime is agreed with the Client.

The above ground foul and waste drainage system will connect to all sanitary appliances, basins, sinks, safety relief drains, and condensate drains as follows.

- G.09 Museum Office - Retain existing drainage serving office sink.
- G.14 Refreshments - Supply and install new waste from existing sink, dishwasher and electric water heater safety relief discharge. Route new waste pipe to connect to new waste in B.13 Baby Change, which then connects to existing WC drain in B.12 WC 02.
- B.01 Museum Makers Workshop - Supply and install new waste from new sink and connect to new drainage in B.20 Lightwell by others. Connect safety relief drain from electric water heater to new waste pipe at low level.
- B.05 Staff - Retain existing waste pipe from B.10 Storage to B.05 Staff and provide adequate supports. Provide new waste pipe from sink to exiting waste pipe and connect new electric water heater safety relief drain.
- B.10 Storage - Retain existing waste pipe and provide adequate supports. New AC Condensate drain connects into existing waste pipe.
- B.11 & 12 - WC 01 & WC 02 - Supply and install new condensate drain from MVHR unit and connects into new waste pipe at low level with waterless trap. Reconnect existing WC drain discharge to below with new WCs. Cut back redundant WHB waste pipe and install new waste pipe from g.14 Refreshments, B.13 Baby Change, B.11 WC 01 and -B.12 WC 02.
- B.13 Baby Change - Supply and install new waste from WHB and connect to existing WC drain in B.12 WC 02.
- B.18 IT - Supply and install new condensate drain from high level wall mounted AC unit with waterless trap and connects into existing waste pipe in B.10 Storage.

The drainage system has been designed and installed to achieve the following:

- Prevent the transmission of foul air in to the building
 - Minimise the frequency of blockages and provide adequate pipe access to enable the effective clearance of any blockages
 - Minimise the risk of flooding to any part of a building, especially where the floor level is located below normal ground level
 - Pipework has been kept as short as possible, with the fewest number of bends, and installed with an adequate gradient.
- For the specification of the below ground drainage system the Contractor shall refer to the Civil Engineering Specification.

The above ground foul and waste drainage will be designed and installed in accordance with the following:

- BS EN 12056: 2
- Building Regulations Approved Document H (2002)
- Institute of Plumbing - Plumbing Engineering Services Design Guide.

Air Admittance valves have not be used within any part of the above ground drainage installation due to the risk of odours and bacteria entering the building as a result of failure.

Stub Stacks will be limited to a maximum cumulative load of 5 l/s with a maximum height above the invert level of the drain for WC Branch connections of 2.5m and all other appliance connections of 1.5m.

Each appliance will be provided with the minimum depth of trap as the following table.

Use Seal

Showers which discharge to a stack. 50 mm

Showers located at ground floor level, which discharge to a gully having a grating. 38 mm

Wash Basins with spray taps, and no outlet plug. 50 mm

Appliances with an outlet bore of 50mm or larger. 50 mm

All other appliances. 75 mm

The above ground foul and waste drainage system has been based on a primary ventilated system (single stack principle). This will connect to the below ground foul drainage system, for details refer to the civil engineering specifications and drawings.

Where any branch doesn't comply with the requirements for unventilated branches, additional branch venting has been provided. A minimum distance of 740mm shall be provided between the invert level of the drain connection and the centre line of the lowest discharge branch connection to the stack.

At the top of each discharge stack the vent pipe diameter shall be equal to the stack diameter. The termination of each soil vent stack, SVP shall be fitted with a durable and secure domical cage, which is resistant to bird nesting and movement by vermin. Ventilation stacks will terminate outside the building and positioned as indicated upon the Architectural drawings.

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

ground drainage system that is adequately ventilated.

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

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

Where pipework passes through fire compartments these shall be suitably protected with intumescent seals as required.

The contractor shall install rodding points to allow clearance of blockages to any discharge pipe which cannot be reached by removing appliances with internal traps and provides at each floor level for stacks and vent pipes. Rodding access shall be provided before all waterless 'Hepvo' traps.

For the specification of WC pans refer to architectural specification.

- **System manufacturer:** Terrain or equal and approved
- **Floor drainage:**
 - **Preparation to existing floors:** Contractor's design.
 - **Floor channels and gullies:** Floor channels and Floor gullies.
 - **Covers and gratings:** Covers and gratings for floor channels and Covers and gratings for floor gullies.
 - **Fixing:**
 - Bedding:** Contractor's design.
 - Backfill:** Contractor's design.
 - Securing:** Included.
 - **Supports:**
 - Fixings:**
 - Bedding:**
 - Backfill:**
- **Sanitary pipework:**
 - **Small diameter branch discharge pipework:**
 - Traps:** Sanitary appliance traps.
 - Pipelines and fittings:** Modified unplasticized polyvinyl chloride (MUPVC) above ground wastewater branch discharge pipes and Unplasticized polyvinyl chloride (PVC-U) above ground drainage pipes.
 - Accessories for jointing:** Solvent welding cement.
 - Supports:** Brackets and clips for above ground drainage pipes.
 - Accessories for fixing:** Included.
 - Fixings:**
 - **Large diameter branch discharge pipework:**

Pipelines and fittings: Modified unplasticized polyvinyl chloride (MUPVC) above ground wastewater branch discharge pipes and Unplasticized polyvinyl chloride (PVC-U) above ground drainage pipes.

Accessories for jointing:

Supports:

Accessories for fixing:

Fixings:

Insulation:

– **Discharge stack pipework:**

Pipelines and fittings: High density polyethylene (HDPE) above ground drainage pipes and Unplasticized polyvinyl chloride (PVC-U) above ground drainage pipes.

Accessories for jointing: Solvent welding cement.

Supports: Brackets and clips for above ground drainage pipes.

Accessories for fixing: Included.

Insulation:

Fixings:

• **Ventilating pipework:**

– **Ventilating branch pipework:**

Pipelines and fittings: Unplasticized polyvinyl chloride (PVC-U) above ground drainage pipes.

Accessories for jointing: Solvent welding cement.

Supports: Brackets and clips for above ground drainage pipes.

Accessories for fixing: Included.

Fixings:

– **Ventilating stack pipework:**

Pipelines and fittings: Unplasticized polyvinyl chloride (PVC-U) above ground drainage pipes.

Accessories for jointing: Solvent welding cement.

Supports: Brackets and clips for above ground drainage pipes.

Accessories for fixing: Included.

Fixings:

• **Overflow pipework:**

– **Pipelines and fittings:** Copper above ground wastewater branch discharge pipelines.

– **Accessories for jointing:** Cappillary or Pressfit (As Mappress or similar)

– **Supports:** Brackets and clips for above ground drainage pipes.

– **Accessories for fixing:** Included.

– **Fixings:**

• **Pipework identification:** Not required.

• **Fire stopping:**

– **Floor penetrations:** Intumescent collars.

– **Wall penetrations:** Intumescent foam.

• **System accessories:** Access fittings;

Air admittance valves;

Discharge and ventilating stack terminations;
and Masking plates.

- **Execution:** Installing above ground wastewater drainage systems;
Installing above ground wastewater drainage discharge branch pipework;
Electrical continuity of above ground wastewater drainage pipework;
and Access to above ground wastewater drainage systems for testing and maintenance.
- **System performance:**
- **System completion:**
- **Insulation:**
- **Fixings:**

Products

Copper above ground wastewater branch discharge pipelines

- **Standard:** To BS EN 1057.
- **Grade:** Half hard, R250.
- **Jointing type:**
- **Finish:** Plain.

Modified unplasticized polyvinyl chloride (MUPVC) above ground wastewater branch discharge pipes

- **Manufacturer:** Polypipe Terrain MUPVC or equal and approved
- **Diameter:** Refer to Contract drawings
- **Standards:** To BS 5255
- **Colour:** White
- **Accessories:** Access fittings;
Noise reducing gaskets for brackets;
- **Jointing type:** Solvent weld
- **Nominal sizes:** See contract drawings
- **New clause item 1:** Grey
- **Installation:** Pipework system to include provision for expansion by the installation of purpose made fittings.

Brackets and clips for above ground drainage pipes

- **Manufacturer:** Polypipe Terrain or equal and approved
- **Pipe location:** Internal.
- **Form:** Pipe clips and Stand off pipe clips.
- **Material:** HDPE and Plastics.
- **Finish:** To match pipelines.
- **Installation:** Brackets and clips to be installed at distances in accordance with manufacturers guidelines, allowing for thermal movement and avoiding pipe deflection

High density polyethylene (HDPE) above ground drainage pipes

- **Manufacturer:** Polypipe Terrain or equal and approved
- **Product reference:** Fuze HDPE Pipework.
- **Standard:** To BS EN 1519-1
- **Bracketry:** Matched to pipework solution, installation position and temperatures.
- **Jointing:** Electrofusion To BS EN 12201-3 . Socket and spigot To BS EN 12201-3
- **Colour:** Black
- **Accessories:** Access fittings;
Noise reducing gaskets for brackets;
- **Installation:** To be installed in accordance with the pipework suppliers recommended installation procedures relevant to the project setting. Pipework shall be adequately supported to manufacturers recommendations and shall be free to expand without noise interference to the local area.
- **Execution:** Fixing and jointing rainwater and above ground drainage pipes.

Unplasticized polyvinyl chloride (PVC-U) above ground drainage pipes

- **Manufacturer:** Polypipe Terrain or equal and approved
- **Standard:** BS 4514 and BS EN 1329-1
- **Jointing:** Solvent weld
- **Colour:** Stacks and hidden pipework to be Black .White pipework in areas that are on view .
- **Pipe:** Plain end.
- **Accessories:** Access fittings;
Noise reducing gaskets for brackets;
- **Installation:** To be installed in accordance with the pipework suppliers recommended installation procedures relevant to the project setting. Pipework shall be adequately supported to manufacturers recommendations and shall be free to expand without noise interference to the local area.
- **Execution:** Fixing and jointing rainwater and above ground drainage pipes.

Masking plates

Shared by: 50-10-05/120 Above-ground wastewater drainage system with internal stacks; 55-40-40/120 Cold water supply system; and 60-45-40/110 Low temperature hot water heating system.

- **Manufacturer:** Contractor's choice.
- **Material:**
 - **All pipes except chromium plated copper:** Plastic.
- **Format:** Split.

Sanitary appliance traps

- **Manufacturer:** Polypipe Terrain or equal and approved
- **Standard:** To BS EN 274-1.

Discharge and ventilating stack terminations

- **Manufacturer:** Contractor's choice.

- **Arrangement:** Perforated cover or cage that does not restrict airflow.
- **Material:** Plastics, as discharge stack.

Air admittance valves

- **Manufacturer:** FloPlast Ltd.
- **Product reference:** Contractor's choice.
- **Standard:** To BS EN 12380.
- **Material:** Contractor's choice.
- **Jointing:** Manufacturer's standard.
- **Minimum air flow rate:** To BS EN 12056-2.

Execution

Installing above ground wastewater drainage systems

- **Standards:** To BS EN 12056-2 and BS EN 12056-5.
- **Collection and distribution of wastewater:**
 - **General:** Quick, quiet and complete; self-cleansing in normal use, without blockage, crossflow, backfall, leakage, odours, noise nuisance or risk to health.
 - **Pressure fluctuations in pipework (maximum):** ± 38 mm water gauge.
 - **Water seal retained in traps (minimum):** 25 mm.
- **Pipelines:** Plumb and/ or true to line.
 - **Routes:**

Routes generally: The shortest practical, with as few bends as possible.

Routes not shown on drawings: Submit proposals.
 - **Jointing:** Joint with materials, fittings and techniques intended for the purpose and that will make effective and durable connections.
- **Allowance for thermal and building movement:** Provide and maintain clearance as fixing and jointing proceeds.
- **Concealed or inaccessible surfaces:** Decorate before starting work specified in clauses from this section.
- **Electrolytic corrosion:** Avoid contact between dissimilar metals where corrosion may occur.
- **Protection:**
 - **Purpose made temporary caps:** Fit to prevent ingress of debris.
 - **Access covers, cleaning eyes and blanking plates:** Fit as the work proceeds.

Installing above ground wastewater drainage discharge branch pipework

- **Pipework:**
 - **Alignment:** Fix securely plumb and/ or true to line.
 - **Branches and low gradient sections:** Fix with uniform and adequate falls to drain efficiently.
 - **Socketed pipes and fittings:** Fix with sockets facing upstream.
 - **Additional supports:** Provide as necessary to support junctions and changes in direction.

- **Wall and floor penetrations:**
 - **Isolating pipework:** Isolate pipework from structure, e.g. with pipe sleeves.
 - **Masking plates:** Fix at penetrations if visible in the finished work.

Electrical continuity of above ground wastewater drainage pipework

- **Joints in metal pipes with flexible couplings:** Make with clips (or suitable standard pipe couplings) supplied for earth bonding by pipework manufacturer to ensure electrical continuity.

Access to above ground wastewater drainage systems for testing and maintenance

- **General:** Install pipework with adequate clearance to permit testing, cleaning and maintenance, including painting where necessary.
- **Access fittings and rodding eyes:** Position to avoid obstruction.

Fixing and jointing rainwater and above ground drainage pipes

Shared by: 90-10-20/348 High density polyethylene (HDPE) above ground drainage pipes; and 90-10-20/354 Unplasticized polyvinyl chloride (PVC-U) above ground drainage pipes.

- **Fixing:**
 - **Supports:**

Stability: Fix securely.

Fixing centres (nominal): 1.8 m and At least at every storey level.
Tighten fixings as work proceeds so that every storey is self-supporting.
 - **Pipework:**

Alignment: Plumb and/ or true to line.

Externally socketed pipes and fittings: Fix with socket ends forming inlet for each individual pipe.
- **Jointing:**
 - **Jointing differing pipework systems:** Use adaptors intended for the purpose.
 - **Cut ends of pipes:** Clean and square. Remove burrs and swarf. Chamfer ends of plastics pipes before inserting into ring seal sockets. Where metal pipes are to be used, recoat bare metal with appropriate primer and paint.
 - **Jointing or mating surfaces:** Clean and, where necessary, use jointing lubricant immediately to allow safe and efficient jointing assembly.
 - **Unsealed joints:** Wedge unsealed joints to cast pipes with timber or sheet lead cut-offs to centralize pipe joints and reduce rattling.
 - **Expansion joint pipe sockets:** Fix rigidly to buildings. Elsewhere, provide brackets and fixings that allow pipes to slide.
 - **Solvent welded pipelines:** Install ring seal joints in all long runs of solvent welded pipework, as movement joints.
- **Wall and floor penetrations:** Isolate pipework from structure

Ω End of system

Cold water supply system

System outline

Cold water supply system

- **Description:** All services with the exception as listed below and as noted on the drawings shall be isolated, stripped out and made safe, prior to the demolition. The redundant equipment shall be stripped out and safely removed and disposed, and/or handed back to the Client.
All services stripped out to the area demarcation line to be made safe at this point. The redundant services should not pose a health and safety risk. All cable containment and pipes shall be capped off at this point.
The Contractor should ensure no sharp edges.
All circuits to be disconnected from the point of the origin and clearly labelled as redundant. Other areas are to be retained in use during the course of the works. It is therefore imperative that these systems are maintained through out these works and any downtime is agreed with the Client.

The Contractor shall extend mains water services from the system water supplies to hot water heaters as identified upon the contract drawings and within this specification.

The water pressure shall be suitable to meet the minimum pressure requirement at all outlets positions as defined within this specification or as separately defined for equipment supplied by third party specialists. The water pressure shall be suitable for the pipework material and its rating and any fittings provided in the system. Mains water systems must be designed in compliance with the requirements of local utility suppliers and the latest edition of the water regulations.

- G.09 Museum Office - Retain existing MCW supply from below to existing sink.
- B.01 Museum Makers Workshop - Install new over sink water heater complete with associated valves and expansion. Extend new MCW from existing to follow route of LTHW heating pipework (below heating pipework to reduce any heat gain).
- B.05 Staff - Install new under sink water heater complete with associated valves, expansion and backflow protection. Extend new MWS from existing. Extend new MWS to new dishwasher with appropriate backflow protection.
- B.08 Lobby - New MWS routed at high level through room.
- G.14 Refreshments - Install new under sink water heater complete with associated valves and expansion and backflow protection to serve new double sink unit. Extend new MWS from existing. Extend new MWS to new dishwasher with appropriate backflow protection.
- B.12 WC 02 - Install new high-level water heater complete with associated valves, expansion and backflow protection to serve new WHBs in WC 01 & 02 and B.13 Baby Change. Extend new MWS from existing to serve new WHBs & WCs in WC 01 & WC 02 and B.13 Baby Change.

- **System performance:**
Contractors Responsibilities

The Contractor shall include for all necessary tools, labour materials and equipment to develop the design, supply, install, co-ordinate with other contractors, test,

commission and set to work the following as a minimum to meet the functional and performance criteria specified within this specification.

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

Function/Objectives

To provide mains cold water for use within the building as identified on the contract drawings.

Applicable Standards

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

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

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

Initial Testing Procedures

Immediately after project award, the Contractor shall undertake a water sample analysis of the potable water supply to ascertain mineral composition, identify its hardness and shall include TVC pseudomonas and sulphate reducing bacteria levels analysis.

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

Category Backflow Protection

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

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

Backflow protection shall be afforded not only to the utility main but also between outlets within the building network.

Pipeline Materials & Distribution

All internal pipework shall be installed using Copper tubing. Jointing shall be undertaken using;

- compression fittings

- end feed fittings

Where exposed to view in WC areas, Kitchens and bathrooms all pipework shall be chromium plated.

The Contractor should seek guidance from the consultant to the appropriate installation material where any doubt exists.

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

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

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

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

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

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

Where pipes penetrate walls, sleeves shall be provided.

All pipework connections to appliances shall be provided with isolating valves.

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

Make final connections to equipment in accordance with manufacturer's instructions and as indicated.

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

Dead legs shall be kept to an absolute minimum; dead legs to basins with blending valves to be within 300mm of the valve.

Contractor shall trace existing pipework and cut back any and all dead legs to nearest live main.

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

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

Insulation

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

- o Internal Exposed - Rigid PVC (Isogenopack)
- o Internal Exposed Valve - No insulation
- o Ceiling voids - Foil finish
- o Internal Services Ducts - Foil Finish
- o Within Internal Boxing - Foil Finish
- o Valves in roof voids, internal ducts, boxings etc. - Foil finish

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

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

Cold water pipework - 0.05g/sMN

Chilled water pipework - 0.015g/sMN

Refrigeration pipework and chilled/glycol pipework below 0°C - 0.010g/sMN

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

Detailed guidance on the thermal insulation of pipework and ductwork is given in TIMSA guidance for achieving compliance with Part L of the Building Regulations. Where externally routing, below ground pipework is installed at depths less than 750mm below the finish floor level insulation shall be provided for frost protection.

Labelling

Pipework shall be identified in accordance with BS1710

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

All valves located in plant rooms, service voids or where adjacent to plant shall be identified. The identification shall be in the form of either a brass or traffolite disc, permanently chained to the valve with chromium plated brass chain, bearing a reference number corresponding with that on the framed and glazed valve chart. The Contractor shall supply and install at all nominated cold water drinking outlets, a small white traffolite label with black lettering, to read - DRINKING WATER. The Contractor shall provide and install at all unblended hot water outlets, a small red traffolite label with white lettering to read - VERY HOT WATER. Labels shall be fixed by means of chromium plated dome-head screws to the wall surface immediately behind and above the relevant tap.

Pipework Accessories & Valves

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

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

Safety Relief Valves and Expansion vessels

All heat generating equipment and all vessels/pipework subjected to a pressure greater than atmospheric, shall be fitted with a Safety Relief Valve and suitably sized expansion vessel in accordance with the manufacturers recommendations. All valves shall incorporate a padlock or lead seal to lock the set pressure and to obviate unauthorised tampering. Safety Relief Valves shall be mounted vertically and fitted directly to the equipment/system with the minimum possible length of pipe and no intervening valve or other restriction. Discharges from relief valves fitted to systems

operating at up to 90°C shall be routed to terminate 200mm above floor level with an anti-drip profile.

All pipework routing from safety relief valves shall be installed in Copper tubing.

Potable Water Testing/Handover Procedures

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

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

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

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

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

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

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

Additional documents

See Document issue sheet for all relevant drawings and schedules.

- **Arrangement:** Mains.
- **Water meters:** Water meters.
- **Pipelines:**
 - **Above ground:** Copper pipelines.
- **Pipeline accessories:**
 - **Expansion devices:** Contractor's design.
 - **Gauges:** Pressure gauges.
 - **Accessories:** Masking plates;
Pipeline strainers;
Pipe sleeves;
and Tundishes.
- **Valves:**
 - **Isolating valves:** Ball valves type A and Copper alloy gate valves.
 - **Check valves:** Cast iron check valves type A.
 - **Regulating valves:** Flow measuring devices type A.
 - **Mixing valves:** Thermostatic mixing valves and Thermostatic mixing valves for use in care establishments. *User to delete as appropriate*
 - **Draining devices:** Draining taps.
 - **Accessories:** Backflow prevention devices and Test points type A.
- **Thermal insulation:**
 - **Pipelines:** Phenolic foam insulation type A.
 - **Tanks:** Metal mesh faced mineral wool mattresses.
- **Vibration isolation:** Contractor's design.
- **Flush control devices:** Flush control devices.

- **Controls:** Refer to section 75 - 75
- **Accessories:** Self-regulating trace heating cables and . *User to delete as appropriate based on BREEAM requirements*
- **Plant and equipment identification:** Identifying pipework;
Plastic warning devices for underground cables and pipelines;
Mechanical plant and equipment identification labels;
Valve charts and schematics;
and Valve identification labels.
- **Execution:** Installing hot and cold water systems generally;
Hydraulic pressure testing of hot and cold water supply systems;
Flushing hot and cold water systems;
and Disinfection of hot and cold water systems.
- **System completion:** Commissioning of hot and cold water supply systems type B;
Inspection and test records;
Demonstrations;
Documentation;
;
Spares;
Operating tools;
and Maintenance.

Products

Pressure gauges

Shared by: 55-40-40/120 Cold water supply system; and 60-45-40/110 Low temperature hot water heating system.

- **Manufacturer:** Contractor's choice.
- **Standard:** To BS EN 837-1.
- **Diameter:** 100 mm.
- **Scale subdivisions:** 20 kPa (0.2 bar) for a maximum scale value of 1000 kPa (10 bar).
- **Material:** Black steel case.
- **Connections:** 'U' pattern siphon and gauge cock.
- **Execution:** Installing pressure gauges.

Masking plates

Shared by: 50-10-05/120 Above-ground wastewater drainage system with internal stacks;
55-40-40/120 Cold water supply system; and 60-45-40/110 Low temperature hot water heating system.

- **Manufacturer:** Contractor's choice.
- **Material:**
 - **All pipes except chromium plated copper:** Plastic.
- **Format:** Split.

Pipeline strainers

Shared by: 55-40-40/120 Cold water supply system; and 60-45-40/110 Low temperature hot water heating system.

- **Manufacturer:** Hattersley Type 907 or equal and approved
- **Pattern:** Y pattern.
- **Baskets:**
 - **Perforation size:** 0.75 mm
- **Material:** Bronze body, grade 304 Stainless steel strainer.
- **Connections:** Taper Threaded to BS EN 10226-2
- **Integral accessories:** Supplied with two Hattersley fig. 631 test points
- **Execution:** Installing strainers.

Pipe sleeves

Shared by: 55-40-40/120 Cold water supply system; and 60-45-40/110 Low temperature hot water heating system.

- **Manufacturer:** Contractor's choice.
- **Material:** Ensure that the material is compatible with the pipe the sleeve is carrying and with the material the sleeve is penetrating
- **Execution:** Install Pipe sleeves with a minimum of 25 mm protrusion either side of a wall or floor. Fill the gap between the pipe and pipe sleeve with fire resistant material equal to the fire and smoke rating of the fire compartment the pipe sleeve penetrates through.

Tundishes

Shared by: 55-40-40/120 Cold water supply system; and 60-45-40/110 Low temperature hot water heating system.

- **Manufacturer:** Contractor's choice.
- **Material:** Copper sheet.
- **Connections:** Diameter to suit drain line.

Copper pipelines

- **General requirements:** Copper pipeline jointing materials and Copper pipeline fittings.
- **Manufacturer:** Contractor's choice.
- **Standard:** To BS EN 1057.
- **Grade:** R250.
- **Finish:** Where visible in occupied zones Chrome-plated to BS EN ISO 1456 and where hidden finish shall be Plain.
- **Execution:** Installing copper pipelines;
Brazed joints in copper and copper alloy pipes;
Installing buried pipelines;
and Protection of buried pipelines.

Copper pipeline fittings

- **Standards:**
 - **Capillary:** To BS EN 1254-1.
 - **Compression:** To BS EN 1254-2
 - **Press fittings:** Manufacturer's standard.

Copper pipeline jointing materials

- **Manufacturer:** Contractor's choice.
- **Standards:**
 - **Lead free solder for capillary fittings:** To BS EN ISO 9453.
 - **Brazing filling:** To BS EN ISO 17672.
 - **Flange jointing rings:** To BS EN 1514-4.

Connections for accessories type A

- **Capillary:** To BS EN 1254-1.
- **Compression for copper tubes:** To BS EN 1254-2.
- **Compression for plastics pipes:** To BS EN 1254-3.
- **Flanged for cast iron:** To BS EN 1092-2.
- **Flanged for copper alloy:** To BS EN 1092-3.
- **Threaded:**
 - **Where pressure-tight joints are made on the threads:** To BS 21 or BS EN 10226-1.
 - **Where pressure-tight joints are not made on the threads:** To BS EN ISO 228-1.

Backflow prevention devices

- **Manufacturer:** Hattersley Valves Fig 250W and Fig 260W
- **Pattern:** Sizes 15- 28 mm Hatterlsey Fig 250CW Type ED non-verifiable double check valve - compression ends.
50mm - 3000 mm Fig 260W double non-return valve, flanged to EN 1092-2 PN 16
- **Standards:**
 - **Double check:** BS EN 13959 Type ED
- **Material:** Copper alloy and Cast Iron
- **Connections:** Compression to BS EN 1254-2 and Flanged to BS EN 1092-3.
- **Accessories:** Identification Disc as described under labelling section in system description.
- **Selection:** Backflow devices shall be selected to achieve the minimum backflow requirement level posed by the installation position, as defined within the water regulations.

All backflow devices selected shall be WRAS approved for use with potable water.

All backflow protection devices shall be installed in full accordance with the manufacturers guidance and with reference to the requirements of the water regulations.

- **Execution:** Installation of valves generally type B.

Ball valves type A

- **Manufacturer:** Hattersley Valves
- **Valve type:** 100C EXT in ceiling voids and risers. Hattersley 100C with slot head operation in exposed areas.
- **Material:** Bronze.

- **Connections:** Compression to BS EN 1254-2.
- **Finish:** Natural.
- **Execution:** Installation of valves generally type B.

Cast iron check valves type A

- **Manufacturer:** Hattersley or equal and approved
- **Standard:** To BS EN 16767.
- **Third party certification:** WRAS approved
- **Arrangement:**
 - **Type:** Swing.
 - **Body pattern:** Straight.
 - **Body ends:** Manufacturer's standard.
- **Temperature (maximum):**
- **Pressure rating:**
- **Fluid:**
- **Mounting:** Manufacturer's standard.
- **Iron type:** Manufacturer's standard.
- **Dimensions:**
- **Auxiliary connections:**
- **Execution:** Installation of valves generally type B.

Flow measuring devices type A

- **General requirements:** Test points type A and .
- **Manufacturer:** Binder or equal and approved
- **Standard:** To BS 7350.
- **Arrangement:** 4.
- **Material:** Copper alloy.
- **Connections:** Compression;
Flanged;
and Threaded.
- **Accessories:** Position indicator and Independent means for positive isolation on adaptor.
- **Execution:** Installation of valves generally type B.

Test points type A

Shared by: 55-40-40/120 Cold water supply system; and 90-10-90/358 Flow measuring devices type A.

- **Manufacturer:** Binder or equal and approved
- **Arrangement:** Self sealing.
- **Material:** Brass.
- **Connections:** Manufacturer's standard.

Thermostatic mixing valves

- **Manufacturer:** Rada - Kohler Mira Ltd.
- **Product reference:** Contractor's choice TMV 2

- **Standard:** To BS EN 1111.
- **Arrangement:** Single control.
- **Connections:** Threaded to BS EN ISO 228-1.
- **Execution:** Installation of valves generally type B.

Thermostatic mixing valves for use in care establishments

- **Manufacturer:** Rada - Kohler Mira Ltd.
- **Product reference:** Contractor's choice TMV 3.
- **Standard:** To BS 7942.
- **Arrangement:** Flow control and pre-set mixed water temperature.
- **Accessories:** Integral backflow devices.
- **Execution:** Installation of valves generally type B.

Draining taps

Shared by: 55-40-40/120 Cold water supply system; 60-45-35/110 Air source heat pump system; and 60-45-40/110 Low temperature hot water heating system.

- **Manufacturer:** Hattersely Fig 370
- **Standard:** To BS 2879.
- **Size:** 1/2", 3/4" and 1"
- **Arrangement:** Type 1 drain taps are suitable for temperatures up to 70oC with a maximum of 90oC for a period less than an hour.
- **Material:** Copper alloy.
- **Connections:** Threaded joints to BS EN 10226-1.
- **Execution:** Installation of valves generally type B.

Phenolic foam insulation type A

Shared by: 55-40-40/120 Cold water supply system; 60-45-35/110 Air source heat pump system; and 60-45-40/110 Low temperature hot water heating system.

- **Manufacturer:** Kingspan Insulation Ltd.
- **Product reference:** The Kooltherm Pipe Insulation System.
- **Kooltherm pipe insulation thickness:** Insulation thickness in accordance with BS 5422
- **Pipe support inserts:** Contractor's choice.
 - **Thickness:** Insulation thickness in accordance with BS 5422
- **Reaction to fire classification:** Reaction to fire classification of DL-s1, d0, as defined in BS EN 13501-1.
- **Vapour barrier:**
 - **Material:** Flexible sheet.
 - **Vapour permeability:** To BS 5422, clause 5.6.
- **Protection:** Provide Venture clad 1577CW self adhesive 5 ply laminate cladding to all pipework, valves and ancilleries externally within plant rooms.
- **Execution:** Installing phenolic foam insulation on pipelines.

Identifying pipework

Shared by: 55-40-40/120 Cold water supply system; 60-45-35/110 Air source heat pump system; and 60-45-40/110 Low temperature hot water heating system.

- **Manufacturer:** Contractor's choice.
- **Standards:** To BS 1710.
- **Identification type:** Adhesive colour bands.
- **Execution:** Installing identification on pipework.

Mechanical plant and equipment identification labels

Shared by: 55-40-40/120 Cold water supply system; 55-40-40/140 Hot water supply system; 60-45-35/110 Air source heat pump system; and 65-10-95/140 Mechanical extract and balanced ventilation systems.

- **Manufacturer:** Contractor's choice.
- **Material:** Face engraved rigid plastic laminate.
- **Label size:** Manufacturer's standard.
- **Colour:**
 - **Background:** White.
 - **Lettering:** Black.
- **Typography:**
 - **Font:** Manufacturer's standard.
 - **Size:** Manufacturer's standard.
- **Information to be included:** Equipment name; Equipment reference number; and Service.
- **Execution:** Installing mechanical plant and equipment identification.

Valve charts and schematics

Shared by: 55-40-40/120 Cold water supply system; 60-45-35/110 Air source heat pump system; and 60-45-40/110 Low temperature hot water heating system.

- **Manufacturer:** Contractor's choice.
- **Material:** Paper print, encapsulated.
- **Information to be included:** Location and identification of pipework regulating, isolating and control valves.
- **Execution:** Installing valve charts and schematics.

Valve identification labels

Shared by: 55-40-40/120 Cold water supply system; 60-45-35/110 Air source heat pump system; and 60-45-40/110 Low temperature hot water heating system.

- **Manufacturer:** Contractor's choice.
- **Material:** Face engraved rigid plastic laminate.
- **Label size:** Manufacturer's standard.
- **Colour:**
 - **Background:** White.
 - **Lettering:** Black.

- **Typography:**
 - **Font:** Manufacturer's standard.
 - **Size:** Manufacturer's standard.
- **Information:** Purpose and reference number.
- **Execution:** Installing valve identification labels.

Execution

Installing hot and cold water systems generally

- **Standard:** To BS 8558 and BS EN 806-4.
- **Performance:** Free from leaks and the audible effects of expansion, vibration and water hammer.
- **Fixing of equipment, components and accessories:** Fix securely, parallel or perpendicular to the structure of the building.
- **Preparation:** Immediately before installing tanks and cisterns on a floor or platform, clear the surface completely of debris and projections.
- **Corrosion resistance:** In locations where moisture is present or may occur, avoid contact between dissimilar metals by use of suitable washers, gaskets, and the like.

Hydraulic pressure testing of hot and cold water supply systems

- **Standard:** To BS 8558 and BS EN 806-4.
- **Notice (minimum):** 2 weeks notice
- **Pressure:** Twice working pressure
- **Duration of test:** 24hrs

Flushing hot and cold water systems

- **Standard:** To BS EN 806-4.
- **Water analysis:** Analyse water samples before treatment.
- **Preliminary checks:** Thoroughly inspect pipework. Complete pressure tests before cleaning or chemical treatment.
- **Waste products:** Neutralize, and dispose of to drain. Preferably direct to manhole.

Disinfection of hot and cold water systems

- **Standard:** To BS EN 806-4.
- **Samples for analysis:** Provide after disinfection and flushing.

Installing pressure gauges

- **Position:** Refer to drawings

Pipelines installation generally type A

- **Standard:** HVCA TR/20/5.
- **Dissimilar metals:** Prevent electrolytic corrosion.

Installing pipeline fittings type A

- **Bushes:** As required for connections to meters

- **Fabricated junctions and fittings:** Fabricated joints will not be accepted without the prior approval of the Contract administrator.
- **Demountable joints:** Regularly spaced along pipeline runs and at items of equipment.

Installing copper pipelines

- **General requirements:** Spacing of pipelines type A;
Installing pipeline fittings type A;
Pipelines installation generally type A;
and .
- **Standard:** In accordance with CDA publications 88 Copper tube in buildings and 149 Large diameter copper tubes.
- **Joining method:**
 - **Permanently concealed joints:** Brazed Joints
 - **Accessible joints:** Capillary, up to 67 mm for pressure up to 600 kPa and 110°C;
Capillary, 67–108 mm for pressure up to 400 kPa and 110°C;
and Press fit.
- **Expansion loops:** Up to 22 mm Formed bends from single pipe length above 22 mm Jointed brazed fittings.
- **Anchor:**
 - **Method:** Two flanges fixed to copper female adaptors.
 - **Pipe restraints:** Saddle clamps.

Brazed joints in copper and copper alloy pipes

- **Preparation, marking and sealing:** In accordance with BS EN 14324.

Spacing of pipelines type A

- **Minimum clearance between insulated pipelines and:**
 - **Wall finish:** 25 mm
 - **Ceiling finish or soffit:** 100mm
 - **Floor:** 150mm
 - **Electrical services:** 150mm
 - **Adjacent services:** 100mm
 - **Uninsulated pipeline:** 75mm
 - **Another insulated pipeline:** 25mm
- **Minimum clearance between uninsulated pipelines and:**
 - **Wall finish:** 25mm
 - **Ceiling finish or soffit:** 100mm
 - **Floor:** 150mm
 - **Electrical services:** 150mm
 - **Adjacent services:** 150mm
 - **Another uninsulated pipeline:** 25mm

Installing insulation and protection products generally

Shared by: 90-90-40/640 Installing phenolic foam insulation on pipelines; and 90-90-40/670 Installing insulation on tanks.

- **Standard:** In accordance with BS 5970.
- **Timing:** Insulate after installed system has been fully tested and joints proved sound.
- **Insulation:** Do not enclose adjacent units together.
- **Clearance:** Maintain between pipes.
- **Finish:** Neatly finish joints, corners, edges and overlaps.

Installing phenolic foam insulation on pipelines

Shared by: 90-90-40/360 Phenolic foam insulation type A and type B.

- **General requirements:** Installing insulation and protection products generally.
- **Joints:** Close butt, seal with 50 mm wide class 0 foil tape on both longitudinal and circumferential joints.
- **At fittings:** Mitre. Secure with tape.
- **Vapour seal:** Tape exposed insulation membrane. Seal vapour barrier at pipe support with class 0 foil tape.

Installing mechanical plant and equipment identification

- **Fixing:** Fix with adhesive to equipment.
- **Position:** On equipment.

Installing valve charts and schematics

- **Fixing:** Install full size schematic close to Plantroom entry and valve charts on wall local to valve sets.
- **Position:** Plant room.

Installing valve identification labels

- **Fixing:** Secure with metal chain.

Installing identification on pipework

- **Application of basic identification colour:** Coloured bands as BS 1710 clause 3.3.
- **Safety colour identification:** On or next to the colour bands.
- **Information:** Abbreviation of name;
Chemical symbol for gases;
- **Direction of flow:** Indication arrow and the word FLOW or the letter F and
Indication arrow and the word RETURN or the letter R.

System completion

Commissioning of hot and cold water supply systems type B

- **Pre-commissioning:** In accordance with BSRIABG 2/2010 and CIBSE Commissioning Code W.
- **Commissioning:** In accordance with BS EN 806-4, BSRIABG 2/2010 and CIBSE Commissioning Code W.
- **Notice (minimum):** 48 h.
- **Equipment:** Check and adjust operation of equipment, controls and safety devices.
- **Outlets:** Check operation of outlets for satisfactory rate of flow and temperature.

Inspection and test records

Shared by: 55-40-40/120 Cold water supply system; and 55-40-40/140 Hot water supply system.

- **Construction phase reports:** System commissionable.
- **Records for water systems:** In accordance with BSRIABG 2/2010.
- **Record sheets:**
 - **Submission:** On completion.
 - **Number of copies:** Three.

Demonstrations

Shared by: 55-40-40/120 Cold water supply system; and 55-40-40/140 Hot water supply system.

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

Documentation

Shared by: 55-40-40/120 Cold water supply system; and 55-40-40/140 Hot water supply system.

- **Operating and maintenance instructions:**
 - **Scope:** Submit for the system giving optimum settings for controls.
 - **Product information:** Include product description, date of purchase, performance characteristics, application (suitability for use), method of operation and control, and cleaning and maintenance requirements.
 - **Format:** Paper copy.
 - **Number of copies:** Two.
- **Record drawings:**
 - **Content:** Location and arrangement of plant in plant rooms; Location, size and route of hot and cold water services; Location, route and depth of underground services;

Location and identification of regulating, isolation and control valves;
and Location of outlets.

- **Format:** A1 paper print and Electronic.
- **Number of copies:** Two.
- **Submittal date:** At handover.
- **Wholesome water consumption notice:** Submit within 30 days.

Spares

Shared by: 55-40-40/120 Cold water supply system; and 55-40-40/140 Hot water supply system.

- **Pipeline ancillaries:**
 - **Keys:** Two of each type.
 - **Hose unions:** Two of each type.

Operating tools

Shared by: 55-40-40/120 Cold water supply system; and 55-40-40/140 Hot water supply system.

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

Maintenance

Shared by: 55-40-40/120 Cold water supply system; and 55-40-40/140 Hot water supply system.

- **Servicing and maintenance:** Undertake for 12 months after completion.

Ω End of system

Hot water supply system

System outline

Hot water supply system

- Description:** All services with the exception as listed below and as noted on the drawings shall be isolated, stripped out and made safe, prior to the demolition. The redundant equipment shall be stripped out and safely removed and disposed, and/or handed back to the Client.
 All services stripped out to the area demarcation line to be made safe at this point. The redundant services should not pose a health and safety risk. All cable containment and pipes shall be capped off at this point.
 The Contractor should ensure no sharp edges.
 All circuits to be disconnected from the point of the origin and clearly labelled as redundant. Other areas are to be retained in use during the course of the works. It is therefore imperative that these systems are maintained through out these works and any downtime is agreed with the Client.

Provide instantaneous hot water for use within the building as identified on the contract drawings.

-G.14 Refreshments - Supply and install new below sink electric hot water heater with associated valves, expansion and backflow protection to serve new double bowl sink.

-B.01 Museum Makers Workshop - Supply and install new over sink electric hot water heater with associated valves, expansion and backflow protection to serve new sink.

-B.05 Staff - Supply and install new below sink electric hot water heater with associated valves, expansion and backflow protection to serve new sink.

-B.12 WC 02 - Supply and install new below sink electric hot water heater with associated valves, expansion and backflow protection to serve new WHBs in WC 01 & 02 and B.13 Baby Change.

Each unit shall be provided with integral manufacturers local controls.

- System performance: Contractors Responsibilities**
 The Contractor shall include for all necessary tools, labour materials and equipment to develop the design, supply, install, co-ordinate with other contractors, test, commission and set to work the following as a minimum to meet the functional and performance criteria specified within this specification.
 The Contractor shall include for provision of maintenance to the system, seasonal commissioning activities and rectification as required by the Contract and the Mechanical & Electrical Specification.

Function/Objectives

To provide instantaneous hot water for use within the building as identified on the contract drawings.

Applicable Standards

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

- Utility Suppliers Connection requirements & procedures

- Water Regulations and WRAS standards
 - Building Regulations
 - British Standards
 - The requirements of the local Building Control Authority
 - Relevant HSE Guidance
 - BSRIA Standards & Guidance notes
 - Client specific requirements
 - CIBSE Guides & Notes
 - HVCA Standards and Guidance Notes.
 - The Institute of Plumbing Guide
 - ACOP L8 - 'The Control of Legionella Bacteria in Water Systems'.
- Any discrepancies identified by the contractor between the specification and the above documents shall be brought to the attention of the CA immediately.

Environmental Performance Assessment

The specification shall be read in conjunction with the latest version of the Environmental pre assessment (BREEAM, LEED, Well or other) to ensure that any credits targeted applicable to the design of this system are achieved.

Initial Testing Procedures

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

Category Backflow Protection

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

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

Backflow protection shall be afforded not only to the utility main but also between outlets within the building network.

Pipeline Materials & Distribution

All internal pipework shall be installed using Copper tubing. Jointing shall be undertaken using;

- compression fittings
- end feed fittings

Where exposed to view in WC areas, Kitchens and bathrooms all pipework shall be chromium plated.

The Contractor should seek guidance from the consultant to the appropriate installation material where any doubt exists.

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

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

The Contractor shall be responsible for designing any thermal expansion requirements required in the pipework system. Where necessary thermal expansion of pipework shall be absorbed by expansion loops, sets or bellows units. Where no

expansion devices are indicated, expansion movement shall be absorbed by changes in direction. Where necessary, bends shall be incorporated in connections to equipment and in branch connection in the mains. Cold draw shall be applied to all pipework where expansion occurs.

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

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

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

Where pipes penetrate walls, sleeves shall be provided.

All pipework connections to appliances shall be provided with isolating valves.

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

Make final connections to equipment in accordance with manufacturer's instructions and as indicated.

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

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

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

Insulation

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

- o Internal Exposed - Rigid PVC (Isogenopack)
- o Internal Exposed Valve - No insulation
- o Ceiling voids - Foil finish
- o Internal Services Ducts - Foil Finish
- o Within Internal Boxing - Foil Finish
- o Valves in roof voids, internal ducts, boxings etc. - Foil finish

Load bearing insulated support inserts shall be provided at all bracket locations to ensure there is no break in the thermal properties, foil finish and protection.

Supports shall be segmental supports suitable for the temperature range of the pipework. The insulation shall be fitted right up to the supports and the facing shall be continued through the brackets.

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

Cold water pipework - 0.05g/sMN

Chilled water pipework - 0.015g/sMN

Refrigeration pipework and chilled/glycol pipework below 0°C - 0.010g/sMN

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

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

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

Labelling

Pipework shall be identified in accordance with BS1710

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

All valves located in plant rooms, service voids or where adjacent to plant shall be identified. The identification shall be in the form of either a brass or traffolite disc, permanently chained to the valve with chromium plated brass chain, bearing a reference number corresponding with that on the framed and glazed valve chart. The Contractor shall supply and install at all nominated cold water drinking outlets, a small white traffolite label with black lettering, to read - DRINKING WATER. The Contractor shall provide and install at all unblended hot water outlets, a small red traffolite label with white lettering to read - VERY HOT WATER. Labels shall be fixed by means of chromium plated dome-head screws to the wall surface immediately behind and above the relevant tap.

Pipework Accessories & Valves

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

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

TMVs will be required on all WHBs.

Safety Relief Valves and Expansion vessels

All heat generating equipment and all vessels/pipework subjected to a pressure greater than atmospheric, shall be fitted with a Safety Relief Valve and suitably sized expansion vessel in accordance with the manufacturers recommendations. All valves shall incorporate a padlock or lead seal to lock the set pressure and to obviate unauthorised tampering. Safety Relief Valves shall be mounted vertically and fitted directly to the equipment/system with the minimum possible length of pipe and no intervening valve or other restriction. Discharges from relief valves fitted to systems operating at up to 90°C shall be routed to terminate 200mm above floor level with an anti-drip profile.

All pipework routing from safety relief valves shall be installed in Copper tubing.

Potable Water Testing/Handover Procedures

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

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

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

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

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

All valve charts, valve labelling, plant schematics shall be completed at the time of commissioning and will form an integral part of the sign off process.
For full details of all Contractual requirements associated with handover and the O&M manuals the Contractor shall refer to section 00-80-70 : Work Contract Completion located within the MEP general clauses.

Additional documents: See Document issue sheet for all relevant drawings and schedules

- **Instantaneous water heater:** Instantaneous water heaters, electric.
- **Controls:** Provide 24 hr /7 day programable timer on power supply to water heaters
- **Safety Valves:** Safety valves
- **Expansion vessels:** Expansion vessels
- **Plant and equipment identification:** Mechanical plant and equipment identification labels.
Provide warning label at all outlets above 43°C ' WARNING VERY HOT WATER'
- **System completion:** Operating tools;
Water quality tests;
Maintenance;
Documentation;
Spares;
Inspection and test records;
Commissioning of hot and cold water supply systems type A;
and Demonstrations.

Products

Expansion vessels

- **Manufacturer:** See contract documentation
- **Standard:** To BS EN 13831.
- **Third party certification:** WRAS approved.
- **Duty:**
 - **Size:** See contract documentation
 - **Working pressure:** See contract documentation
 - **Precharge pressure:** See contract documentation
 - **Operating temperature:** See contract documentation
- **Materials:**
 - **Shell:** Manufacturer's standard.
 - **Membrane:** Manufacturer's standard.
- **Membrane:** Manufacturer's standard.
- **Accessories:** Vessel connecting kit and Wall bracket.

Safety valves

- **Manufacturer:** Nabic Fig 500 or equal and approved
- **Standard:** To BS EN ISO 4126-1.
- **Lift type:** High.
- **Arrangement:** Single.

- **Material:** Copper alloy.
- **Connections:** Threaded to BS EN 10226-1.
- **Accessories:** Padlock
- **Execution:** Installation of safety valves.

Instantaneous water heaters, electric

- **Manufacturer:** Stiebel Eltron or approved equivalent
- **Standards:** To BS EN 60335-2-35 and BS EN 60335-1.
- **Third party certification:** BEAB-approved and WRAS-approved.
- **Arrangement:** See contract documentation
- **Rating:** See contract documentation
- **Flow rate:** See contract documentation
- **Control:** Provide 24 hr /7 day programable timer on power supply to water heaters
- **Accessories:** Provide 24 hr /7 day programable timer on power supply to water heaters

Mechanical plant and equipment identification labels

Shared by: 55-40-40/120 Cold water supply system; 55-40-40/140 Hot water supply system; 60-45-35/110 Air source heat pump system; and 65-10-95/140 Mechanical extract and balanced ventilation systems.

- **Manufacturer:** Contractor's choice.
- **Material:** Face engraved rigid plastic laminate.
- **Label size:** Manufacturer's standard.
- **Colour:**
 - **Background:** White.
 - **Lettering:** Black.
- **Typography:**
 - **Font:** Manufacturer's standard.
 - **Size:** Manufacturer's standard.
- **Information to be included:** Equipment name; Equipment reference number; and Service.
- **Execution:** Installing mechanical plant and equipment identification.

Execution

Installation of valves generally type A

- **Installation:** In accordance with BS 6683.
- **Position:**
- **Isolation and regulation valves:** Provide at equipment and on sub-circuits.
- **Access:** Locate valves so they can be readily operated and maintained. Locate next to equipment which is to be isolated.
- **Connection to pipework:** Fit with joints that suit the pipe material.

Installation of safety valves

- **General requirements:** Installation of valves generally type A.
- **Inlet connection:** As short as possible; diameter no smaller than the outlet bore.
- **Discharge lines:** Rise vertically. Fit with small bore drain points to prevent the accumulation of water.

Installing mechanical plant and equipment identification

- **Fixing:** Fix with adhesive to equipment.
- **Position:** On equipment.

System completion

Commissioning of hot and cold water supply systems type A

- **Pre-commissioning:** In accordance with BSRIABG 2/2010 and CIBSE Commissioning Code W.
- **Commissioning:** In accordance with BS EN 806-4, BSRIABG 2/2010 and CIBSE Commissioning Code W.
- **Notice (minimum):** 48 h.
- **Equipment:** Check and adjust operation of equipment, controls and safety devices.
- **Outlets:** Check operation of outlets for satisfactory rate of flow and temperature.

Inspection and test records

Shared by: 55-40-40/120 Cold water supply system; and 55-40-40/140 Hot water supply system.

- **Construction phase reports:** System commissionable.
- **Records for water systems:** In accordance with BSRIABG 2/2010.
- **Record sheets:**
 - **Submission:** On completion.
 - **Number of copies:** Three.

Demonstrations

Shared by: 55-40-40/120 Cold water supply system; and 55-40-40/140 Hot water supply system.

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

Documentation

Shared by: 55-40-40/120 Cold water supply system; and 55-40-40/140 Hot water supply system.

- **Operating and maintenance instructions:**

- **Scope:** Submit for the system giving optimum settings for controls.
- **Product information:** Include product description, date of purchase, performance characteristics, application (suitability for use), method of operation and control, and cleaning and maintenance requirements.
- **Format:** Paper copy.
- **Number of copies:** Two.
- **Record drawings:**
 - **Content:** Location and arrangement of plant in plant rooms; Location, size and route of hot and cold water services; Location, route and depth of underground services; Location and identification of regulating, isolation and control valves; and Location of outlets.
 - **Format:** A1 paper print and Electronic.
 - **Number of copies:** Two.
- **Submittal date:** At handover.
- **Wholesome water consumption notice:** Submit within 30 days.

Water quality tests

- **Standard:** To BS EN 806-4.
- **Samples:**
 - **Sample points:** Main supply to site.
 - **Samples for analysis:** Submit samples for bacteriological analysis.
- **Water temperature:** Record at each sampling point at the time of taking the sample.
- **Test results:**
 - **Record:** Details of all analyses.
 - **Submit:** On completion.
 - **Number of copies:** Two.

Spares

Shared by: 55-40-40/120 Cold water supply system; and 55-40-40/140 Hot water supply system.

- **Pipeline ancillaries:**
 - **Keys:** Two of each type.
 - **Hose unions:** Two of each type.

Operating tools

Shared by: 55-40-40/120 Cold water supply system; and 55-40-40/140 Hot water supply system.

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

Maintenance

Shared by: 55-40-40/120 Cold water supply system; and 55-40-40/140 Hot water supply system.

- **Servicing and maintenance:** Undertake for 12 months after completion.

Ω End of system

Air source heat pump system

System outline

Air source heat pump system

- **Description:** All services with the exception as listed below and as noted on the drawings shall be isolated, stripped out and made safe, prior to the demolition. The redundant equipment shall be stripped out and safely removed and disposed, and/or handed back to the Client.
All services stripped out to the area demarcation line to be made safe at this point. The redundant services should not pose a health and safety risk. All cable containment and pipes shall be capped off at this point. The Contractor should ensure no sharp edges.
All circuits to be disconnected from the point of the origin and clearly labelled as redundant. Other areas are to be retained in use during the course of the works. It is therefore imperative that these systems are maintained through out these works and any downtime is agreed with the Client.

An air source heat pump wall mounted indoor unit shall be installed (as indicated upon the design drawings) to generate the heating/cooling to the Comms room.

The heat pump condensing unit shall be positioned externally within the light well in a location that permits free air flow across its heat exchanger face and so that its discharge air does not negatively affect the efficiency of any other units within the vicinity. The spacing distance defined within the manufacturers guidance should be followed.

The indoor and external units shall be interconnected via insulated refrigerant pipework and power/control wiring.

The indoor unit shall be controlled via a local wall mounted controller within the comms room maintain the system set points for temperature and timeclock control.

Refrigerant pipework and power/control wiring shall be routed on tray at high level in the rooms and ceiling voids where possible between the indoor and outdoor units.

The internal wall mounted heat pump fan coil unit shall be provided with a lift pump connected to a gravity condensate drain at high level that runs to fall to the nearest waste pipe complete with waterless trap.

The Contractor shall ensure that the noise generation from the selected heat pumps falls within the maximum levels defined within the acoustic report.

- **System performance:** The Contractor shall provide an air source heat pump installation to generate heating/cooling to the Comms room.

The system shall be designed in accordance with the following guidance documents:

BSRIA BG 7 : Heat Pumps
Building Regulations part L and associated Non domestic building compliance guide

CIBSE guides

The F Gas regulations 2008

Pressure system safety regulations 2000

BSRIA Pre-Commission Cleaning of Pipework Systems (2nd edition) AG1/2001.1

BS EN ISO 15493

BSEN 378-1:2000 Specification for Refrigerating Systems and Heat Pumps

Manufacturers Recommendations

- **System manufacturer:** Daikin or equal and approved
- **Heat pump type:** Air-to-air heat pumps.
- **Pipelines:** Refrigerant pipelines and fittings.
- **Thermal insulation:** Phenolic foam insulation type A.
- **Outlets:**
 - **Radiator circuit:**
 - Pipelines:** Copper
 - Pipeline ancillaries:** Temperature gauges.
- **Plant and equipment identification:** Identifying pipework;
Mechanical plant and equipment identification labels;
Valve charts and schematics;
and Valve identification labels.
- **Execution:** Installing heat pump systems.
- **System completion:** Commissioning of refrigerating systems;
Performance testing;
Inspection and test records;
Demonstrations;
Documentation;
and Servicing and maintenance.

Products

Refrigerant pipelines and fittings

- **Manufacturer:** Contractor's choice.
- **Standard:** To BS EN 378-2.
- **Pipelines:** To BS EN 12735-1.
- **Execution:** Installing refrigerant pipework.

Connections for accessories, type D

- **Capillary:** To BS EN 1254-1.
- **Compression for copper tubes:** To BS EN 1254-2.
- **Compression for plastics pipes:** To BS EN 1254-3.
- **Flanged for cast iron:** To BS EN 1092-2.
- **Flanged for copper alloy:** To BS EN 1092-3.
- **Threaded:**
 - **Where pressure-tight joints are made on the threads:** To BS 21 or BS EN 10226-1.
 - **Where pressure-tight joints are not made on the threads:** To BS EN ISO 228-1.

Draining taps

Shared by: 55-40-40/120 Cold water supply system; 60-45-35/110 Air source heat pump system; and 60-45-40/110 Low temperature hot water heating system.

- **Manufacturer:** Hattersely Fig 370
- **Standard:** To BS 2879.
- **Size:** 1/2", 3/4" and 1"
- **Arrangement:** Type 1 drain taps are suitable for temperatures up to 70oC with a maximum of 90oC for a period less than an hour.
- **Material:** Copper alloy.
- **Connections:** Threaded joints to BS EN 10226-1.
- **Execution:** Installation of valves generally type B.

Air-to-air heat pumps

- **Manufacturer:** Daikin or equal and approved
- **Standards:**
 - **Safety and environmental:** To BS EN 378-1 and BS EN 378-2.
 - **Test requirements:** To BS EN 14511-1, BS EN 14511-2, BS EN 14511-3 and BS EN 14511-4.
 - **Electrical safety:** To BS EN 60335-2-40.
- **Heat pump type:** Single split.
- **Mode:** Cooling and Heating.
- **Electrical supply type:** Single phase.
- **Compressor:**
 - **Type:** Scroll.
- **Refrigerant:** R32.

Indoor units

- **Manufacturer:** Daikin FTXM range or equal and approved
- **Standards:** To BS EN 378-1 and BS EN 378-2.
- **Arrangement:** User to complete
- **Output cooling:** User to complete
- **Output heating:** User to complete
- **Accessories:** Infrared remote control.

Phenolic foam insulation type A

Shared by: 55-40-40/120 Cold water supply system; 60-45-35/110 Air source heat pump system; and 60-45-40/110 Low temperature hot water heating system.

- **Manufacturer:** Kingspan Insulation Ltd.
- **Product reference:** The Kooltherm Pipe Insulation System.
- **Kooltherm pipe insulation thickness:** Insulation thickness in accordance with BS 5422
- **Pipe support inserts:** Contractor's choice.
 - **Thickness:** Insulation thickness in accordance with BS 5422

- **Reaction to fire classification:** Reaction to fire classification of DL-s1, d0, as defined in BS EN 13501-1.
- **Vapour barrier:**
 - **Material:** Flexible sheet.
 - **Vapour permeability:** To BS 5422, clause 5.6.
- **Protection:** Provide Venture clad 1577CW self adhesive 5 ply laminate cladding to all pipework, valves and ancilleries externally within plant rooms.
- **Execution:** Installing phenolic foam insulation on pipelines.

Identifying pipework

Shared by: 55-40-40/120 Cold water supply system; 60-45-35/110 Air source heat pump system; and 60-45-40/110 Low temperature hot water heating system.

- **Manufacturer:** Contractor's choice.
- **Standards:** To BS 1710.
- **Identification type:** Adhesive colour bands.
- **Execution:** Installing identification on pipework.

Mechanical plant and equipment identification labels

Shared by: 55-40-40/120 Cold water supply system; 55-40-40/140 Hot water supply system; 60-45-35/110 Air source heat pump system; and 65-10-95/140 Mechanical extract and balanced ventilation systems.

- **Manufacturer:** Contractor's choice.
- **Material:** Face engraved rigid plastic laminate.
- **Label size:** Manufacturer's standard.
- **Colour:**
 - **Background:** White.
 - **Lettering:** Black.
- **Typography:**
 - **Font:** Manufacturer's standard.
 - **Size:** Manufacturer's standard.
- **Information to be included:** Equipment name; Equipment reference number; and Service.
- **Execution:** Installing mechanical plant and equipment identification.

Valve charts and schematics

Shared by: 55-40-40/120 Cold water supply system; 60-45-35/110 Air source heat pump system; and 60-45-40/110 Low temperature hot water heating system.

- **Manufacturer:** Contractor's choice.
- **Material:** Paper print, encapsulated.
- **Information to be included:** Location and identification of pipework regulating, isolating and control valves.
- **Execution:** Installing valve charts and schematics.

Valve identification labels

Shared by: 55-40-40/120 Cold water supply system; 60-45-35/110 Air source heat pump system; and 60-45-40/110 Low temperature hot water heating system.

- **Manufacturer:** Contractor's choice.
- **Material:** Face engraved rigid plastic laminate.
- **Label size:** Manufacturer's standard.
- **Colour:**
 - **Background:** White.
 - **Lettering:** Black.
- **Typography:**
 - **Font:** Manufacturer's standard.
 - **Size:** Manufacturer's standard.
- **Information:** Purpose and reference number.
- **Execution:** Installing valve identification labels.

Channel supports

Shared by: 60-45-35/110 Air source heat pump system; 60-45-40/110 Low temperature hot water heating system; and 65-10-95/140 Mechanical extract and balanced ventilation systems.

- **Manufacturer:** Contractor's choice.
- **Channels:**
 - **Load capacity:** Contractors design
 - **Format:** Slotted.
 - **Dimensions:** 41 x 21 x 1.5 mm;
41 x 21 x 2.5 mm;
41 x 41 x 1.5 mm;
and 41 x 41 x 2.5 mm.
 - **Type:** Contractors design
 - **Material:** Carbon steel.
 - **Finish:** Hot dip galvanized.
 - **Accessories:** 90° brackets;
Base plates;
Channel type cantilever arms;
End caps;
Internal connectors;
6 mm threaded rod;
8 mm threaded rod;
10 mm threaded rod;
and Trapeze hangers.

Execution

Installing heat pump systems

- **Standards:** To BS EN 378-2, BS EN 378-3 and BS EN 378-4.

- **Fixing of equipment, components and accessories:** Fix securely on purpose-made bases or supports.
- **External units:** Away from windows and adjacent buildings. Protect from high winds. Prevent snow, leaves and debris from blocking air flow.
- **Access:** Provide for inspection and servicing of heat pumps and ancillary equipment.
- **Refrigerant lines:** Short and straight.
- **Condensate:** To drain away rapidly, without risk of freezing.

Installing refrigerant pipework

- **General requirements:** Spacing of pipelines type B;
Installing pipeline fittings type B;
Pipelines installation generally type B;
and General inspection and testing.
- **Standards:** To BS EN 378-3 and BS EN 378-4.
- **Refrigerant lines:** Short and straight.

General inspection and testing

- **Inspection of joints:**
 - **Joints:** Cut out, cut open and inspect.
 - **Number of joints:**
- **Safety precautions:** In accordance with HSE GS 4.

Installing insulation and protection products generally

Shared by: 90-90-40/640 Installing phenolic foam insulation on pipelines; and 90-90-40/670 Installing insulation on tanks.

- **Standard:** In accordance with BS 5970.
- **Timing:** Insulate after installed system has been fully tested and joints proved sound.
- **Insulation:** Do not enclose adjacent units together.
- **Clearance:** Maintain between pipes.
- **Finish:** Neatly finish joints, corners, edges and overlaps.

Installing phenolic foam insulation on pipelines

Shared by: 90-90-40/360 Phenolic foam insulation type A and type B.

- **General requirements:** Installing insulation and protection products generally.
- **Joints:** Close butt, seal with 50 mm wide class 0 foil tape on both longitudinal and circumferential joints.
- **At fittings:** Mitre. Secure with tape.
- **Vapour seal:** Tape exposed insulation membrane. Seal vapour barrier at pipe support with class 0 foil tape.

Installing mechanical plant and equipment identification

- **Fixing:** Fix with adhesive to equipment.
- **Position:** On equipment.

Installing valve charts and schematics

- **Fixing:** Install full size schematic close to Plantroom entry and valve charts on wall local to valve sets.
- **Position:** Plant room.

Installing valve identification labels

- **Fixing:** Secure with metal chain.

Installing identification on pipework

- **Application of basic identification colour:** Coloured bands as BS 1710 clause 3.3.
- **Safety colour identification:** On or next to the colour bands.
- **Information:** Abbreviation of name;
Chemical symbol for gases;
- **Direction of flow:** Indication arrow and the word FLOW or the letter F and
Indication arrow and the word RETURN or the letter R.

System completion

Commissioning of refrigerating systems

- **Pre-commissioning:** In accordance with CIBSE Commissioning code R.
- **Commissioning:** In accordance with CIBSE Commissioning code R.
- **Notice (minimum):** 1 week.

Performance testing

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

Inspection and test records

- **Reports:**
 - **Construction phase:** System commissionable.
- **Records for water systems:** In accordance with BSRIA 2/89.3.
- **Records for air systems:** In accordance with BSRIA 3/89.3.
- **Record sheets:**
 - **Submission:** On completion.
 - **Number of copies:** Three.

Demonstrations

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

Documentation

- **Operating and maintenance instructions:**
 - **Scope:** Refer to general conditions section 00-80-70 Works Contract Completion
 - **Product information:** Refer to general conditions section 00-80-70 Works Contract Completion
 - **Format:** Refer to general conditions section 00-80-70 Works Contract Completion
 - **Number of copies:** Refer to general conditions section 00-80-70 Works Contract Completion
- **Record drawings:**
 - **Content:** Refer to general conditions section 00-80-70 Works Contract Completion
 - **Format:** Refer to general conditions section 00-80-70 Works Contract Completion
 - **Number of copies:** Refer to general conditions section 00-80-70 Works Contract Completion
- **Submittal date:** Refer to general conditions section 00-80-70 Works Contract Completion

Servicing and maintenance

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

Ω End of system

Low temperature hot water heating system

System outline

Low temperature hot water heating system

- **Description:** All services with the exception as listed below and as noted on the drawings shall be isolated, stripped out and made safe, prior to the demolition. The redundant equipment shall be stripped out and safely removed and disposed, and/or handed back to the Client.
All services stripped out to the area demarcation line to be made safe at this point. The redundant services should not pose a health and safety risk. All cable containment and pipes shall be capped off at this point. The Contractor should ensure no sharp edges.
All circuits to be disconnected from the point of the origin and clearly labelled as redundant. Other areas are to be retained in use during the course of the works. It is therefore imperative that these systems are maintained through out these works and any downtime is agreed with the Client.

The existing low temperature hot water (LTHW) heating plant and distribution pipework shall be retained.

The Sub Contractor shall undertake the detailed survey of the existing mechanical and public health systems prior to commencing any works on site.

The Sub Contractor shall undertake commissioning checks of all existing LTHW systems prior to undertaking any works on site.

Prior to commencing any work on site, the Sub Contractor shall take commissioning readings of all the heating circuits and submit them to the Contract Administrator as a record of the performance of the systems.

Also prior to commencing any work on site water samples shall be taken from all the heating circuits to determine the quality of the water in the existing system and shall include TVC pseudomonas and sulphate reducing bacteria levels. The main water supply for filling/flushing shall have a sample analysed via an accredited testing facility before filling commences.

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

The system shall be flushed and cleaned by a water treatment specialist in accordance with BSRIA Pre-Commission Cleaning of Pipework Systems (2nd edition) AG1/2001.1. The specialist shall be employed at an early stage during the contract to advise on best practice cleaning methodologies.

The Sub Contract shall provide Building Operating & Maintenance Manuals for all mechanical and electrical systems.

The Sub Contract shall provide a Building Log Book - In accordance with the Building Regulations Part L2, encompassing all mechanical and electrical systems. The Building Log Book shall follow the template identified within CIBSE TM31 and shall be completed prior to building handover as a separate volume of the Operation and Maintenance manuals.

The existing LTHW distribution system shall be retained and the following alterations shall be carried out:

- The main plant within the plantroom is modern and no modifications are required within the plantroom other than isolations during the works to the LTHW distribution system and re-balancing.
- Strip out radiators as shown on the drawings and in the equipment schedules. Strip out redundant pipework and cap off where required.
- Reposition radiators as shown on the drawings and in the equipment schedules along with modified pipework and new valve connections. Strip out redundant pipework and cap off where required and make good walls as necessary.
- Replace existing insulation to all existing LTHW pipework within the project area with new.
- Provide insulation to all new LTHW pipework.
- Provide new fan convectors and shown on the drawings and in the equipment schedules within the Makers workshop. Provide new local controls and coordinated with museum displays.

Where radiators and modified or relocated provide new TRVs and LSVs.

- Following completion of the works flush and clean the LTHW pipework system as above and re-balance and commission LTHW system.
- On completion of the works water samples shall be taken from the LTHW System to determine the quality of the water and shall include TVC pseudomonas and sulphate reducing bacteria levels.

Description of Works

G.03 Welcome & Retail - Retain existing 2No kick space heaters and connecting LTHW pipework. Allow to remove and re-install within new exhibition cabinets. Install new isolating valves and thermostatic controls with lock out. Retain existing radiator and associated valves.

G.05 Gallery 01 - Retain existing 2No fan convectors and pipework. Retain existing 2No kick space heaters and connecting LTHW pipework. Allow to remove and re-install within new exhibition cabinets. Install new isolating valves and thermostatic controls with lock out.

G.06 Lobby 02 - Retain existing 2No radiators and associated valves.

G.08 Lobby 01 - Retain existing radiator and associated valves.

G.09 Museum Office - Retain existing fan convector.

G.10 Lift - Strip out existing radiator and relocate to basement B.15 Learning Space.

G.11 Gallery 2 - Retain existing fan convector.

G.14 Refreshments - Retain existing LTHW pipework to serve new fan convector and connect to existing transfer grille to rear from corridor.

B.01 Museum Makers Workshop - Replace existing fan convector unit with new unit. Reconnect existing pipework with new isolating valves. Install new fan convector and route new LTHW pipework from existing reverse return circuit to new unit with new isolating valves.

B.08 Lobby - Retain existing radiator and associated valves.

B.09 Lift - Strip out existing radiator and relocate to basement G.14 Refreshments.

B.10 Storage - Install relocated radiator from B.18 IT along with new distribution pipework and isolating valves.

B.15 Learning Space - Replace existing fan convector unit with new unit. Reconnect existing pipework with new isolating valves. Install relocated radiator from G.10 Lift along with new distribution pipework and isolating valves.

B.18 IT - Strip out existing radiator and relocate to basement B.10 Storage.

B.19 Corridor - Strip out existing radiator and relocate on adjacent wall. Strip out and cut back existing LTHW pipework from redundant radiator position back to live main with no dead leg. Install new distribution pipework with new isolating valves to relocated radiator.

B.23 Stair 01 - Retain existing radiator and associated valves.

- **System performance:** The Contractor shall supply, install and commission equipment and alterations to the low temperature hot water heating system within the existing building.

The system shall be designed in accordance with:-

- CIBSE Guides, Volumes A, B, C
- HVCA TR20/1 (2003) Low Temperature Hot Water Heating
- Pressure Systems Regulations 2000
- All relevant British Standards
- BSEN 13480: 2002 Metallic industrial piping
- BSRIA Pre-Commission Cleaning of Pipework Systems (2nd edition) AG1/2001.1

System Design Parameters :

- Max pipeline water velocity = 1 m/s (up to 65mm dia), 2.5 m/s (80mm to 200mm)
- Max pipeline water velocity = up to 1 m/s for branch pipelines less than 50mm up to 1.5m/s for pipelines between 50 -100mm up to 2m/s above 100mm
- Max pipeline pressure drop = 250Pa/m

- **Arrangement:** Two pipe and Variable flow circuits.
- **Heat source:** Gas fired condensing boilers.
- **Fuel:** Natural gas.
- **Flues and chimneys:** Metal flues and chimneys.
- **Pressurization units:** Pressurization units.
- **Feed and expansion tanks:** Moulded plastics cisterns.
- **Pumps:** Close coupled in line pumps.
- **Water treatment plant:**
 - **Equipment:** Dosing pots.

- **Chemicals:** Scale inhibitor chemicals.
- **Pipelines:** Steel pipelines.
- **Pipelines accessories:**
 - **Venting devices:** Automatic air vents.
 - **Expansion devices:** Contractor's design.
 - **Separators:** Combined air and dirt separators.
 - **Gauges:** Pressure gauges and Temperature gauges.
 - **Accessories:** Masking plates;
Pipeline strainers;
Pipe sleeves;
and Tundishes.
and Direct Acting Safety Valves
- **Valves:**
 - **Isolating valves:** Ball valves type B and Butterfly valves.
 - **Check valves:** Cast iron check valves type B.
 - **Regulating valves:** Flow measuring devices type B. and Pressure Independent Control Valves and Differential Pressure Control Valves
 - **Radiator valves:** Radiator valves and Thermostatic radiator valves.
 - **Draining devices:** Draining taps.
 - **Accessories:** Test points type B.
- **Thermal insulation:** Phenolic foam insulation type A.
- **Vibration isolation:** Contractor's design.
- **Heat emitters:** Fan convectors and Radiators.
- **Controls:** Refer to section 75-75
- **System accessories:** Roof equipment supports and Channel supports.
- **Plant and equipment identification:** Identifying pipework;
Valve charts and schematics;
and Valve identification labels.
- **Execution:** Installing water based heating systems;
Hydraulic pressure testing of low temperature hot water heating systems;
and Flushing and pre-commission cleaning of heating systems.
- **System completion:** Commissioning boiler plant;
Commissioning water heating systems;
Performance testing;
Demonstrations;
Inspection and test records;
Documentation;
Operating tools;
and Servicing and maintenance.

Products

Direct Acting Safety Valves

- **Description:** Direct acting pressure relief valve for heating circuit
- **Location:** To be installed immediately after flow connection to system boilers, refer to design schematics

- **Manufacturer:** Nabic or equal and approved
- **Standards:** Standard
BS 6759-1 - Direct Acting Safety Valves
- **Details:** Material - Bronze or DZR copper alloy body.
Ends - Threaded to BS 21.
Spring Type - Double spring loaded high lift type.
Protection from unauthorised adjustment - Lock adjusting screw.

Automatic air vents

- **Manufacturer:** Contractor's choice.
- **Arrangement:** Vertical inlet.
- **Material:** Gunmetal.
- **Connections:** Threaded.

Pressure differential de-aerators

- **Manufacturer:**
- **Arrangement:** Self circulating unit..
- **Material:** Carbon steel.
- **Connections:**

Combined air and dirt separators

- **Manufacturer:** Spirotech - Spirocombi or equal and approved
- **Arrangement:** Vertical housing with internal large surface area mechanism to remove microbubbles via coalescence effect..
- **Material:** Carbon steel.
- **Connections:** Flanged.
- **Execution:** Installing combined air and dirt separators.

Pressure gauges

Shared by: 55-40-40/120 Cold water supply system; and 60-45-40/110 Low temperature hot water heating system.

- **Manufacturer:** Contractor's choice.
- **Standard:** To BS EN 837-1.
- **Diameter:** 100 mm.
- **Scale subdivisions:** 20 kPa (0.2 bar) for a maximum scale value of 1000 kPa (10 bar).
- **Material:** Black steel case.
- **Connections:** 'U' pattern siphon and gauge cock.
- **Execution:** Installing pressure gauges.

Masking plates

Shared by: 50-10-05/120 Above-ground wastewater drainage system with internal stacks; 55-40-40/120 Cold water supply system; and 60-45-40/110 Low temperature hot water heating system.

- **Manufacturer:** Contractor's choice.
- **Material:**

- **All pipes except chromium plated copper:** Plastic.
- **Format:** Split.

Pipeline strainers

Shared by: 55-40-40/120 Cold water supply system; and 60-45-40/110 Low temperature hot water heating system.

- **Manufacturer:** Hattersley Type 907 or equal and approved
- **Pattern:** Y pattern.
- **Baskets:**
 - **Perforation size:** 0.75 mm
- **Material:** Bronze body, grade 304 Stainless steel strainer.
- **Connections:** Taper Threaded to BS EN 10226-2
- **Integral accessories:** Supplied with two Hattersley fig. 631 test points
- **Execution:** Installing strainers.

Pipe sleeves

Shared by: 55-40-40/120 Cold water supply system; and 60-45-40/110 Low temperature hot water heating system.

- **Manufacturer:** Contractor's choice.
- **Material:** Ensure that the material is compatible with the pipe the sleeve is carrying and with the material the sleeve is penetrating
- **Execution:** Install Pipe sleeves with a minimum of 25 mm protrusion either side of a wall or floor. Fill the gap between the pipe and pipe sleeve with fire resistant material equal to the fire and smoke rating of the fire compartment the pipe sleeve penetrates through.

Tundishes

Shared by: 55-40-40/120 Cold water supply system; and 60-45-40/110 Low temperature hot water heating system.

- **Manufacturer:** Contractor's choice.
- **Material:** Copper sheet.
- **Connections:** Diameter to suit drain line.

Steel pipelines

- **General requirements:** Steel pipeline jointing materials and Steel pipeline fittings.
- **Manufacturer:** Contractor's choice.
- **Standard:**
 - **Up to 150mm:** To BS EN 10255, heavy weight.
- **Finish:** Varnish.
- **Options:** Pipeline supports and Steel expansion loops.
- **Execution:** Installing buried pipelines and Protection of buried pipelines.

Steel pipeline fittings

- **Manufacturer:** Contractor's choice.
- **Standards:**
 - **Malleable:** To BS 143 and 1256.

- **Flanged:** To BS EN 1092-1.
- **Welded:** To BS EN 10253-1 and BS EN 10253-2.

Steel pipeline jointing materials

- **Manufacturer:** Contractor's choice.
- **Standards:**
 - **Jointing compound:** To BS 6956-5.
 - **PTFE tape:** To BS EN 751-3.
 - **Flange jointing rings:** To BS EN 1514-4.
 - **Elastomeric gaskets:** To BS EN 681-1.
 - **Welding rods:**
 - Gas welding:** To BS EN 12536.
 - Arc welding:** To BS EN ISO 636.

Pipeline supports

- **Manufacturer:** Contractor's choice.
- **Material:** Contractor's choice.
- **Execution:** Installing pipeline supports.

Connections for accessories type C

- **Capillary:** To BS EN 1254-1.
- **Compression for copper tubes:** To BS EN 1254-2.
- **Compression for plastics pipes:** To BS EN 1254-3.
- **Flanged for cast iron:** To BS EN 1092-2.
- **Flanged for copper alloy:** To BS EN 1092-3.
- **Threaded:**
 - **Where pressure-tight joints are made on the threads:** To BS 21 or BS EN 10226-1.
 - **Where pressure-tight joints are not made on the threads:** To BS EN ISO 228-1.

Connections for accessories, type D

- **Capillary:** To BS EN 1254-1.
- **Compression for copper tubes:** To BS EN 1254-2.
- **Compression for plastics pipes:** To BS EN 1254-3.
- **Flanged for cast iron:** To BS EN 1092-2.
- **Flanged for copper alloy:** To BS EN 1092-3.
- **Threaded:**
 - **Where pressure-tight joints are made on the threads:** To BS 21 or BS EN 10226-1.
 - **Where pressure-tight joints are not made on the threads:** To BS EN ISO 228-1.

Butterfly valves

- **General requirements:** Connections for accessories type C.

- **Manufacturer:** Hattersley or equal and approved 65mm and above - Fig 950W
- **Standard:** To BS EN 593.
- **Arrangement:** Double flanged.
- **DN rating:** Manufacturer's standard.
- **PN rating:** Manufacturer's standard.
- **Working conditions:**
 - **Type of fluid:** Water.
 - **Maximum working pressure:** To be Confirmed by User and checked with manufacturer
 - **Fluid temperature:** 5 °C.
 - **Flow velocity:** To be confirmed by user
- **Materials:**
 - **Body:** Manufacturer's standard.
 - **Shaft:** Manufacturer's standard.
 - **Disc:** Manufacturer's standard.
 - **Seat:** Manufacturer's standard.
- **Operation:**
 - **Manual:** Lever.
- **Options:**
- **Execution:** Installation of valves generally type B.

Cast iron check valves type B

- **Manufacturer:** Hattersley or equal and approved 65mm and above - Fig 160W flanged ends PN16
- **Standard:** To BS EN 16767.
- **Third party certification:** WRAS approved
- **Arrangement:**
 - **Type:** Disk.
 - **Body ends:** Flanged. BS EN 1092-3
- **Mounting:** Horizontal.
- **Execution:** Installation of valves generally type B.

Draining taps

Shared by: 55-40-40/120 Cold water supply system; 60-45-35/110 Air source heat pump system; and 60-45-40/110 Low temperature hot water heating system.

- **Manufacturer:** Hattersley Fig 370
- **Standard:** To BS 2879.
- **Size:** 1/2", 3/4" and 1"
- **Arrangement:** Type 1 drain taps are suitable for temperatures up to 70°C with a maximum of 90°C for a period less than an hour.
- **Material:** Copper alloy.
- **Connections:** Threaded joints to BS EN 10226-1.
- **Execution:** Installation of valves generally type B.

Scale inhibitor chemicals

- **Manufacturer:** Contractor's choice.
- **Chemicals:** Contractor's choice.

Fan convectors

- **Manufacturer:** Dunham Bush or equal and approved
- **Standards:** To BS EN 442-1, BS EN 442-2 and BS EN 442-3.
- **Third party certification:** Manufacturer's standard.
- **Duty:**
 - **Reference:** Refer to equipment schedules
- **Electrical supply:** Single phase.
- **Casing finish:** Manufacturer's standard.
- **Connections:** Manufacturer's standard.
- **Accessories:** Air release valve;
Integral thermostat;
Removable, washable air filter;
Three speed fan;
and Ventilation only setting.
- **Execution:** Installing heat emitters generally.

Phenolic foam insulation type A

Shared by: 55-40-40/120 Cold water supply system; 60-45-35/110 Air source heat pump system; and 60-45-40/110 Low temperature hot water heating system.

- **Manufacturer:** Kingspan Insulation Ltd.
- **Product reference:** The Kooltherm Pipe Insulation System.
- **Kooltherm pipe insulation thickness:** Insulation thickness in accordance with BS 5422
- **Pipe support inserts:** Contractor's choice.
 - **Thickness:** Insulation thickness in accordance with BS 5422
- **Reaction to fire classification:** Reaction to fire classification of DL-s1, d0, as defined in BS EN 13501-1.
- **Vapour barrier:**
 - **Material:** Flexible sheet.
 - **Vapour permeability:** To BS 5422, clause 5.6.
- **Protection:** Provide Venture clad 1577CW self adhesive 5 ply laminate cladding to all pipework, valves and ancilleries externally within plant rooms.
- **Execution:** Installing phenolic foam insulation on pipelines.

Identifying pipework

Shared by: 55-40-40/120 Cold water supply system; 60-45-35/110 Air source heat pump system; and 60-45-40/110 Low temperature hot water heating system.

- **Manufacturer:** Contractor's choice.
- **Standards:** To BS 1710.
- **Identification type:** Adhesive colour bands.
- **Execution:** Installing identification on pipework.

Valve charts and schematics

Shared by: 55-40-40/120 Cold water supply system; 60-45-35/110 Air source heat pump system; and 60-45-40/110 Low temperature hot water heating system.

- **Manufacturer:** Contractor's choice.
- **Material:** Paper print, encapsulated.
- **Information to be included:** Location and identification of pipework regulating, isolating and control valves.
- **Execution:** Installing valve charts and schematics.

Valve identification labels

Shared by: 55-40-40/120 Cold water supply system; 60-45-35/110 Air source heat pump system; and 60-45-40/110 Low temperature hot water heating system.

- **Manufacturer:** Contractor's choice.
- **Material:** Face engraved rigid plastic laminate.
- **Label size:** Manufacturer's standard.
- **Colour:**
 - **Background:** White.
 - **Lettering:** Black.
- **Typography:**
 - **Font:** Manufacturer's standard.
 - **Size:** Manufacturer's standard.
- **Information:** Purpose and reference number.
- **Execution:** Installing valve identification labels.

Channel supports

Shared by: 60-45-35/110 Air source heat pump system; 60-45-40/110 Low temperature hot water heating system; and 65-10-95/140 Mechanical extract and balanced ventilation systems.

- **Manufacturer:** Contractor's choice.
- **Channels:**
 - **Load capacity:** Contractors design
 - **Format:** Slotted.
 - **Dimensions:** 41 x 21 x 1.5 mm;
41 x 21 x 2.5 mm;
41 x 41 x 1.5 mm;
and 41 x 41 x 2.5 mm.
 - **Type:** Contractors design
 - **Material:** Carbon steel.
 - **Finish:** Hot dip galvanized.
 - **Accessories:** 90° brackets;
Base plates;
Channel type cantilever arms;
End caps;
Internal connectors;
6 mm threaded rod;

8 mm threaded rod;
10 mm threaded rod;
and Trapeze hangers.

Rubber bellows

- **Manufacturer:** Pipe Solutions Ltd or equal and approved
- **Rubber bellows type:** Untied.
- **Connections:** Flanged.
- **Execution:** Installation of flexible hoses and rubber bellows.

Execution

Installing water based heating systems

- **Standard:** To BS EN 14336.

Hydraulic pressure testing of low temperature hot water heating systems

- **Testing:** In accordance with BS EN 14336, Appendix B.
- **Notice (minimum):** 5 working days.
- **Pressure:** 1.5 times working pressure.
- **Duration of test:** 1 h.

Flushing and pre-commission cleaning of heating systems

- **Preliminary checks:** Thoroughly inspect pipework. Complete pressure tests before cleaning.
- **Flushing:** In accordance with BSRIA BG 29/2012.
- **Cleaning:** In accordance with BSRIA BG 29/2012 and BSRIA BG 50/2013.
- **Waste products:** Neutralize, and dispose of to drain. Preferably direct to manhole.

Installing pressure gauges

- **Position:** Refer to drawings

Installing combined air and dirt separators

- **Position:** Fit with dirt drain at lowest point for removing dirt that sinks.

Installing pipeline supports

- **Position:**
 - **In plant rooms:** Contractor's choice.
 - **Distribution corridors and risers:** Contractor's choice.
 - **Surface mountings:** Split ring, spacer nipple and backplate.

Installing pressurization units

- **Standards:**
- **Location of expansion vessel:** In the system return pipeline close to the heat source or chilled water unit.

Installing dosing pots

- **Position:** Install where there is a high differential pressure between flow and return pipeline.
- **Drain point:** Provide adjacent to the unit.
- **Fixing:** Securely to a wall using mounting bracket.

Testing flues and chimneys

- **Standard:** To BS EN 1859.
- **Results:** Submit.

Installing insulation and protection products generally

Shared by: 90-90-40/640 Installing phenolic foam insulation on pipelines; and 90-90-40/670 Installing insulation on tanks.

- **Standard:** In accordance with BS 5970.
- **Timing:** Insulate after installed system has been fully tested and joints proved sound.
- **Insulation:** Do not enclose adjacent units together.
- **Clearance:** Maintain between pipes.
- **Finish:** Neatly finish joints, corners, edges and overlaps.

Installing phenolic foam insulation on pipelines

Shared by: 90-90-40/360 Phenolic foam insulation type A and type B.

- **General requirements:** Installing insulation and protection products generally.
- **Joints:** Close butt, seal with 50 mm wide class 0 foil tape on both longitudinal and circumferential joints.
- **At fittings:** Mitre. Secure with tape.
- **Vapour seal:** Tape exposed insulation membrane. Seal vapour barrier at pipe support with class 0 foil tape.

Installing valve charts and schematics

- **Fixing:** Install full size schematic close to Plantroom entry and valve charts on wall local to valve sets.
- **Position:** Plant room.

Installing valve identification labels

- **Fixing:** Secure with metal chain.

Installing identification on pipework

- **Application of basic identification colour:** Coloured bands as BS 1710 clause 3.3.
- **Safety colour identification:** On or next to the colour bands.
- **Information:** Abbreviation of name;
Chemical symbol for gases;
- **Direction of flow:** Indication arrow and the word FLOW or the letter F and
Indication arrow and the word RETURN or the letter R.

Installation of flexible hoses and rubber bellows

- **Position:** Close to the source of vibration.

System completion

Commissioning water heating systems

- **Pre-commissioning:** In accordance with BSRIA 2/89.3 and Commissioning Code: Water distribution systems.
- **Commissioning:** In accordance with BSRIA AG 2/89.3 and Commissioning Code: Water distribution systems.
- **Variable flow systems:** In accordance with CIBSE KS09 Commissioning variable flow pipework systems.
- **Notice (minimum):** One week.

Commissioning boiler plant

- **Pre-commissioning:** In accordance with CIBSE Commissioning code B.
- **Commissioning:** In accordance with CIBSE Commissioning code B.
- **Notice (minimum):** One week.

Performance testing

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

Demonstrations

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

Inspection and test records

- **Reports:**
 - **Construction phase:** System commissionable.
- **Records for water systems:** In accordance with BSRIA 2/89.3.
- **Record sheets:** .

- **Submission:** On completion.
- **Number of copies:** Three.

Documentation

- **Operating and maintenance instructions:**
 - **Scope:** Submit for the system giving optimum settings for controls.
 - **Product information:** Include product description, date of purchase, performance characteristics, application (suitability for use), method of operation and control, and cleaning and maintenance requirements.
 - **Format:** Paper copy.
 - **Number of copies:** Two.
- **Record drawings:**
 - **Content:** Location and arrangement of plant in plant rooms;
Location, size and route of mechanical services;
Location, route and depth of underground services;
Location and identification of pipework regulating, isolation and control valves;
and Location of outlets.
 - **Format:** A1 paper print drawing and Electronic drawing.
 - **Number of copies:** Two.
- **Submittal date:** At handover.

Operating tools

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

Servicing and maintenance

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

Ω End of system

Mechanical extract and balanced ventilation systems

System outline

Mechanical extract and balanced ventilation systems

- Description:** All services with the exception as listed below and as noted on the drawings shall be isolated, stripped out and made safe, prior to the demolition. The redundant equipment shall be stripped out and safely removed and disposed, and/or handed back to the Client.
 All services stripped out to the area demarcation line to be made safe at this point. The redundant services should not pose a health and safety risk. All cable containment and pipes shall be capped off at this point.
 The Contractor should ensure no sharp edges.
 All circuits to be disconnected from the point of the origin and clearly labelled as redundant. Other areas are to be retained in use during the course of the works. It is therefore imperative that these systems are maintained through out these works and any downtime is agreed with the Client.

The building will be served by mixture of natural ventilation, fan assisted summer ventilation & purge and a mechanical ventilation system with heat recovery as described below.

G.05 Gallery 01 - Retain existing ventilation ducts and openings as shown on drawings, where ducts are to be blocked so as to install the new Gallery opening, these shall be properly sealed with care to the requirements of the fire strategy.

G.08 Lobby 01 - Two, master and slave, summer extract fans shall be installed within the rooflight at high level within the Lobby and shall be activated via CO2 sensors located within G.05 Gallery 01. Make up air shall be drawn through the natural vents and manually opening windows within G.05 Gallery 01. The doors to the Gallery shall be provided with door hold open control, in conjunction with the fire strategy requirements, to provide summer extract assisted ventilation.

G.09 Museum Office - Existing ventilation to office shall be retained.

G.10 Lift - Exhaust duct from below discharges through wall with weather louvre.

G.11 Gallery 2 - Retain existing fresh air intakes to rear of fan convectors. Modify existing ductwork connection as required with damper to suit new fan convector.

B.01 Museum Makers Workshop - Supply and install new extract ductwork system with extract grilles at high level tight to slab and routed into B.09 Lift. A new extract fan shall be located within the B.09 Lift space and the exhaust duct shall rise to the floor above and discharge to atmosphere via a new weather louvre. Acoustic lining shall be provided to extract duct within B.01 to the extract fan. The door to the B.20 Lightwell shall be provided with door hold open control, in conjunction with the fire strategy requirements, to provide summer extract assisted ventilation. The door to

the Lightwell shall be used for purge ventilation. The make -up air for the extract fan shall be via the existing natural vents and manual opening windows. Retain existing fresh air intake to rear of fan convector. Modify existing ductwork connection as required with damper to suit new fan convector. The fan shall be controlled via a local controller activated via a CO2 sensor within the room.

B.09 Lift - B.01 Museum Makers Workshop extract fan located at high level.

B.10 Storage - Retain existing office ventilation system.

B.15 Learning Space - The door to B.23 Stair 01 shall be provided with door hold open control, in conjunction with the fire strategy requirements, to provide summer extract assisted ventilation. Supply and install new transfer grille over B.17 Store door to provide purge ventilation. Re-install and modify existing ductwork connection from external weather louvre in B.20 Lightwell to the rear of the new fan convector within the Learning Space.

B.17 Store - Supply and install new transfer grille over B.17 Store door to provide purge ventilation.

B.19 Corridor - Supply and install door transfer grille in corridor door to G.14 Refreshments.

B.20 Lightwell - Repair existing plantroom louvres at basement level.

B.23 Stair 01 - Supply and install new window mounted extract fan through lower window opening to provide boost to assisted summer natural ventilation and purge and shall be activated via CO2 sensors located within B.15 Learning Space

MVHR System - A new Mechanical Ventilation with Heat Recovery (MVHR) unit shall be supplied and install to the underside of the slab within B.11 WC 01. Access will be required from below to allow filters to be changed. The unit shall consist of supply and extract fans, intake filters, a plate heat exchanger, bypass damper and integral controls. Intake and exhaust weather louvres shall be located low level in the existing windows to 'Blue Boar Street' within B.10 Storage and B.12 WC 02 respectively and shall be sympathetic to the age of the glazing. Circular galvanised ductwork shall be routed with the ceiling voids from the MVHR unit to sidewall and ceiling mounted supply grilles within the following rooms; B.08 Lobby and G.14 Refreshments. Circular galvanised ductwork shall be routed through the ceiling voids to the MVHR unit from ceiling mounted extract grilles within the following rooms; B.05 Staff, B.11 WC 01, B.12 WC 02, B.13 Baby Change and B.18 IT. Insulated circular galvanised ductwork shall be routed through the ceiling voids to the MVHR unit from the intake and exhaust louvres.

The MVHR has been designed to operate under time clock control from the integral manufacturers controller and will be limited to operation when the building is occupied. Where practical, ventilation provision to areas will be regulated to suit occupancy or CO2 levels in the spaces, allowing fan energy power consumption to be limited, refer to the service design drawings for details of strategy.

Opposed blade volume control dampers shall be provided on all ventilation branches to permit a proportional air balance to be carried out at completion.

Where test hole positions are provided within the ductwork system for proportional air balance these should be filled with plugs and the contractor should provide a removable section of insulation that will be marked with a traffolyte plate indicating the test hole position, this insulation can then be replaced after testing is carried out. The Contractor should also ensure that test hole locations are accessible from beneath.

Fire dampers will be provided where ventilation ductwork passes between fire compartment walls. Generally, all fire rated walls or positions where ductwork passes between compartment floors shall be provided with fusible link fire dampers. Motorised fire dampers shall be provided as indicated on design drawings. Where motorised dampers are provided their operation shall be triggered via a fire alarm interface link into the damper control panel, a facility will be provided by the Contractor to isolate this link during fire alarm tests. Where fire dampers are fitted, access doors shall be provided either side for reset/maintenance.

The use of flexible ductwork will be permitted for final connections to ceiling diffusers but must be kept to a length of 0.5m, fully extended, or less to avoid excessive pressure loss within the ductwork system.

All ventilation ductwork shall be insulated throughout the installation. Cladding shall be applied to all exposed ventilation ductwork or where it routes externally from the building.

Waterless traps shall be provided on the drain trays from the MVHR unit Heat exchangers.

All ductwork shall be identified in accordance with BS1710.

- **System performance:** In accordance with:-
 - BS 5720
 - BS 5588-9
 - DWW 144
 - HTM 03-01
 - BS 1710
 - Building Regulations Documents, in particular F & L2;
 - CIBSE Guides .
 - Design conditions:
 - External summertime conditions; 30 degC DB 25 degC WB
 - External wintertime conditions; -5 degC DB 100% RH

Internal design conditions

In compliance with the RDS

Energy criteria:

Specific fan power in accordance with Non Domestic Compliance Guide 2010

Noise Criteria :

External noise targets in compliance with acoustic report

Ductwork Sizing Velocities

5-6 m/s Main System Ductwork

3.5 m/s Sub Branches

2.5 - 3 m/s Final diffuser/grille connections

2.5m/s sizing velocity for all coils

- **Room extract air terminal devices:** Air transfer grilles and Grilles.
- **Air ductwork and accessories:**
 - **Ductwork:** Circular sheet metal ductwork and fittings;
Rectangular sheet metal ductwork and fittings;
and Fire rated and smoke extract ductwork and fittings.
 - **Accessories:** Existing.
- **Thermal insulation on extract air ductwork:** Phenolic foam insulation type B.
- **Vibration isolation mountings:** Isolation hangers.
- **Heat recovery:** Air handling unit and Plate recuperators.
- **Acoustic treatment:** Air transfer and cross talk attenuators;
Circular silencers;
and Rectangular silencers.
- **Extract fans:** Centrifugal fans;
Axial flow fans;
and Roof mounted fans.
- **External exhaust air terminals:** External louvres.
- **Accessories:** Roof equipment supports and Channel supports.
- **Controls:** Refer to Section 75 - 75
- **Identification of ductwork and equipment:** Identifying ductwork and Mechanical plant and equipment identification labels.
- **Testing:** Air leakage testing of plant items.
- **Execution:** Installing ductwork on air handling units.
- **System completion:** Commissioning of air distribution systems;
Performance testing;
Inspection and test records;
Demonstrations;
Documentation;
Spares and consumables;
and Maintenance.

Products

Primary filters

- **Manufacturer:** As AHU supplier
- **Standards:**
 - **Performance:** To BS EN 779.
 - **Testing:** To Eurovent 4/9 Method of testing air filters.
- **Filter type:** Pleated panels.
- **Filter class:** G4.
- **Conditions:** Ambient.
- **Flammability:** Non-flammable for duration of recommended working life.
- **Casing:** Rigid.
- **Access:** Side.

- **Filter mounting frames:**
 - **Construction:** Manufacturer's standard.
 - **Material:** Manufacturer's standard.
- **Execution:** Installing filter frames;
Installing filters;
and Edge seals.
- **Accessories:**

Air handling unit

- **Manufacturer:** Nuaire or equal and approved
- **Standard:** To BS EN 13053.
- **Duty:**
 - **Reference:** Refer to equipment schedule
 - **System:** Refer to equipment schedule
 - **Air volume:** Refer to equipment schedule
 - **External resistance:** Refer to equipment schedule
 - **Discharge velocity:** Refer to equipment schedule
 - **Sound power level:** Refer to equipment schedule
- **Environment:** Internal.
- **Construction:** Manufacturer's standard.
- **Arrangement:** Draw through.
- **Method of support:** Contractor's choice.
- **Anti-vibration mountings:** Manufacturer's standard.
- **Components:**
 - **Dampers:**
Shut off: Air control dampers.
 - **Filters:** Primary filters.
 - **Humidifiers:** Not required
 - **Heat recovery:** Plate recuperators.
 - **Fans:** Centrifugal fans.
 - **Attenuators:** Circular silencers and Rectangular silencers.
- **Flexible connections:** To HVCA DW/144.
- **Positions for maintenance access:** Contractor's choice.
- **Direction of airflow:** Horizontal.
- **Accessories:** Drain lines.
- **Execution:** Component assembly;
Access;
Coil installation generally;
Installing fans;
Services connections;
Isolation of air handling units;
Support for air handling units;
Air leakage testing;
and Testing.

Air control dampers

- **Purpose:** Shut off.
- **Position:** Manufacturer's standard.
- **Damper control:** Motorized.
- **Damper type:** Multi-blade damper, opposed blade.
- **Material:** Manufacturer's standard.
- **Ancillaries:** Position indicator.

Drain lines

- **Drain lines:** Provide, with traps, from sections where water may collect.
- **Execution:** Drain lines installation.

Air transfer grilles

- **Manufacturer:** Trox or equal and approved
- **Duty:**
 - **Reference:** Refer to equipment schedule
 - **Location:** Refer to equipment schedule and design drawings
 - **Size:** Refer to equipment schedule
 - **Sound power level:** Refer to Schedule
- **Shape:** Rectangular.
- **Grille type:** Non-vision.
- **Position:** Refer to drawings
- **Material:** Manufacturer's standard.
- **Finish:** Manufacturer's standard.
- **Accessories:** Intumescent core to BS ISO 10294-5 and Integral balance damper
- **Execution:** Installing air terminal devices and Support of air terminal units in ceiling grids.

External louvres

- **Manufacturer:** Trox or equal and approved
- **Application:** Supply.
- **Duty:**
 - **Reference:** Refer to equipment schedule
 - **System:** Refer to equipment schedule
 - **Air volume:** Refer to equipment schedule
 - **Size:** Refer to equipment schedule
- **Construction:** Robust with purpose made subframe. Provide integral drainage channels and drip cills.
- **Configuration:** In modular panel form.
- **Screen:** Bird-screen across inside face of louvres.
- **Execution:** Installing air terminal devices.

Grilles

- **Manufacturer:** Trox or equal and approved
- **Standards:**
 - **Mixed flow applications:** To BS EN 12238.
 - **Displacement flow applications:** To BS EN 12239.
 - **Sound power levels:** To BS EN ISO 5135.
- **Application:** Supply.
- **Duty:**
 - **Reference:** Refer to equipment schedule
 - **System:** Refer to equipment schedule
 - **Air volume:** Refer to equipment schedule
 - **Size:** Refer to equipment schedule
 - **Sound power level:** Refer to equipment schedule
- **Core velocity (maximum):** 3 m/s.
- **Shape:** Rectangular.
- **Grille type:** Manufacturer's standard.
- **Position:** Wall.
- **Material:** Manufacturer's standard.
- **Finish:** Manufacturer's standard.
- **Accessories:** Integral balance damper
- **Execution:** Support of air terminal units in ceiling grids.

Circular sheet metal ductwork and fittings

- **Standards:** To HVCA DW/144, BS EN 1506 and BS EN 12237.
- **Classification:** Class A.
- **Air leakage testing:** Not required
- **Material:** Zinc coated steel.
- **Construction:** Spirally wound.
- **Regulating dampers:**
 - **Standard:** As HVCA DW/144.
 - **Balancing type:** Opposed blade.
 - **Operation:** Manual.
 - **Material:** Manufacturer's standard.
- **Flexible joint connections:** Fit on fan inlets and outlets and at building expansion joints.
- **Hangers and supports:**
 - **Standard:** To HVCA DW/144.
 - **Strength requirements:** To BS EN 12236.
- **Access openings:**
 - **Purpose:** Inspection and Cleaning.
 - **Sizes:** To HVCA DW/144, Appendix D.
- **Execution:** Air ductwork generally;
Installing sheet metal ductwork;

Installing control equipment and instruments in metal ductwork;
Ductwork support for vapour seal continuity;
Test holes in ductwork;
Weatherproofing ductwork penetrations;
Ductwork cleanliness;
Specialist ductwork cleaning;
Verification of cleanliness of ventilation systems;
 and Installing ductwork supports.

Rectangular sheet metal ductwork and fittings

- **Standards:** To HVCA DW/144 and BS EN 1505.
- **Classification:** Class A.
- **Air leakage testing:** Not required
- **Material:** Zinc coated steel.
- **Regulating dampers:**
 - **Standard:** To HVCA DW/144.
 - **Balancing type:** Opposed blade.
 - **Operation:** Manual.
 - **Material:** Manufacturer's standard.
- **Flexible joint connections:** Fit on fan inlets and outlets and at building expansion joints.
- **Hangers and supports:**
 - **Standard:** To HVCA DW/144.
 - **Strength requirements:** To BS EN 12236.
- **Access openings:**
 - **Purpose:** Cleaning and Maintenance.
 - **Sizes:** To HVCA DW/144 Appendix D.
- **Execution:** Air ductwork generally;
Installing sheet metal ductwork;
Installing ductwork supports;
Ductwork support for vapour seal continuity;
Test holes in ductwork;
Weatherproofing ductwork penetrations;
Installing control equipment and instruments in metal ductwork;
Ductwork cleanliness;
Specialist ductwork cleaning;
 and Verification of cleanliness of ventilation systems.

Axial flow fans

- **Manufacturer:** Nuaire & Elta or equal and approved
- **Performance:**
 - **Standard:** To BS 848-1.
 - **Inlet and outlet arrangement:** To BS 848-1, type D.
- **Duty:**
 - **Reference:** Refer to equipment schedule
 - **Application:** Extract.
 - **Air volume:** Refer to equipment schedule

- **Fan speed: Refer to equipment schedule**
 - **Sound power level: Refer to equipment schedule**
- **Mechanical safety:** To BS 848-5.
- **Electrical safety:** To BS EN 60335-2-80.
- **Dimensions:** To BS EN ISO 13351.
- **Operating conditions:**
 - **Environment:** Condensation.
 - **Air density:** 1.20 kg/m³.
- **Operation:** Single.
- **Variable air volume method:** Variable speed drive.
- **Impellers:** Fixed pitch.
- **Casing:** Manufacturer's standard.
- **Motor and drive:**
 - **Type:** Match fan.
 - **Speed:** Variable speed.
- **Materials:**
 - **Casing:** Manufacturer's standard.
 - **Impeller:** Manufacturer's standard.
- **Anti-vibration mountings:** Isolation hangers.
- **Flexible duct connections:** Flexible ductwork.
- **Accessories:** Flow measurement points; Removable access panel; and Speed controller.
- **Execution:** Installing fans generally.

Centrifugal fans

Shared by: 65-10-95/140 Mechanical extract and balanced ventilation systems; and 90-45-15/310 Air handling unit.

- **Manufacturer:** Nuaire or equal and approved
- **Performance:**
 - **Standard:** To BS 848-1.
 - **Inlet and outlet arrangement:** To BS 848-1, type D.
 - **Outlet positions:**
- **Duty:**
 - **Reference: Refer to equipment schedule**
 - **Application:** Supply.
 - **Air volume: Refer to equipment schedule**
 - **Resistance: Refer to equipment schedule**
 - **Fan speed: Refer to equipment schedule**
 - **External static resistance: Refer to equipment schedule**
 - **Sound power level: Refer to equipment schedule**
 - **Air temperature:**
- **Mechanical safety:** To BS 848-5.
- **Electrical safety:** To BS EN 60335-2-80.

- **Dimensions:** To BS EN ISO 13351.
- **Operating conditions:**
 - **Environment:** Condensation.
 - **Air density:** 1.20 kg/m³.
- **Variable air volume method:** Variable speed drive.
- **Motor and drive:** Match fan.
- **Casing:** Single inlet single width.
- **Mounting:** Channel frame.
- **Material:** Manufacturer's standard.
- **Anti-vibration mountings:** Isolation hangers.
- **Flexible duct connections:** Flexible ductwork.
- **Accessories:** Back draft shutters;
Flow measurement points;
Removable access panel;
and Speed controller.
- **Execution:** Installing fans generally.
- **Fan blades:**

Plate recuperators

Shared by: 65-10-95/140 Mechanical extract and balanced ventilation systems; and 90-45-15/310 Air handling unit.

- **Manufacturer:** As AHU supplier
- **Duty:**
 - **Thermal Efficiency:** 50% minimum TH Ef
- **Casing:** Galvanized sheet steel.
- **Finish:** Manufacturer's standard.
- **Heat transfer plates:** Aluminium sheet.
- **Coating material:** Manufacturer's standard.
- **Access doors for maintenance:** Hinged, airtight and watertight.
- **Accessories:** Face and bypass dampers and Matching ductwork flanges. Condensate drain connection and glass traps
- **Execution:** Installing drain traps and Supports.

Drain traps

- **Material:** Manufacturer's standard.
- **Execution:** Installing drain traps.

Phenolic foam insulation type B

- **Manufacturer:** Kingspan Insulation Ltd.
- **Product reference:** Kooltherm FM pipe insulation.
- **Board size:** Contractor's choice.
- **Thickness:** In compliance with TIMSA guidance and Approved document Part L2
- **Form:** Duct slab.
- **Thermal conductivity:** 0.018 W/m·K at 0°C.
0.018 W/m·K at 10°C.

0.023 W/m·K at 50°C.

0.025 W/m·K at 75°C.

- **Finish:** Manufacturer's standard.
- **Reaction to fire classification:** Reaction to fire classification of DL-s1, d0, as defined in BS EN 13501-1.
Reaction to fire classification of DL-s3, d2, as defined in BS EN 13501-1.
- **Insulation thickness (minimum):** To BS 5422.
- **Vapour barrier:**
 - **Material:** Flexible sheet
 - **Vapour permeability:** To BS 5422, clause 5.6.
- **Protection:** Provide Venture clad 1577CW self adhesive 5 ply laminate cladding to all pipework, valves and ancilleries externally within plant rooms.
- **Accessories:**
- **New clause item 1:** Insulation for valves and flanges and Insulation at loadbearing pipeline supports
- **Execution:** Installing phenolic foam insulation on pipelines and Installing at non-loadbearing pipelines supports.

Insulation for valves and flanges

- **Material:** Phenolic foam
- **Form:** Removable and re-usable preformed rigid covers.
- **Finish:** Aluminium foil faced internally. Provide Venture clad 1577CW self adhesive 5 ply laminate cladding to all pipework, valves and ancilleries externally and within plant rooms.
- **Execution:** Installing at valves and flanges.

Insulation at loadbearing pipeline supports

- **Pipelines carrying fluids at temperature up to 120°C:** Kingspan Kooltherm pipe support insert.
- **Execution:** Installing at loadbearing pipelines supports.

Identifying ductwork

- **Manufacturer:** Contractor's choice.
- **Standard:** To HVCA DW/144 appendix B and BS 1710
- **Identification type:** Self-adhesive plastics or transfers.
- **Execution:** Installing ductwork identification.

Mechanical plant and equipment identification labels

Shared by: 55-40-40/120 Cold water supply system; 55-40-40/140 Hot water supply system; 60-45-35/110 Air source heat pump system; and 65-10-95/140 Mechanical extract and balanced ventilation systems.

- **Manufacturer:** Contractor's choice.
- **Material:** Face engraved rigid plastic laminate.
- **Label size:** Manufacturer's standard.
- **Colour:**
 - **Background:** White.

- **Lettering:** Black.
- **Typography:**
 - **Font:** Manufacturer's standard.
 - **Size:** Manufacturer's standard.
- **Information to be included:** Equipment name; Equipment reference number; and Service.
- **Execution:** Installing mechanical plant and equipment identification.

Channel supports

Shared by: 60-45-35/110 Air source heat pump system; 60-45-40/110 Low temperature hot water heating system; and 65-10-95/140 Mechanical extract and balanced ventilation systems.

- **Manufacturer:** Contractor's choice.
- **Channels:**
 - **Load capacity:** Contractors design
 - **Format:** Slotted.
 - **Dimensions:** 41 x 21 x 1.5 mm;
41 x 21 x 2.5 mm;
41 x 41 x 1.5 mm;
and 41 x 41 x 2.5 mm.
 - **Type:** Contractors design
 - **Material:** Carbon steel.
 - **Finish:** Hot dip galvanized.
 - **Accessories:** 90° brackets;
Base plates;
Channel type cantilever arms;
End caps;
Internal connectors;
6 mm threaded rod;
8 mm threaded rod;
10 mm threaded rod;
and Trapeze hangers.

Isolation hangers

Shared by: 65-10-95/140 Mechanical extract and balanced ventilation systems; and 90-45-30/320 Centrifugal fans.

- **Manufacturer:** Contractor's choice.
- **Isolation hangers type:** Contractor's choice.
- **Colour code:** Contractor's choice.
- **Load:** Contractor's choice.
- **Deflection:** Contractor's choice.
- **Drop rod misalignment capability:** 20%.

Execution

Installing ductwork on air handling units

- **Air discharge:** Connect ductwork to allow air to straighten as it leaves the air handling unit.

Edge seals

- **Purpose:** Prevent air by-passing filters. Seals must remain effective after removal and replacement of cells.

Installing filter frames

- **Fixing:** Securely fasten frames to ductwork walls.
- **Gaps around frames:** Seal with mastic sealant.

Installing filters

- **Mounting:** Clamp securely against sealing gasket to prevent leaks.

Component assembly

- **Sealing:** Provide gaskets between air handling unit sections to prevent air leakage from casing.
- **Site drilling of air handling unit:** Not permitted.

Access

- **Access space:** Position air handling units to allow space for maintenance and access.

Coil installation generally

- **Venting and draining:** Set out pipelines to and from the coils to allow venting and draining of the coils and piping.
- **Support:** Do not support pipelines and valves on coil connections.
- **Access:** Allow space to inspect and maintain the coils on both sides.

Drain lines installation

- **Fall:** 10 mm/m.
- **Discharge:** To a tundish or other form of air break.
- **Clean-out plugs:** Fit at each change of direction in the drain line.
- **Material:**
- **Trap:** Provide to prevent flooding.

Installing fans

- **Blow through units:** Arrange section to allow uniform velocity profile downstream.
- **Accessories:** Flexible connection between fan discharge and casing spigot and Manometer connections to measure static pressure at fan discharge.

Services connections

- **Entry points:** Seal around electrical cable and pipeline entry points to prevent air leakage.
- **Flexible cables:** Provide between fan motor and local isolator.

Isolation of air handling units

- **Electrical connections:** Provide means of isolating air handling units electrically.
- **Pipe connections:** Provide means of isolating pipelines to air handling units.
- **Steam:** Provide means of isolating steam to humidifier when access door is opened.

Support for air handling units

- **Method:** Builder's work base.

Testing

- **Test location:** Factory.
- **Tests:** Component air pressure drops;
Component water pressure drops;
and Fan and motor speeds.
- **Test results:** Submit on completion.

Installing air terminal devices

Shared by: 90-45-20/310 Air transfer grilles; and 90-45-20/370 External louvres.

- **General:** Do not distort air terminal devices. Fix securely.
- **Air leakage:** Prevent. Seal joints with self adhesive foam strip or equivalent.
- **Appearance:** Finish visible edge joints neatly. Do not leave sharp edges and protruding screws.
- **Operation:** Fit so that moving parts operate correctly and removable cores can be taken out and replaced.
- **High level and ceiling applications:** On removable cores, provide safety wires with quick release ends.

Support of air terminal units in ceiling grids

Shared by: 90-45-20/310 Air transfer grilles; and 90-45-20/380 Grilles.

- **Standard:** To HVCA DW/144.
- **Special supports:** Contractor's choice.
- **Position:** Agree final position of air terminals before installation.

Air ductwork generally

Shared by: 90-45-25/315 Circular sheet metal ductwork and fittings; 90-45-25/320 Fire rated and smoke extract ductwork and fittings; and 90-45-25/365 Rectangular sheet metal ductwork and fittings.

- **Cut edges on ductwork, flanges and supports:** Smooth and burr free.

Installing sheet metal ductwork

Shared by: 90-45-25/315 Circular sheet metal ductwork and fittings; and 90-45-25/365 Rectangular sheet metal ductwork and fittings.

- **Standard:** To BESADW/144.
- **Hangers and supports:**
- **Installing flexible joint connections:**

Installing ductwork supports

Shared by: 90-45-25/315 Circular sheet metal ductwork and fittings; 90-45-25/320 Fire rated and smoke extract ductwork and fittings; and 90-45-25/365 Rectangular sheet metal ductwork and fittings.

- **Standard:** In accordance with HVCA DW/144;
In accordance with HVCA DW/154;
In accordance with HVCA DW/191;
and In accordance with BSRIA BG 10/2010.

Ductwork support for vapour seal continuity

Shared by: 90-45-25/315 Circular sheet metal ductwork and fittings; 90-45-25/320 Fire rated and smoke extract ductwork and fittings; and 90-45-25/365 Rectangular sheet metal ductwork and fittings.

- **Method of support:** Ensure vapour seal is maintained throughout.

Test holes in ductwork

Shared by: 90-45-25/315 Circular sheet metal ductwork and fittings; 90-45-25/320 Fire rated and smoke extract ductwork and fittings; and 90-45-25/365 Rectangular sheet metal ductwork and fittings.

- **Position:** In accordance with CIBSE Commissioning Code Series A and BESADW/144.

Weatherproofing ductwork penetrations

Shared by: 90-45-25/315 Circular sheet metal ductwork and fittings; 90-45-25/320 Fire rated and smoke extract ductwork and fittings; and 90-45-25/365 Rectangular sheet metal ductwork and fittings.

- **Roof penetrations:** Contractor's choice, with comment from Architect.
- **Wall penetrations:** Contractor's choice, with comment from Architect..

Fire rated ductwork sleeves and collars

- **Position:** As defined on system drawings
- **Material:** To match ductwork.
- **Standard:**

Installing control equipment and instruments in metal ductwork

Shared by: 90-45-25/315 Circular sheet metal ductwork and fittings; and 90-45-25/365 Rectangular sheet metal ductwork and fittings.

- **General:** Fit sensors, damper motors and other control equipment.
- **Connections:** Connect control equipment and instruments.

Ductwork cleanliness

Shared by: 90-45-25/315 Circular sheet metal ductwork and fittings; 90-45-25/320 Fire rated and smoke extract ductwork and fittings; and 90-45-25/365 Rectangular sheet metal ductwork and fittings.

- **Cleaning:** In accordance with HVCA TR/19.
- **Level of protection:** PDI level 1.

Specialist ductwork cleaning

Shared by: 90-45-25/315 Circular sheet metal ductwork and fittings; 90-45-25/320 Fire rated and smoke extract ductwork and fittings; and 90-45-25/365 Rectangular sheet metal ductwork and fittings.

- **Cleaning:** In accordance with HVCA TR/19.

Verification of cleanliness of ventilation systems

Shared by: 90-45-25/315 Circular sheet metal ductwork and fittings; 90-45-25/320 Fire rated and smoke extract ductwork and fittings; and 90-45-25/365 Rectangular sheet metal ductwork and fittings.

- **Verification:** In accordance with HVCA TR/19.
- **Method:** Vacuum test.
- **Completion report:**
 - **Format:** Electronic and Paper copy.
 - **Submit:** At handover.
 - **Number of copies:** Two

Air leakage testing of plant items

- **Standard:** To HVCA DW/144.
- **Procedure:** Include in-line plant with certificate of conformity for pressure class and air leakage classification for system under test.
- **Report:**
 - **Format:** Electronic and Paper copy.
 - **Submit:** At handover.
 - **Number of copies:** Two

Installing fans generally

Shared by: 90-45-30/310 Axial flow fans; 90-45-30/320 Centrifugal fans; and 90-45-30/360 Roof mounted fans.

- **Fixing:** Use fixing points provided. Do not strain the fan structure when bolts are tightened.
- **Orientation:**
- **Alignment:** Install fan to allow optimum air flow path.

Installing drain traps

- **Air break:** Locate between trap outlet and drainage system.
- **Traps under suction:** Install the outlet below the inlet a depth equivalent to at least 1.5x working pressure.

- **Traps under positive pressure:** Install inlet and outlet at same level.

Supports

- **Fixings:** Support heat recovery devices independently of ductwork.

Installing drain traps

- **Air break:** Locate between trap outlet and drainage system.
- **Traps under suction:** Install the outlet below the inlet a depth equivalent to at least 1.5x working pressure.
- **Traps under positive pressure:** Install inlet and outlet at same level.

Installing insulation and protection products generally

Shared by: 90-90-40/640 Installing phenolic foam insulation on pipelines; and 90-90-40/670 Installing insulation on tanks.

- **Standard:** In accordance with BS 5970.
- **Timing:** Insulate after installed system has been fully tested and joints proved sound.
- **Insulation:** Do not enclose adjacent units together.
- **Clearance:** Maintain between pipes.
- **Finish:** Neatly finish joints, corners, edges and overlaps.

Installing phenolic foam insulation on pipelines

Shared by: 90-90-40/360 Phenolic foam insulation type A and type B.

- **General requirements:** Installing insulation and protection products generally.
- **Joints:** Close butt, seal with 50 mm wide class 0 foil tape on both longitudinal and circumferential joints.
- **At fittings:** Mitre. Secure with tape.
- **Vapour seal:** Tape exposed insulation membrane. Seal vapour barrier at pipe support with class 0 foil tape.

Installing at valves and flanges

- **Application:** Do not obstruct removal of nuts and bolts, or operation of valves.

Installing at loadbearing pipelines supports

- **Application:** Close butt to insulation.
- **Joints:** Seal with 100 mm wide class 0 foil tape.
- **Sleeve:** Provide sheet metal protection sleeve.

Installing at non-loadbearing pipelines supports

- **Insulation:** Carry through pipe support.

Installing mechanical plant and equipment identification

- **Fixing:** Fix with adhesive to equipment.
- **Position:** On equipment.

Installing ductwork identification

- **Standard:** In accordance with BESADW/144.
- **Position:** Locate where visible.
- **Direction of flow:** Equilateral triangle, 150 mm length of side, with one apex pointing in the direction of flow.
- **Information:**

System completion

Commissioning of air distribution systems

- **Pre-commissioning:** In accordance with BSRIA 3/89.3 and CIBSE Commissioning code A.
- **Commissioning:** In accordance with BSRIA 3/89.3 and CIBSE Commissioning Code A.
- **Notice (minimum):** One week.

Performance testing

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

Inspection and test records

- **Reports:**
 - **Construction phase:** System commissionable.
- **Records for air systems:** In accordance with BSRIA 3/89.3.
- **Record sheets:**
 - **Submission:** On completion.
 - **Number of copies:** Three.

Demonstrations

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

Documentation

- **Operating and maintenance instructions:**
 - **Scope:** Submit for the system as a whole giving optimum settings for controls.
 - **Product information:** Include product description, date of purchase, performance characteristics, application (suitability for use), method of operation and control, and cleaning and maintenance requirements.
 - **Format:** Paper copy.
 - **Number of copies:** Two.
- **Record drawings:**
 - **Content:** Location and arrangement of plant in plant rooms;
Location, size and route of ductwork;
Location and identification of regulating dampers and fire dampers;
and Location of outlets.
 - **Format:** A1 paper print and Electronic.
 - **Number of copies:** Two.
- **Submittal date:** At handover.

Spares and consumables

- **Spares:**
 - **Filters:** Supply one spare of each type.
- **Detectors:** Supply two of each type.
- **Air terminal device keys:**
- **Filters:**
 - **Cleaning solution:** Supply coating solution for one complete cleaning of metal plate filters.
 - **Filter media:**
 - **Retaining clips and rubber gaskets:** Two sets for each type of filter.

Maintenance

- **Servicing and maintenance:** Undertake for 12 months after completion.

Ω End of system

Earthing and bonding system

System outline

Earthing and bonding system

- **Description:** The system shall facilitate for the transfer of electrical current to earth to protect personnel, buildings, structure, plant and equipment in the case of an electrical fault within the supply system and from interference from electro-magnetic fields and electrostatic forces.

The earthing and equipotential bonding system will provide protection against electric shock due to indirect contact by preventing the occurrence of a voltage of such magnitude and duration between simultaneously accessible conductive parts that danger could arise.

All services stripped out to the area demarcation line to be made safe at this point. The redundant services should not pose a health and safety risk. All cable containment and pipes shall be capped off at this point.

The Contractor shall ensure no sharp edges. All circuits to be disconnected from the point of the origin and clearly labelled as redundant. Other areas are to be retained in use during the works. It is therefore Imperative that these systems are maintained throughout these works and any downtime is agreed with the Client.

The above summary is intended for the general guidance of the Contractor only in the preparation of the tender. No omission from this description shall relieve the Contractor of their obligation to carry out the whole of the works hereinafter described.

The switchboard earth bars, main incoming utility services, lightning protection system, building steelwork frame, mechanical pipework, cable containment systems and any other extraneous conductive parts are to be connected to the main earthing terminal. This earthing terminal is to be connected to the electricity supplier's earth.

Copper earth cables are to be green/yellow LSF sheathed throughout their length unless otherwise denoted.

Provide a permanent label durably marked in letters 4.75mm minimum height "SAFETY ELECTRICAL CONNECTION - DO NOT REMOVE", in visible position, at each bonding conductor connection to extraneous conductive parts.

Provide all supplementary bonding conductors to extraneous exposed conductive metal parts. Minimum size of supplementary bonding conductors will be 4mm².

Allow provision to enable testing of the earth system to be carried out in accordance with the requirements for electrical installations BS 7671 & Code for Earthing BS7430

Supplementary earth cables are to be provided as required by design calculations. Minimum cable size is to be 4mm². Cable is to be cable tied to armoured cable.

Cable armour and the use of this as a CPC and bonding to the earth bars shall be as per the cable schedules.

- **Main incoming earth:** Existing.
- **Main equipotential bonding:**
 - **Connect the following to the main earthing terminal:** Main equipotential bonding shall be connected to all incoming pipework and all metalwork as prescribed by BS 7671 and including:
 - Heating Services
 - Cold Water Service
 - Ductwork
 - Main structural steelwork
 - Cable Trays / Basket / Trunkings
 - Cold water pipework
 - Heating pipework
 - Lightning protection
 - **Cable type:** PVC insulated cables.
 - **Size:** To BS 7671, Regulation 544.1.1.
- **Supplementary equipotential bonding:**
 - **Bond the following:** As per BS7671 : Guidance Note 8
 - **Cable type:** PVC insulated cables.
 - **Size:** Minimum of 2.5 mm² if sheathed or where mechanical protection is provided, otherwise 4 mm².
- **Circuit protective conductors:**
 - **Conductor type:** Cable armour;
Cable armour and auxiliary;
and Core of cable.
 - **Size:** To BS 7671, Regulation 543.1.3 and To BS 7671, Regulation 543.1.4.
- **Earth terminal:** Earth bars.
- **Accessories:** Earthing and bonding clamps;
Soil conditioning agents.
- **Electrical identification:** Electrical shock treatment signs;
Equipment labels and warning notices;
and Electrical diagrams generally.
- **Execution:** General installation;
Installing earth conductor joints and connections;
Installing surface barriers around earth rods;
Installing main earthing conductor;
Installing main equipotential bonding conductors;
Installing supplementary bonding conductors;
Dissimilar metals;
Earthing and bonding of street furniture;
Notices and labels;
and Installing functional earthing conductors.
- **System completion:** Inspection and testing and Documentation.

Products

Cable cleats

Shared by: 70-70-45/110 Low voltage distribution system; 70-70-75/110 Hard wired low voltage small power system; and 90-55-15/735 Cable installation on channel cable supports, cable tray, cable ladder and cable basket.

- **Manufacturer:** Contractor's choice.
- **Standard:** To BS EN 61914.
- **Format:** Contractor's choice.
- **Material:** Metallic.
- **Temperatures for permanent installation:**
 - **Maximum:** 105°C.
 - **Minimum:** -25°C.
- **Resistance to impact:** Heavy.
- **Type of retention or resistance to electromechanical forces:** Resistant to electromechanical forces, withstanding one short circuit.
- **Environmental influences:**
 - **Non-metallic and composite components:** Resistant to ultraviolet light.
 - **Metallic and composite components:** High resistance to corrosion.

Cable ties

Shared by: 70-70-45/110 Low voltage distribution system; 70-70-75/110 Hard wired low voltage small power system; and 90-55-15/735 Cable installation on channel cable supports, cable tray, cable ladder and cable basket.

- **Manufacturer:** Contractor's choice.
- **Standard:** To BS EN 62275.
- **Format:** Wrap around self-locking releasable.
- **Material:** Nylon and Metal.
- **Loop tensile strength (minimum):** Manufacturer's standard.
- **Temperatures for permanent installation:**
 - **Maximum:** 60°C.
 - **Minimum:** -15°C.
- **Contribution to fire:** Non-flame propagating.
- **Environmental influences:**
 - **Non-metallic and composite components:** Resistant to ultraviolet light.
 - **Metallic and composite components:** Resistant to corrosion.

Cable bands

Shared by: 70-70-45/110 Low voltage distribution system; and 90-55-15/735 Cable installation on channel cable supports, cable tray, cable ladder and cable basket.

- **Manufacturer:** Contractor's choice.
- **Material:** Manufacturer's standard.
- **Protective covering:** Manufacturer's standard.

Cable baskets

Shared by: 70-70-45/110 Low voltage distribution system; 70-70-75/110 Hard wired low voltage small power system; 70-80-35/110 Hard wired general lighting system; 75-45-20/110 Data distribution system; 75-60-10/110 CCTV system; 75-60-40/110 Intruder detection and alarm system; 75-65-30/110 Fire detection and alarm system; and 90-55-15/650 Extra low and low voltage cables in accessible roof spaces.

- **Manufacturer:** Contractor's choice.
- **Material:**
- **Coating material:** Hot dip galvanised, powder coated RAL colour to architectural specification
- **Features:**
 - **Segregation:** Cable dividers.
 - **Protective cover:** Required.
- **Execution:** Installing cable basket; Multiple cable runs; and Cable support zones.
- **Standard:** To BS EN 61537.

Cable trays

Shared by: 70-70-45/110 Low voltage distribution system; 70-70-75/110 Hard wired low voltage small power system; 75-60-10/110 CCTV system; and 90-55-15/650 Extra low and low voltage cables in accessible roof spaces.

- **Manufacturer:** Contractor's choice.
- **Standard:** To BS EN 61537.
- **Material:** Steel.
- **Resistance against flame propagation:** Non-Flame propagating.
- **Electrical properties:**
 - **Continuity characteristics:** Without electrical continuity.
 - **Conductivity characteristics:** Without electrical conductive system component.
- **Coating material:** Hot dip galvanised, powder coated RAL colour to architectural specification
- **Temperature properties for transport, storage, installation and application:**
 - **Minimum:** Manufacturer's standard.
 - **Maximum:** Manufacturer's standard.
- **Mechanical properties:**
 - **Cable tray free base area:** Manufacturer's standard.
 - **Resistance to impact:** Manufacturer's standard.
- **Features:**
 - **Flange type:** Return.
 - **Segregation:** Cable dividers.
 - **Protective cover:** Required.
- **Execution:** Installing cable tray and cable ladder; Installing cable supports on roofs;

Multiple cable runs;
and Cable support zones.

Rigid conduit

Shared by: 70-70-25/660 Installing main earthing conductor; 70-70-45/110 Low voltage distribution system; 70-70-75/110 Hard wired low voltage small power system; 70-80-35/110 Hard wired general lighting system; 75-45-40/110 Audio-frequency-induction-loop system; 75-60-05/110 Access control system; 75-60-40/110 Intruder detection and alarm system; 75-65-30/110 Fire detection and alarm system; 75-70-05/110 Assistance call system; and 90-55-15/645 Low voltage cables concealed in walls and partitions.

- **Manufacturer:** Contractor's choice.
- **Standards:** To BS EN 61386-21.
- **Mechanical properties:**
 - **Resistance to compression:** Heavy.
 - **Resistance to impact:** Heavy.
- **Transport, installation and application:**
 - **Lower temperature (minimum):** Manufacturer's standard.
 - **Upper temperature (maximum):** Manufacturer's standard.
- **Resistance to bending:** Rigid.
- **Electrical characteristics:** With electrical continuity properties.
- **Resistance to external influences:**
 - **Protection against ingress of solid objects (minimum):** To BS EN 60529, IP3X.
 - **Protection against ingress of water (minimum):** To BS EN 60529, IPX0.
- **Resistance to corrosion:** To BS EN 61386-1, Class 4.
- **Tensile strength:** Heavy.
- **Resistance to flame propagation:** Manufacturer's standard.
- **Suspended load capacity:** Heavy.
- **Colour:** Submit proposals.
- **Sizes (OD):** 25 mm.
- **Execution:** Installing rigid metallic conduit;
Installing rigid non metallic conduit;
Installing conduit connections to equipment;
and Conduit, trunking and ducting zones.

Cable trunking and cable ducting systems

Shared by: 70-70-45/110 Low voltage distribution system; 70-70-75/110 Hard wired low voltage small power system; 70-80-35/110 Hard wired general lighting system; 75-60-05/110 Access control system; 75-60-40/110 Intruder detection and alarm system; 75-65-30/110 Fire detection and alarm system; 75-70-05/110 Assistance call system; 75-70-05/120 Emergency voice communication system; and 90-55-15/650 Extra low and low voltage cables in accessible roof spaces.

- **Manufacturer:** Contractor's choice.
- **Standards:** To BS EN 50085-1 and BS EN 50085-2-1.
- **Material:** Metallic;
Non-metallic;
and Steel.

- **Construction:** To include means of preventing contact between liquids and insulated conductors and live parts.
- **Temperature properties:**
 - **Storage and transport temperature (maximum):** Manufacturer's standard.
 - **Installation and application temperature (minimum):** Manufacturer's standard.
 - **Application temperature (maximum):** Manufacturer's standard.
- **Resistance to flame propagation:** Required.
- **Electrical properties:** With electrical continuity characteristics.
- **Ingress protection (minimum):** To BS EN 60529, IP x4.
- **Protection against corrosive and polluting substances:** High protection outside and inside.
- **Access method:** With tools.
- **Screening:** Required.
- **Execution:** Conduit, trunking and ducting zones and Installing trunking generally.

PVC insulated cables

Shared by: 70-70-25/110 Earthing and bonding system; 70-70-45/110 Low voltage distribution system; 75-45-40/110 Audio-frequency-induction-loop system; 90-65-05/630 Installing combined daylight and occupancy sensors; 90-65-05/640 Installing daylight sensors; 90-65-05/660 Installing mains voltage occupancy detectors; and 90-65-05/670 Installing photoelectric control units.

- **Manufacturer:** Contractor's choice.
- **Standard:** To BS 6004.
- **Third party certification:** British Approvals Service for Cables (BASEC) certified.
- **Rigid PVC insulated cables (PVC singles, H07V):**
 - **Construction:** To table 4a.
 - **Size:** Refer to cable schedule
- **PVC insulated and PVC sheathed cables (PVC/ PVC):**
 - **Construction:** To table 7.
 - **Sheath colour:** Manufacturer's standard.
 - **Size:** Refer to cable schedule
- **PVC insulated, PVC sheathed cables with circuit protective conductor (PVC/ PVC with CPC):**
 - **Construction:** To table 8.
 - **Size:** Refer to cable schedule
- **Heat resisting PVC insulated cables (HR PVC singles, H07V-K):**
 - **Construction:** To table 11a.
 - **Size:** Refer to cable schedule
- **Execution:** Installing low voltage cables;
Extra low and low voltage cable routes;
Low voltage cables concealed in walls and partitions;
Extra low and low voltage cables in accessible roof spaces;
Extra low and low voltage surface mounted cables;
Installing low voltage cables in conduit and trunking;

and Cable installation on channel cable supports, cable tray, cable ladder and cable basket.

Earth bars

- **Manufacturer:** Contractor's choice.
- **Material:**
 - **Bar type:** Hard drawn copper to BS EN 13601.
 - **Support:** PVC-U.
- **Size:**
 - **Profile:** 50 mm x 6 mm.
 - **Length:** Contractor's choice.
- **Predrilled connections (minimum):** Contractor's choice.
- **Disconnecting links:** 2.
- **Execution:** Installing earth bars.

Earthing and bonding clamps

Shared by: 70-70-25/110 Earthing and bonding system; and 70-70-25/660 Installing main earthing conductor.

- **Standard:** To BS 951.

Soil conditioning agents

- **Material:** Manufacturer's standard.
- **Execution:** Installing soil conditioning agents.

Electrical shock treatment signs

Shared by: 70-70-25/110 Earthing and bonding system; 70-70-45/110 Low voltage distribution system; 70-70-75/110 Hard wired low voltage small power system; and 70-80-35/110 Hard wired general lighting system.

- **Manufacturer:** Contractor's choice.
- **Format:** Plastics encapsulated.

Equipment labels and warning notices

Shared by: 70-70-25/110 Earthing and bonding system; 70-70-45/110 Low voltage distribution system; 70-70-75/110 Hard wired low voltage small power system; and 70-80-35/110 Hard wired general lighting system.

- **Manufacturer:** Contractor's choice.
- **Material:** Face engraved rigid plastic laminate.
- **Label size:** Submit proposals.
- **Colour:**
 - **Background:** Manufacturer's standard.
 - **Lettering:** Manufacturer's standard.
- **Typography:**
 - **Font:** Manufacturer's standard.
 - **Size:** Manufacturer's standard.
- **System notice wording:** Manufacturer's standard.

Electrical diagrams generally

Shared by: 70-70-25/110 Earthing and bonding system; 70-70-45/110 Low voltage distribution system; 70-70-75/110 Hard wired low voltage small power system; and 70-80-35/110 Hard wired general lighting system.

- **Material:** Engraved plastics laminate and 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.

Execution

General installation

- **Standards:** In accordance with BS 7430 and BS 7671.

Installing earth conductor joints and connections

- **Number of joints:** Minimize.
- **Contact surfaces:** Clean. Coat with corrosion inhibitor.
- **Bimetallic joints:** Do not cross-contaminate.
- **Protection to Joints and connections subject to moisture:**
 - **Type of protection:** Contractor's choice.
- **Connections to test points:** Clamp.
- **Copper tape jointing:**
 - **Type:** Phosphor bronze clamps, nuts, bolts and washers and Thermic weld.
 - **Copper tape overlap (minimum):** 100 mm.
- **Protective cable terminations:** Compression lugs with phosphor bronze nuts, bolts and washers.

Installing surface barriers around earth rods

- **Non-conducting barriers:** Install to prevent personnel or livestock contact with the ground within 2 m of earth rods.
- **Location and design:** Contractor's choice.

Installing main earthing conductor

- **Conductor location:** Install between the main incoming earth and the main earthing terminal in one continuous length.
- **Connection:** Make with compression lugs and phosphor bronze nuts and bolts and spring washers.
- **Earthing conductor route:** Contractor's choice.
- **Connection to earth electrodes:** Earthing and bonding clamps.
- **Protection to main earthing conductor:** Rigid conduit.

Installing main equipotential bonding conductors

- **Separate and continuous connections:** Install between each service and the main earth terminal.
- **Bonding conductor routes:** Contractor's choice.
- **Bonding connections at main earth terminal:** Connect with compression lugs and phosphor bronze nuts and bolts and spring washers.

Installing supplementary bonding conductors

- **Earth connections:** Connect with compression lugs.

Dissimilar metals

- **Connecting dissimilar metals:** Prevent electrolytic action.

Earthing and bonding of street furniture

- **Standards:** In accordance with BS 7671 and the Electricity Distributor's requirements.
- **Supplies to street furniture:** Use cables with separate phase, neutral and protective conductors.

Notices and labels

- **Earth bars:** Describe each connection and label with 'SAFETY ELECTRICAL CONNECTION – DO NOT REMOVE'.
- **Earthing and main protective bonding connections:** Describe each connection and label with 'SAFETY ELECTRICAL CONNECTION – DO NOT REMOVE'.
- **Supplementary bonding connections:** Describe each connection and label with 'SAFETY ELECTRICAL CONNECTION – DO NOT REMOVE'.
- **Telecommunications functional earth connections:** Label with 'TELECOMMS EARTH – DO NOT REMOVE'.

Installing functional earthing conductors

- **Standard:** To BS 6701.
- **Labelling:** Identify the purpose of functional earth cables along their length using clip-on cable markers.
- **Spacing (maximum):** 3 m.

Installing cable tray and cable ladder

Shared by: [90-55-10/330 Cable ladders](#); and [90-55-10/335 Cable trays](#).

- **Standards:** To BS 7671 and in accordance with IET guidance note 1.
- **Preparation:**
 - **Burrs and sharp edges:** Make smooth.
 - **Cutting:** Minimize and make good edges. Cuts to cable tray to be square along an unperforated line.
 - **Treatment of cut surface:** Extend 25 mm beyond the cut. Match finish of cable supports.
- **Access:** Provide space around cable ladder and tray 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 ladder and tray:** Maximize.
 - **Ends:** Blank with end plates.
- **Changes of size and direction:** Manufacturer's accessories of the same material type, pattern, finish and thickness as cable supports.
- **Fire barriers:** Provide where required to maintain fire performance of fabric.
- **Protective covers:** Provide to cables requiring mechanical protection.
- **Support:**
 - **Fixing arrangement:** Independently fix and support from building structure using threaded rod fixed to channel cable support with shake proof washers and hex nuts;
Independently fix and support from building structure using threaded rod fixed into expanding anchors;
and Independently fix and support from building structure using threaded rod fixed into resin injection anchors.
 - **Clearance from building fabric (minimum):** 20 mm.
- **Components:** Avoid contact between dissimilar metals.
- **Routing of cable ladder and tray:** Submit working drawings showing the final routes.

Installing cable basket

- **Standards:** To BS 7671 and in accordance with IEE Guidance Note 1.
- **Joints:**
 - **Cut:** Adjacent cross basket wires. Make smooth any burrs or edges.
 - **Earth conductors:** Connect across joints.
- **Accessories:** Form on site and connect with basket manufacturer's coupling components.
- **Fire barriers:** Provide where required to maintain fire performance of fabric.
- **Support:**
 - **Fixing arrangement:** Independently fix and support from building structure using threaded rod fixed to channel cable support with shake proof washers and hex nuts;
Independently fix and support from building structure using threaded rod fixed into expanding anchors;
and Independently fix and support from building structure using threaded rod fixed into resin injection anchors.
 - **Clearance from building fabric (minimum):** 20 mm.
- **Components:** Avoid contact between dissimilar metals.
- **Routing of cable basket:** Submit working drawings showing the final routes.

Installing cable supports on roofs

Shared by: 90-55-10/330 Cable ladders; and 90-55-10/335 Cable trays.

- **Position:** Elevate above roof.
- **Mounting:** Load spreading supports.

Multiple cable runs

Shared by: [90-55-10/325 Cable baskets](#); [90-55-10/330 Cable ladders](#); and [90-55-10/335 Cable trays](#).

- **Requirement:**

Cable support zones

Shared by: [90-55-10/325 Cable baskets](#); [90-55-10/330 Cable ladders](#); and [90-55-10/335 Cable trays](#).

- **Ceiling voids:**
 - **Clear distance between underside of cable supports and brackets and topside of ceiling (minimum):** Contractor's choice.

Installing conduit, trunking and ducting

Shared by: [90-55-10/460 Conduit fittings](#); [90-55-10/715 Installing pliable and flexible conduit](#); [90-55-10/720 Installing rigid metallic conduit](#); [90-55-10/725 Installing rigid non metallic conduit](#); [90-55-10/735 Installing conduit connections to equipment](#); and [90-55-10/765 Conduit, trunking and ducting zones](#).

- **Standards:** In accordance with BS 7671 and IET Guidance Note 1.
- **Preparation:** Cut square. Remove burrs and sharp edges to make smooth.
- **Protection of metallic conduit, trunking and ducting:**
 - **Joints and ends:** Remove grease, oil, dirt and rust before applying protective paint. Paint immediately following installation.
 - **Protective paint:**
 - Generally:** Compatible with conduit, trunking and ducting finish.
 - Type:** Match factory finish.
- **Cross-sectional area:** Maintain throughout the conduit, trunking and ducting length.
- **Arrangement:** Position vertically and horizontally in line with equipment served, and parallel with building lines.
- **Spare containment:** Install one spare 25 mm diameter conduit from each distribution board to the nearest accessible void space, terminating in a conduit box with lid.
- **Draw wires:** Install galvanized soft iron wires within spare conduit, trunking and ducting.
- **Distance from other services running parallel (minimum):**
 - **Generally:** 150 mm.
 - **Above radiators:** 1000 mm.
 - **Steam services:** 600 mm.
- **Drainage of conduit, trunking and ducting:** Locate drainage outlets at lowest points in conduit, trunking and ducting installed externally, and where condensation may occur.
- **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, trunking and ducting from building structure.

- **Cleaning:** Clean insides of conduit, trunking and ducting before installing cables.
- **Cabling:** Install when conduit, trunking and ducting enclosure is complete.
- **Submittals:** Submit manufacturer's technical information. Submit drawings showing the proposed routes of conduit, trunking and ducting and the location of service outlets.

Installing conduit generally

Shared by: 90-55-10/715 Installing pliable and flexible conduit; 90-55-10/720 Installing rigid metallic conduit; 90-55-10/725 Installing rigid non metallic conduit; and 90-55-10/735 Installing conduit connections to equipment.

- **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:**
 - **Generally:** 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:**
 - **Generally:** Install flush with finished surfaces. Provide extension rings if required.
 - **Fixing screws:** Countersunk, or round-headed screws.
 - **Number of fixings (minimum):** Two.
 - **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):** Two.
 - **Floors:** Do not install draw-in boxes in floors.
- **Conduit in walls:** Avoid concealed horizontal runs.
- **Suspended ceiling installations:** Fasten outlet boxes to structure above ceiling.

Installing rigid metallic conduit

- **General requirements:** Installing conduit generally and Installing conduit, trunking and ducting.
- **Fixings:** Distance saddle; Saddle; and Spacer bar saddle.
- **Joints:** Plain and 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.

Installing rigid non metallic conduit

- **General requirements:** Installing conduit generally and Installing conduit, trunking and ducting.
- **Fixings:** Distance saddle; Saddle; and Spacer bar saddle.
- **Joints:** Compression and Threaded.
- **Conduit connections to boxes and items of equipment:** Threaded bushed entries.

Installing conduit connections to equipment

Shared by: 90-55-10/360 Flexible conduit; and 90-55-10/380 Rigid conduit.

- **General requirements:** Installing conduit generally and Installing conduit, trunking and ducting.
- **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 of adequate length to facilitate removal of equipment for maintenance. Final termination in swivel connectors.
- **Connections to external equipment:** Flexible conduit.

Installing trunking generally

- **Supports and mounting arrangement:** Wall mounted; Ceiling mounted; Floor mounted; Purpose made brackets; and Suspension rods and steel channels.
- **Changes of direction:** Manufacturer's bends and tees.
- **Joints:**
 - **Generally:** 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.

- **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.

Conduit, trunking and ducting zones

Shared by: [90-55-10/360 Flexible conduit](#); [90-55-10/380 Rigid conduit](#); and [90-55-10/410 Cable trunking and cable ducting systems](#).

- **General requirements:** [Installing conduit, trunking and ducting](#).
- **Ceiling voids:** Provide clear distance of 150 mm (minimum) between underside of any conduit, trunking or trunking and the topside of ceiling.

Installing low voltage cables

Shared by: [90-55-15/342 Fire resistant, insulated and sheathed cables](#); [90-55-15/345 PVC insulated cables](#); [90-55-15/346 PVC insulated cables for interconnecting wiring](#); [90-55-15/349 Single-core heat resisting insulating cables](#); [90-55-15/351 Thermosetting insulated cables](#); [90-55-15/352 Thermosetting insulated and PVC sheathed cables \(XLPE/ PVC singles\)](#); [90-55-15/355 Thermosetting insulated metal screened LSZH sheathed multicore cables](#); [90-55-15/665 Installing flexible cords](#); [90-55-15/670 Installing prefabricated wiring](#); and [90-55-15/680 Installing low voltage armoured cables](#).

- **Standard:** In accordance with 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. Clear cable path of debris.
- **Installation temperature (minimum):** 5°C.
- **Cables:** Install in one length. Dress cables flat, free from twists, kinks and strain.
- **Cable pulling:** Do not overstress. Prevent kinks and twisting of the cable.
- **Cable protection:** Cables passing through walls and floors to be sleeved with conduit or pipeduct to a minimum of 300 mm. Bush at both ends. Ensure that appropriate fire stopping materials are used to maintain the original fire integrity of the wall or floor around the penetration.
- **Concealed cable runs to wall accessories:** Run vertically from the accessory.
- **Exposed cable runs:**
- **Distance from other services running parallel (minimum):** 150 mm. Position cables below heating pipes.
- **Jointing and termination:**
 - **Final circuit cables:** At electrical accessories only.
 - **Core connections:** Using compression lugs to equipment without integral clamping terminals.
 - **Terminating cables when not using glands:** Take sheathing of cables into accessory boxes and equipment and protect against abrasion with grommets.

Extra low and low voltage cable routes

Shared by: 90-55-15/342 Fire resistant, insulated and sheathed cables; 90-55-15/343 Fire resistant, insulated and sheathed armoured cables; 90-55-15/344 Mineral insulated cables type A and type B; 90-55-15/345 PVC insulated cables; 90-55-15/346 PVC insulated cables for interconnecting wiring; 90-55-15/351 Thermosetting insulated cables; 90-55-15/352 Thermosetting insulated and PVC sheathed cables (XLPE/ PVC singles); 90-55-15/353 Thermosetting insulated and PVC sheathed armoured cables; 90-55-15/354 Thermosetting insulated and LSZH sheathed armoured cables; 90-55-15/355 Thermosetting insulated metal screened LSZH sheathed multicore cables; 90-55-15/366 Balanced twisted-pair cables; 90-55-15/385 Prefabricated LSZH insulated singles in flexible conduit; and 90-55-15/386 Prefabricated LSZH insulated and sheathed multi-core.

- **Cables generally:**
 - **Concealed cable runs to wall accessories:** Run vertically from the accessory.
 - **Exposed cable runs:** Contractor's choice.
- **Distance from other services running parallel (minimum):** 150 mm. Position cables below heating pipes.

Low voltage cables concealed in walls and partitions

Shared by: 90-55-15/342 Fire resistant, insulated and sheathed cables; 90-55-15/343 Fire resistant, insulated and sheathed armoured cables; 90-55-15/344 Mineral insulated cables type A and type B; 90-55-15/345 PVC insulated cables; 90-55-15/346 PVC insulated cables for interconnecting wiring; 90-55-15/351 Thermosetting insulated cables; 90-55-15/352 Thermosetting insulated and PVC sheathed cables (XLPE/ PVC singles); 90-55-15/353 Thermosetting insulated and PVC sheathed armoured cables; 90-55-15/354 Thermosetting insulated metal screened LSZH sheathed multicore cables; 90-55-15/385 Prefabricated LSZH insulated singles in flexible conduit; and 90-55-15/386 Prefabricated LSZH insulated and sheathed multi-core.

- **Position:** In a zone within 150 mm of wall perimeter (except at the floor); and run vertically or horizontally from these zones, or from floor level, to switches, accessories, etc and At least 50 mm from the surface. Ensure all routes are agreed with architect (working drawings) to ensure historic fabric is maintained.
- **Protection:** Rigid conduit and Cover with galvanized steel channel nailed to substrate.

Extra low and low voltage cables in accessible roof spaces

Shared by: 90-55-15/340 Flexible cords; 90-55-15/342 Fire resistant, insulated and sheathed cables; 90-55-15/343 Fire resistant, insulated and sheathed armoured cables; 90-55-15/344 Mineral insulated cables type A and type B; 90-55-15/345 PVC insulated cables; 90-55-15/346 PVC insulated cables for interconnecting wiring; 90-55-15/351 Thermosetting insulated cables; 90-55-15/352 Thermosetting insulated and PVC sheathed cables (XLPE/ PVC singles); 90-55-15/353 Thermosetting insulated and PVC sheathed armoured cables; 90-55-15/354 Thermosetting insulated and LSZH sheathed armoured cables; 90-55-15/355 Thermosetting insulated metal screened LSZH sheathed multicore cables; 90-55-15/366 Balanced twisted-pair cables; 90-55-15/385 Prefabricated LSZH insulated singles in flexible conduit; and 90-55-15/386 Prefabricated LSZH insulated and sheathed multi-core.

- **Cables running across ceiling joists:** Cable baskets; Cable trays; and Cable trunking and cable ducting systems.

Extra low and low voltage surface mounted cables

Shared by: [90-55-15/340 Flexible cords](#); [90-55-15/342 Fire resistant, insulated and sheathed cables](#); [90-55-15/343 Fire resistant, insulated and sheathed armoured cables](#); [90-55-15/344 Mineral insulated cables type A and type B](#); [90-55-15/345 PVC insulated cables](#); [90-55-15/346 PVC insulated cables for interconnecting wiring](#); [90-55-15/351 Thermosetting insulated cables](#); [90-55-15/352 Thermosetting insulated and PVC sheathed cables \(XLPE/ PVC singles\)](#); [90-55-15/353 Thermosetting insulated and PVC sheathed armoured cables](#); [90-55-15/354 Thermosetting insulated and LSZH sheathed armoured cables](#); [90-55-15/355 Thermosetting insulated metal screened LSZH sheathed multicore cables](#); and [90-55-15/366 Balanced twisted-pair 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.

Installing low voltage cables in conduit and trunking

Shared by: [90-55-15/342 Fire resistant, insulated and sheathed cables](#); [90-55-15/343 Fire resistant, insulated and sheathed armoured cables](#); [90-55-15/344 Mineral insulated cables type A and type B](#); [90-55-15/345 PVC insulated cables](#); [90-55-15/346 PVC insulated cables for interconnecting wiring](#); [90-55-15/349 Single-core heat resisting insulating cables](#); [90-55-15/351 Thermosetting insulated cables](#); [90-55-15/352 Thermosetting insulated and PVC sheathed cables \(XLPE/ PVC singles\)](#); [90-55-15/353 Thermosetting insulated and PVC sheathed armoured cables](#); [90-55-15/354 Thermosetting insulated and LSZH sheathed armoured cables](#); [90-55-15/355 Thermosetting insulated metal screened LSZH sheathed multicore cables](#); [90-55-15/366 Balanced twisted-pair cables](#); [90-55-15/385 Prefabricated LSZH insulated singles in flexible conduit](#); and [90-55-15/386 Prefabricated LSZH insulated and sheathed multi-core](#).

- **Cable installation:** Orderly and capable of being withdrawn.
- **Single core wiring:** Arrange using the loop-in method.
- **Cables within trunking:** Tie at 2 m intervals for cables of the same circuit reference. Label ties with circuit reference number at 10 m intervals.
- **Cables in vertical conduit:** Provide cable clamps in accessible conduit boxes at 5 m intervals.
- **Extra low voltage cables:** Install within a separate partition from low voltage cables where installed in multi compartment trunking.

Cable installation on channel cable supports, cable tray, cable ladder and cable basket

Shared by: [90-55-15/342 Fire resistant, insulated and sheathed cables](#); [90-55-15/343 Fire resistant, insulated and sheathed armoured cables](#); [90-55-15/344 Mineral insulated cables type A and type B](#); [90-55-15/345 PVC insulated cables](#); [90-55-15/346 PVC insulated cables for interconnecting wiring](#); [90-55-15/351 Thermosetting insulated cables](#); [90-55-15/353 Thermosetting insulated and PVC sheathed armoured cables](#); [90-55-15/354 Thermosetting insulated and LSZH sheathed armoured cables](#); and [90-55-15/355 Thermosetting insulated metal screened LSZH sheathed multicore cables](#).

- **Cabling:** Install when cable supports are complete.
- **Position:** Place single and multi-core cables side by side.
- **Fastening:**

- **Fastenings generally:** Secure cables, do not indent sheaths. Position to enable any submain cable to be individually removed.
- **Submain cables <95 mm²:** Cable cleats.
Spacing (maximum): 600 mm.
- **Submain cables >95 mm²:** Cable cleats and Cable bands.
Spacing (maximum): 600 mm.
- **Final circuit cabling:** Cable ties.
Spacing (maximum): 600 mm.
- **Extra low voltage, communications and fibre optic cabling:** Cable ties.
Spacing (maximum): 600 mm.

Installing earth bars

- **Main earth bar location:** Next to the incoming electricity point of supply and Next to the main switchboard.
- **Multiple earth bars:** Connect with a conductor ring.
- **Mounting:**
 - **Spacers:** Ceramic.
 - **Support spacing (maximum):** 300 mm for 25 mm bar and 450 mm for 50 mm bar.
 - **Clearance between wall and earth bar (minimum):** 30 mm.

Installing soil conditioning agents

- **Position:** Contractor's choice.

System completion

Inspection and testing

- **Standards:** To BS 7671 and in accordance with BS 7430.
- **Notice before commencing tests (minimum):** 24 h.
- **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:** Calculate from measurement of the sum of the resistance of the phase conductor and the resistance of the circuit protective conductor and Direct measurement.
 - **Measurement locations:** Origin, switchgear, fixed equipment and outlets, and circuit extremities.

Documentation

- **Operating and maintenance instructions:**
 - **Scope:** Submit for the system giving optimum settings for controls.

- **Product information:** Include product description, date of purchase, performance characteristics, application (suitability for use), method of operation and control, and cleaning and maintenance requirements.
- **Format:** Paper copy.
- **Number of copies:** Three.
- **Record drawings:**
 - **Content:** Location and arrangement of plant in plant rooms; Location, size and route of earth electrodes; and Location of earth terminals.
 - **Format:** A1 paper print drawing and Electronic drawing.
 - **Number of copies:** Three.
- **Submittal date:** Four weeks before handover.

Ω End of system

Inspection and testing of new low voltage electrical installations or changes to an existing installation

System outline

Inspection and testing of new low voltage electrical installations or changes to an existing installation

- **General requirements:**
 - **Electrical test engineer:** Electrical installation contractor.
Approval: National Inspection Council for Electrical Installation Contracting (NICEIC).
Evidence of approval: Submit.
 - **Test equipment calibration:** UKAS approved.
- **Certification type:** Electrical installation certificate in accordance with BS 7671.
- **Execution:** Test equipment calibration and Inspection and testing electrical installations generally.
- **System completion:** Electrical installation certificates.

Execution

Test equipment calibration

- **Test equipment calibration:** UKAS approved.

Inspection and testing electrical installations generally

- **Standards:** To BS 7671 and in accordance with IEE Guidance note 3
- **Notice before commencing tests (minimum):** 24 h.
- **Installed equipment standards:** Verify and confirm compliance with the relevant equipment standards.
 Verify and confirm that all parts of the fixed installation are selected and erected correctly.
 Verify and confirm that the fixed installation is free from visible damage or otherwise defective.
- **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.
- **Insulation resistance (minimum):**
 - **SELV and PELV circuits:** 1 megohm when tested at 250 V d.c.
 - **Other circuits less than or equal to 500 V (excluding SELV and PELV):** 2 megohm when tested at 500 V d.c.
 - **Circuits above 500 V:** 2 megohm when tested at 1000 V d.c.

- **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.

System completion

Electrical installation certificates

- **Standard:** In accordance with BS 7671 appendix 6;
To National Inspection Council for Electrical Installation Contracting (NICEIC) standard;
and To SELECT standard.
- **Format:** A4 paper print, type written results and Electronic, type written results.
- **Test equipment identity:** Record on test certificates.
- **Certificates of calibration:** Submit for each test instrument.
- **Schedule of test results:** Submit three copies.

Ω End of system

Low voltage distribution system

System outline

Low voltage distribution system

- **Description:** The contractor shall supply, install, test and commission a complete LV distribution system to the works area.

All services with the exception as listed below and as noted on the drawings shall be isolated, stripped out and made safe, prior to the demolition.

The redundant equipment shall be stripped out and safely removed and disposed, and/or handed back to the Client.

All services stripped out to the area demarcation line to be made safe at this point.

The redundant services should not pose a health and safety risk. All cable containment and pipes shall be capped off at this point. The Contractor should ensure no sharp edges.

All circuits to be disconnected from the point of the origin and clearly labelled as redundant. Other areas are to be retained in use during the course of the works.

It is therefore imperative that these systems are maintained through out these works and any downtime is agreed with the Client.

The Contractor shall test inspect and re-use existing sub-main cabling within the basement electrical cupboard to the existing distribution equipment. This arrangement is detailed on the LV schematic. Only the cabling & containment shall be reused. DBs, final circuitry, devices etc are new.

The existing busbar and isolating switch fuses shall be removed to gain wall space and the new DB with isolation shall be installed to feed the refurbished area.

The existing circuitry within the shop and existing museum GF area is supplied from a local distribution board on the "town Hall side". the position of this DB is unknown. Allowance shall be made to trace these existing circuits, remove as described above, and resupply the new power and lighting from the existing Townhall DBs. Arrangements shall be made with FM to gain access to these circuits and trace remove and rewire etc.

Distribution cables to mechanical control panels, distribution switchpanels, and final circuit distribution boards are to be carried out in LSOH armoured cabling routed on galvanised steel cable tray installed within ceiling voids and vertical service risers. Where detailed separate CPC's are to be run with the main cables.

The proposed electrical distribution boards are suitably sized, metered and rated to allow the future tenants to connect their own additional electrical equipment into the distribution board.

All outgoing circuitry shall utilise LSOH single core cabling within voids trunking and on areas where aesthetics do not need to be considered.

For cabling within the Galleries, Maker's and classroom spaces where, cabling is to be installed on historic building fabric, MICC unsheathed cabling shall be used. A high quality installation and level of workmanship is expected when utilising this cable type.

The Contractor shall ensure all fixings of cabling and containment is confirmed with the architect and structural engineer to ensure a safe fixing system that is compatible with the historic building fabric.

Metering

To enable the user to manage the energy usage of the building, the engineering systems are to be provided with sufficient energy meters conforming to the Building Regulations, CIBSE TM39 Building Energy Metering and BREEAM requirements for the annual energy to enable the electricity consumption to be monitored. All substantial motor loads are to be metered,.

All energy meters are to be fitted with MODBUS communications module and connected into the BMS system.

- **System Performance:** To distribute low voltage (LV) electrical power, safely and reliably, around the site starting with the cables connecting the main LV switchboard(s) to the mains intake, and finishing at the output terminals of all site distribution boards, power distribution units, mechanical systems supply points and/or the main switch input terminals of all items of equipment that have their own integral isolator.
 - Electricity at Work Regulations 1989
 - BS 7671:2008 + latest amendment - Requirements for Electrical Installations
- **Switchgear:** Distribution boards and consumer units.
- **Distribution circuit cabling:**
 - **Types:** Power busbar trunking;
Fire resistant, insulated and sheathed cables;
Fire resistant, insulated and sheathed armoured cables;
PVC insulated cables;
Thermosetting insulated and PVC sheathed cables (XLPE/ PVC singles);
Thermosetting insulated cables;
Thermosetting insulated and LSZH sheathed armoured cables;
Thermosetting insulated and PVC sheathed armoured cables;
Thermosetting insulated metal screened LSZH sheathed multicore cables;
and Mineral insulated cables type A.
- **Cable accessories:** Cable bands;
Cable cleats;
and Cable ties.
- **Containment:** Rigid conduit;
Cable trunking and cable ducting systems;
Cable baskets;
Cable ladders;
Cable trays;

- **Containment accessories:** Conduit fittings.
- **Rewireable installation:** Required.
- **Concealed installation:** Required where not damaging to the historic building fabric
- **Electrical identification:** Electrical shock treatment signs;
Equipment labels and warning notices;
and Electrical diagrams generally.
- **Execution:** Installing low voltage distribution systems;
Electrical property measurement of low voltage systems;
and Connection to the incoming supply.
- **System Completion:** Inspecting, testing and commissioning of switchgear generally
;
Inspecting, testing and commissioning automatic power factor correction equipment;
Inspecting, testing and commissioning harmonic filters;
Inspecting, testing and commissioning UPS equipment;
Documentation;
Spares and consumables;
and Maintenance.

Products

Distribution boards and consumer units

- **Manufacturer:** Schneider
- **Standards:** To BS EN 60439-1 and To BS EN 60439-3.
- **Type tests:** Full manufacturer type tests to IEC 60439-3
- **Rated operational voltage (Ue):** 415 V.
- **Enclosure:**
 - **Ingress protection (minimum):** To BS EN 60529, IP31.
 - **Material:** Steel.
 - **Finish:** Manufacturer's standard.
 - **Colour:** Manufacturer's standard.
 - **Locking mechanism:** Cylinder locks with a standard key type.
- **Incoming device:** Switches, disconnectors, switch-disconnectors and fuse combination units.
- **Busbars and connections:**
 - **Type:** Fully shrouded.
 - **Rated operational current (Ie):** 250 A.
 - **Rated short-time withstand current (Icw) for 1 s:** 25 kA
- **Neutral and earth bars:** Individual terminal for each outgoing circuit.
- **Neutral terminations:** Match current carrying capacity of phase conductor.
- **Outgoing devices:**
 - **Type:** As Circuit schedules;
Miniature circuit breakers;
and Residual current circuit breakers with integral overcurrent protection.
 - **Quantity:** As Circuit schedules.
- **Spare ways:** Fit with blank plates.

- **Accessories:** Low voltage safety matting;
Current transformers;
Digital metering equipment;
Residual current monitoring devices;
and Padlocks and keys.
- **Execution:** Installing switchgear generally.

Switches, disconnectors, switch-disconnectors and fuse combination units

- **Manufacturer:** Schneider
- **Standard:** To BS EN 60947-3.
- **Arrangement:** Switch-disconnector.
- **Mechanical interlocking:** Rotary handle.
- **Rated operational current (In):** As Circuit schedules.
- **Rated operational voltage (Ue):** 250 V and 415 V.
- **Rated operational frequency:** 50 Hz.
- **Number of poles:** As LV Schematic
- **Utilization category:** AC-23A.
- **Terminals:** Suitable for the connection of copper and aluminium conductors.
- **Enclosure:**
 - **Ingress protection (minimum):** To BS EN 60529, IP41.
 - **Mechanical protection (minimum):** Manufacturer's standard.
 - **Material:** Manufacturer's standard.
 - **Finish:** Powder coated.
- **Fuses:** Not required.
- **Execution:** Installing multi box assemblies and Installing switchgear generally.

Low voltage safety matting

- **Manufacturer:** Contractor's choice.
- **Standard:** To BS 921.
- **Thickness (minimum):** 6.5 mm.
- **Width (minimum):** 900 mm.
- **Length (minimum):** Match low voltage switchgear assembly.
- **Execution:** Installing safety matting.

Cable cleats

Shared by: 70-70-45/110 Low voltage distribution system; 70-70-75/110 Hard wired low voltage small power system; and 90-55-15/735 Cable installation on channel cable supports, cable tray, cable ladder and cable basket.

- **Manufacturer:** Contractor's choice.
- **Standard:** To BS EN 61914.
- **Format:** Contractor's choice.
- **Material:** Metallic.
- **Temperatures for permanent installation:**
 - **Maximum:** 105°C.
 - **Minimum:** -25°C.

- **Resistance to impact:** Heavy.
- **Type of retention or resistance to electromechanical forces:** Resistant to electromechanical forces, withstanding one short circuit.
- **Environmental influences:**
 - **Non-metallic and composite components:** Resistant to ultraviolet light.
 - **Metallic and composite components:** High resistance to corrosion.

Cable ties

Shared by: 70-70-45/110 Low voltage distribution system; 70-70-75/110 Hard wired low voltage small power system; and 90-55-15/735 Cable installation on channel cable supports, cable tray, cable ladder and cable basket.

- **Manufacturer:** Contractor's choice.
- **Standard:** To BS EN 62275.
- **Format:** Wrap around self-locking releasable.
- **Material:** Nylon and Metal.
- **Loop tensile strength (minimum):** Manufacturer's standard.
- **Temperatures for permanent installation:**
 - **Maximum:** 60°C.
 - **Minimum:** -15°C.
- **Contribution to fire:** Non-flame propagating.
- **Environmental influences:**
 - **Non-metallic and composite components:** Resistant to ultraviolet light.
 - **Metallic and composite components:** Resistant to corrosion.

Cable bands

Shared by: 70-70-45/110 Low voltage distribution system; and 90-55-15/735 Cable installation on channel cable supports, cable tray, cable ladder and cable basket.

- **Manufacturer:** Contractor's choice.
- **Material:** Manufacturer's standard.
- **Protective covering:** Manufacturer's standard.

Cable baskets

Shared by: 70-70-45/110 Low voltage distribution system; 70-70-75/110 Hard wired low voltage small power system; 70-80-35/110 Hard wired general lighting system; 75-45-20/110 Data distribution system; 75-60-10/110 CCTV system; 75-60-40/110 Intruder detection and alarm system; 75-65-30/110 Fire detection and alarm system; and 90-55-15/650 Extra low and low voltage cables in accessible roof spaces.

- **Manufacturer:** Contractor's choice.
- **Material:**
- **Coating material:** Hot dip galvanised, powder coated RAL colour to architectural specification
- **Features:**
 - **Segregation:** Cable dividers.
 - **Protective cover:** Required.
- **Execution:** Installing cable basket;

Multiple cable runs;
and Cable support zones.

- **Standard:** To BS EN 61537.

Cable trays

Shared by: 70-70-45/110 Low voltage distribution system; 70-70-75/110 Hard wired low voltage small power system; 75-60-10/110 CCTV system; and 90-55-15/650 Extra low and low voltage cables in accessible roof spaces.

- **Manufacturer:** Contractor's choice.
- **Standard:** To BS EN 61537.
- **Material:** Steel.
- **Resistance against flame propagation:** Non-Flame propagating.
- **Electrical properties:**
 - **Continuity characteristics:** Without electrical continuity.
 - **Conductivity characteristics:** Without electrical conductive system component.
- **Coating material:** Hot dip galvanised, powder coated RAL colour to architectural specification
- **Temperature properties for transport, storage, installation and application:**
 - **Minimum:** Manufacturer's standard.
 - **Maximum:** Manufacturer's standard.
- **Mechanical properties:**
 - **Cable tray free base area:** Manufacturer's standard.
 - **Resistance to impact:** Manufacturer's standard.
- **Features:**
 - **Flange type:** Return.
 - **Segregation:** Cable dividers.
 - **Protective cover:** Required.
- **Execution:** Installing cable tray and cable ladder;
Installing cable supports on roofs;
Multiple cable runs;
and Cable support zones.

Rigid conduit

Shared by: 70-70-25/660 Installing main earthing conductor; 70-70-45/110 Low voltage distribution system; 70-70-75/110 Hard wired low voltage small power system; 70-80-35/110 Hard wired general lighting system; 75-45-40/110 Audio-frequency-induction-loop system; 75-60-05/110 Access control system; 75-60-40/110 Intruder detection and alarm system; 75-65-30/110 Fire detection and alarm system; 75-70-05/110 Assistance call system; and 90-55-15/645 Low voltage cables concealed in walls and partitions.

- **Manufacturer:** Contractor's choice.
- **Standards:** To BS EN 61386-21.
- **Mechanical properties:**
 - **Resistance to compression:** Heavy.
 - **Resistance to impact:** Heavy.
- **Transport, installation and application:**

- **Lower temperature (minimum):** Manufacturer's standard.
 - **Upper temperature (maximum):** Manufacturer's standard.
- **Resistance to bending:** Rigid.
- **Electrical characteristics:** With electrical continuity properties.
- **Resistance to external influences:**
 - **Protection against ingress of solid objects (minimum):** To BS EN 60529, IP3X.
 - **Protection against ingress of water (minimum):** To BS EN 60529, IPX0.
- **Resistance to corrosion:** To BS EN 61386-1, Class 4.
- **Tensile strength:** Heavy.
- **Resistance to flame propagation:** Manufacturer's standard.
- **Suspended load capacity:** Heavy.
- **Colour:** Submit proposals.
- **Sizes (OD):** 25 mm.
- **Execution:** Installing rigid metallic conduit;
Installing rigid non metallic conduit;
Installing conduit connections to equipment;
and Conduit, trunking and ducting zones.

Cable trunking and cable ducting systems

Shared by: 70-70-45/110 Low voltage distribution system; 70-70-75/110 Hard wired low voltage small power system; 70-80-35/110 Hard wired general lighting system; 75-60-05/110 Access control system; 75-60-40/110 Intruder detection and alarm system; 75-65-30/110 Fire detection and alarm system; 75-70-05/110 Assistance call system; 75-70-05/120 Emergency voice communication system; and 90-55-15/650 Extra low and low voltage cables in accessible roof spaces.

- **Manufacturer:** Contractor's choice.
- **Standards:** To BS EN 50085-1 and BS EN 50085-2-1.
- **Material:** Metallic;
Non-metallic;
and Steel.
- **Construction:** To include means of preventing contact between liquids and insulated conductors and live parts.
- **Temperature properties:**
 - **Storage and transport temperature (maximum):** Manufacturer's standard.
 - **Installation and application temperature (minimum):** Manufacturer's standard.
 - **Application temperature (maximum):** Manufacturer's standard.
- **Resistance to flame propagation:** Required.
- **Electrical properties:** With electrical continuity characteristics.
- **Ingress protection (minimum):** To BS EN 60529, IP x4.
- **Protection against corrosive and polluting substances:** High protection outside and inside.
- **Access method:** With tools.
- **Screening:** Required.
- **Execution:** Conduit, trunking and ducting zones and Installing trunking generally.

Conduit fittings

Shared by: 70-70-45/110 Low voltage distribution system; 70-70-75/110 Hard wired low voltage small power system; 70-80-35/110 Hard wired general lighting system; and 75-45-20/110 Data distribution system.

- **Manufacturer:** Match conduit.
- **Standards:** To BS EN 61386-1 and to BS EN 61386-21, BS EN 61386-22, or BS EN 61386-23 as appropriate; or to BS 4607-1.
- **Material:**
 - **Type:** Steel and PVC-U.
 - **Finish:** Match conduit.
- **Conduit boxes:** Fit covers of same material and finish as boxes. Include brass earthing terminals in PVC-U boxes.
- **Plugs:**
 - **For metallic boxes:** Manufacturer's standard.
 - **For non metallic boxes:** Manufacturer's standard.
- **Locknuts.:**
 - **For metallic boxes:** Manufacturer's standard.
 - **For non metallic boxes:** Manufacturer's standard.
- **Execution:** Installing conduit, trunking and ducting.

Fire resistant, insulated and sheathed cables

Shared by: 70-70-45/110 Low voltage distribution system; 70-70-75/110 Hard wired low voltage small power system; 70-80-35/110 Hard wired general lighting system; and 75-65-30/110 Fire detection and alarm system.

- **Manufacturer:** Batt cables or equal and approved
- **Standard:** To BS 7629-1.
- **Third party certification:** British Approvals Service for Cables (BASEC) certified and LPCB.
- **Size:** Refer to cable schedule
- **Screen:** Copper tape.
- **Execution:** Installing low voltage cables;
Extra low and low voltage cable routes;
Low voltage cables concealed in walls and partitions;
Extra low and low voltage cables in accessible roof spaces;
Extra low and low voltage surface mounted cables;
Installing low voltage cables in conduit and trunking;
and Cable installation on channel cable supports, cable tray, cable ladder and cable basket.

Fire resistant, insulated and sheathed armoured cables

Shared by: 70-70-45/110 Low voltage distribution system; and 75-65-30/110 Fire detection and alarm system.

- **Manufacturer:** Batt cables or equal and approved
- **Standard:** To BS 7846.
- **Third party certification:** British Approvals Service for Cables (BASEC) certified and LPCB.

- **Size:** Refer to cable schedule
- **Insulation:** Cross-linked polyethylene.
- **Execution:** Extra low and low voltage cable routes;
Low voltage cables concealed in walls and partitions;
Extra low and low voltage cables in accessible roof spaces;
Extra low and low voltage surface mounted cables;
Installing low voltage cables in conduit and trunking;
Cable installation on channel cable supports, cable tray, cable ladder and cable basket;
Installing low voltage armoured cables;
Jointing and terminating low voltage armoured cables;
Excavations;
Cables in ducts;
Cables in trenches;
Installing underground cable marker tape;
and Cables in vertical trunking and ducts.

Mineral insulated cables type A

- **Manufacturer:** Contractor's choice.
- **Standard:** To BS EN 60702-1.
- **Third party certification:** British Approvals Service for Cables (BASEC) certified and LPCB.
- **Metallic sheath:** Contractor's choice.
- **Light duty mineral insulated with outer sheath (LD MICS/ LSZH):**
 - **Construction:** To tables 7, 8 and 9.
 - **Size:** Contractor's choice.
- **Heavy duty mineral insulated with outer sheath (HD MICS/ LSZH):**
 - **Construction:** To tables 10, 11 and 12.
 - **Size:** Contractor's choice.
- **Execution:** Extra low and low voltage cable routes;
Low voltage cables concealed in walls and partitions;
Extra low and low voltage cables in accessible roof spaces;
Extra low and low voltage surface mounted cables;
Installing low voltage cables in conduit and trunking;
and Cable installation on channel cable supports, cable tray, cable ladder and cable basket.

PVC insulated cables

Shared by: 70-70-25/110 Earthing and bonding system; 70-70-45/110 Low voltage distribution system; 75-45-40/110 Audio-frequency-induction-loop system; 90-65-05/630 Installing combined daylight and occupancy sensors; 90-65-05/640 Installing daylight sensors; 90-65-05/660 Installing mains voltage occupancy detectors; and 90-65-05/670 Installing photoelectric control units.

- **Manufacturer:** Contractor's choice.
- **Standard:** To BS 6004.
- **Third party certification:** British Approvals Service for Cables (BASEC) certified.
- **Rigid PVC insulated cables (PVC singles, H07V):**
 - **Construction:** To table 4a.

- **Size:** Refer to cable schedule
- **PVC insulated and PVC sheathed cables (PVC/ PVC):**
 - **Construction:** To table 7.
 - **Sheath colour:** Manufacturer's standard.
 - **Size:** Refer to cable schedule
- **PVC insulated, PVC sheathed cables with circuit protective conductor (PVC/ PVC with CPC):**
 - **Construction:** To table 8.
 - **Size:** Refer to cable schedule
- **Heat resisting PVC insulated cables (HR PVC singles, H07V-K):**
 - **Construction:** To table 11a.
 - **Size:** Refer to cable schedule
- **Execution:** Installing low voltage cables;
Extra low and low voltage cable routes;
Low voltage cables concealed in walls and partitions;
Extra low and low voltage cables in accessible roof spaces;
Extra low and low voltage surface mounted cables;
Installing low voltage cables in conduit and trunking;
and Cable installation on channel cable supports, cable tray, cable ladder and cable basket.

Thermosetting insulated cables

Shared by: 70-70-45/110 Low voltage distribution system; 70-70-75/110 Hard wired low voltage small power system; and 70-80-35/110 Hard wired general lighting system.

- **Manufacturer:** Contractor's choice.
- **Standard:** To BS 7211.
- **Third party certification:** British Approvals Service for Cables (BASEC) certified.
- **Rigid thermosetting insulated single core cables (LSZH singles, H07Z):**
 - **Construction:** To table 3a.
 - **Size:** Refer to cable schedule
- **Thermosetting insulated and sheathed single core cables (LSZH/ LSZH singles):**
 - **Construction:** To table 5.
 - **Size:** Refer to cable schedule
- **Thermosetting insulated and sheathed cables with circuit protective conductor (LSZH/ LSZH with CPC):**
 - **Construction:** To table 7.
 - **Size:** Refer to cable schedule
- **Execution:** Installing low voltage cables;
Extra low and low voltage cable routes;
Low voltage cables concealed in walls and partitions;
Extra low and low voltage cables in accessible roof spaces;
Extra low and low voltage surface mounted cables;
Installing low voltage cables in conduit and trunking;
and Cable installation on channel cable supports, cable tray, cable ladder and cable basket.

Thermosetting insulated and PVC sheathed cables (XLPE/ PVC singles)

Shared by: 70-70-45/110 Low voltage distribution system; and 90-65-05/670 Installing photoelectric control units.

- **Manufacturer:** Contractor's choice.
- **Standard:** To BS 7889.
- **Third party certification:** British Approvals Service for Cables (BASEC) certified.
- **Conductors:** Copper.
- **Size:** Refer to cable schedule
- **Execution:** Installing low voltage cables;
Extra low and low voltage cable routes;
Low voltage cables concealed in walls and partitions;
Extra low and low voltage cables in accessible roof spaces;
Extra low and low voltage surface mounted cables;
and Installing low voltage cables in conduit and trunking.

Thermosetting insulated and PVC sheathed armoured cables

- **Manufacturer:** Contractor's choice.
- **Standard:** To BS 5467.
- **Third party certification:** British Approvals Service for Cables (BASEC) certified.
- **Cable type:** Multi-core XLPE/ SWA/ PVC and Single-core XLPE/ AWA/ PVC.
- **Insulation:** Cross-linked polyethylene GP 8.
- **Rated voltage:** 600/ 1000 V.
- **Conductors:** Copper.
- **Size:** Refer to cable schedule
- **Execution:** Extra low and low voltage cable routes;
Extra low and low voltage cables in accessible roof spaces;
Extra low and low voltage surface mounted cables;
Installing low voltage cables in conduit and trunking;
Installing low voltage armoured cables;
Jointing and terminating low voltage armoured cables;
Excavations;
Cables in ducts;
Cables in trenches;
Installing underground cable marker tape;
Cable installation on channel cable supports, cable tray, cable ladder and cable basket;
and Cables in vertical trunking and ducts.

Thermosetting insulated and LSZH sheathed armoured cables

Shared by: 70-70-45/110 Low voltage distribution system; 70-70-75/110 Hard wired low voltage small power system; and 70-80-35/110 Hard wired general lighting system.

- **Manufacturer:** Contractor's choice.
- **Standard:** To BS 6724.
- **Third party certification:** British Approvals Service for Cables (BASEC) certified.
- **Cable type:** Multi-core XLPE/ SWA/ LSZH and Single-core XLPE/ AWA/ LSZH.
- **Insulation:** Cross-linked polyethylene GP 8.

- **Rated voltage:** 600/ 1000 V.
- **Conductors:** Copper.
- **Size:** Refer to cable schedule
- **Execution:** Extra low and low voltage cable routes;
Extra low and low voltage cables in accessible roof spaces;
Extra low and low voltage surface mounted cables;
Installing low voltage cables in conduit and trunking;
Installing low voltage armoured cables;
Jointing and terminating low voltage armoured cables;
Excavations;
Cables in ducts;
Cables in trenches;
Installing underground cable marker tape;
Cable installation on channel cable supports, cable tray, cable ladder and cable basket;
and Cables in vertical trunking and ducts.

Thermosetting insulated metal screened LSZH sheathed multicore cables

- **Manufacturer:** Contractor's choice.
- **Standard:** To BS 8436.
- **Third party certification:** British Approvals Service for Cables (BASEC) certified.
- **Size:** Refer to cable schedule
- **Execution:** Installing low voltage cables;
Extra low and low voltage cable routes;
Low voltage cables concealed in walls and partitions;
Extra low and low voltage cables in accessible roof spaces;
Extra low and low voltage surface mounted cables;
Installing low voltage cables in conduit and trunking;
and Cable installation on channel cable supports, cable tray, cable ladder and cable basket.

Miniature circuit breakers

- **Manufacturer:** ABB
- **Standard:** To BS EN 60898-1 and To BS EN 60898-2.
- **Type tests:** Manufacturer's standard.
- **Rated operational current (In):** As Circuit schedules.
- **Rated operational voltage (Ue):** 230 V a.c and 400 V a.c.
- **Number of poles:** Single;
Double;
Triple;
and Four.
- **Rated short-circuit breaking capacity (Icu):** As Circuit schedules.
- **Curve type:** B;
C;
and D.
- **Mounting:** DIN rail.

Residual current circuit breakers with integral overcurrent protection

- **Manufacturer:** ABB

- **Standard:** To BS EN 61009-1
- **Rated operational current (In):** As Circuit schedules.
- **Rated operational voltage (Ue):** 230 V a.c and 400 V a.c.
- **Number of poles:** Double;
Triple;
and Four.
- **Rated residual operating current:** 10 mA;
30 mA;
and 300 mA.
- **Time delay:** 50-70 ms;
80 ms;
100 ms;
and 200 ms.
- **Mounting:** DIN rail.

Current transformers

- **Manufacturer:** Contractor's choice.
- **Standard:** To BS EN 60044-1.
- **Accuracy classification:**
 - **For use with protective equipment:** Provide separate current transformers for each protection device and instrumentation. Ensure current transformers provide appropriate accuracy and are compatible with over current factors, characteristics, performance and VA rating required for satisfactory operation of protection devices, instruments and meters indicated.
 - **For use with measuring equipment:** As above
- **Format:** Cast resin encapsulated solid ring.
- **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.
- **Mounting arrangement:** Busbar;
DIN rail;
and In-built mounting feet.
- **Execution:** Installing current transformers.

Digital metering equipment

- **Manufacturer:** As switchboard and distribution board manufacturer
- **Standard:** To BS EN 50470-1.
- **Display:** LCD.
- **Metering functions:** Voltage between phases (V);
Voltage between phases and neutral (V);
Phase currents (A);
Frequency (Hz);
Power factor;
Active power (W);
Reactive power (V·A(r));
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 Measurement of imported/ exported energy flow.

- **Mounting:** DIN rail mounted and Recessed into switchgear assembly.
- **Enclosure:** Match assembly enclosure.
- **Outputs:** RS232/485;
 Ethernet;
 and Pulse output module.
- **Execution:** Installing electrical monitoring and metering equipment.

Padlocks and keys

- **Manufacturer:** Contractor's choice.
- **Locking mechanism:** Manufacturer's standard.
- **Material:** Manufacturer's standard.
- **Padlock identification:** Stamp padlock describing its function.
- **Execution:** Padlocks and keys.

Electrical shock treatment signs

Shared by: 70-70-25/110 Earthing and bonding system; 70-70-45/110 Low voltage distribution system; 70-70-75/110 Hard wired low voltage small power system; and 70-80-35/110 Hard wired general lighting system.

- **Manufacturer:** Contractor's choice.
- **Format:** Plastics encapsulated.

Equipment labels and warning notices

Shared by: 70-70-25/110 Earthing and bonding system; 70-70-45/110 Low voltage distribution system; 70-70-75/110 Hard wired low voltage small power system; and 70-80-35/110 Hard wired general lighting system.

- **Manufacturer:** Contractor's choice.
- **Material:** Face engraved rigid plastic laminate.
- **Label size:** Submit proposals.
- **Colour:**
 - **Background:** Manufacturer's standard.
 - **Lettering:** Manufacturer's standard.
- **Typography:**
 - **Font:** Manufacturer's standard.
 - **Size:** Manufacturer's standard.
- **System notice wording:** Manufacturer's standard.

Electrical diagrams generally

Shared by: 70-70-25/110 Earthing and bonding system; 70-70-45/110 Low voltage distribution system; 70-70-75/110 Hard wired low voltage small power system; and 70-80-35/110 Hard wired general lighting system.

- **Material:** Engraved plastics laminate and 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.

Execution

Installing low voltage distribution systems

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

Connection to the incoming supply

- **Customer's installation:** Connect to the incoming point of supply.

Testing and commissioning of site-assembled busbar trunking

- **Notice before testing and commissioning:** 7 days.
- **Routine testing and commissioning:** Submit results.
- **Additional inspection and testing:** Check and adjust tightness of busbar connections and supports.
Check tightness of bolted connections.
Check busbar joints using ductor resistance measurements.
Check earth connections.
Check clearance of live parts from direct contact.
Carry out earth fault protection simulation tests.
- **Inspection and test results:** Submit.

Installing switchgear generally

Shared by: 90-50-45/410 Distribution boards and consumer units; and 90-50-45/450 Switches, disconnectors, switch-disconnectors and fuse combination units.

- **General requirements:** Labelling switchgear.
- **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:**
 - **Generally:** Fix independently of wiring installation with zinc electroplated fasteners.
 - **Indoor equipment:** Fix using internal lugs.
 - **Outdoor equipment:** Fix using external lugs.
- **Orientation:** Accurate and square to vertical and horizontal axes. Align adjacent items of switchgear on the same horizontal axis.
- **Extension boxes:** Provide where necessary.
- **Gland plates:** Non-ferrous for single core cables.

- **Interconnection of close coupled switchgear:**
 - **Cable type:** Copper busbar links.
 - **Containment:** Manufacturer's enclosure.
- **Identification:**
 - **Neutral and earth bar terminals:** Label with the outgoing circuit reference.
 - **Cable terminations:** Label with circuit reference, with push-on plastics markers.

Labelling switchgear

- **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.

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.
- **Position:** Contractor's choice.

Installing cable tray and cable ladder

Shared by: 90-55-10/330 Cable ladders; and 90-55-10/335 Cable trays.

- **Standards:** To BS 7671 and in accordance with IET guidance note 1.
- **Preparation:**
 - **Burrs and sharp edges:** Make smooth.
 - **Cutting:** Minimize and make good edges. Cuts to cable tray to be square along an unperforated line.
 - **Treatment of cut surface:** Extend 25 mm beyond the cut. Match finish of cable supports.
- **Access:** Provide space around cable ladder and tray 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 ladder and tray:** Maximize.
 - **Ends:** Blank with end plates.
- **Changes of size and direction:** Manufacturer's accessories of the same material type, pattern, finish and thickness as cable supports.
- **Fire barriers:** Provide where required to maintain fire performance of fabric.
- **Protective covers:** Provide to cables requiring mechanical protection.

- **Support:**
 - **Fixing arrangement:** Independently fix and support from building structure using threaded rod fixed to channel cable support with shake proof washers and hex nuts;
Independently fix and support from building structure using threaded rod fixed into expanding anchors;
and Independently fix and support from building structure using threaded rod fixed into resin injection anchors.
 - **Clearance from building fabric (minimum):** 20 mm.
- **Components:** Avoid contact between dissimilar metals.
- **Routing of cable ladder and tray:** Submit working drawings showing the final routes.

Installing cable basket

- **Standards:** To BS 7671 and in accordance with IEE Guidance Note 1.
- **Joints:**
 - **Cut:** Adjacent cross basket wires. Make smooth any burrs or edges.
 - **Earth conductors:** Connect across joints.
- **Accessories:** Form on site and connect with basket manufacturer's coupling components.
- **Fire barriers:** Provide where required to maintain fire performance of fabric.
- **Support:**
 - **Fixing arrangement:** Independently fix and support from building structure using threaded rod fixed to channel cable support with shake proof washers and hex nuts;
Independently fix and support from building structure using threaded rod fixed into expanding anchors;
and Independently fix and support from building structure using threaded rod fixed into resin injection anchors.
 - **Clearance from building fabric (minimum):** 20 mm.
- **Components:** Avoid contact between dissimilar metals.
- **Routing of cable basket:** Submit working drawings showing the final routes.

Installing cable supports on roofs

Shared by: [90-55-10/330 Cable ladders](#); and [90-55-10/335 Cable trays](#).

- **Position:** Elevate above roof.
- **Mounting:** Load spreading supports.

Multiple cable runs

Shared by: [90-55-10/325 Cable baskets](#); [90-55-10/330 Cable ladders](#); and [90-55-10/335 Cable trays](#).

- **Requirement:**

Cable support zones

Shared by: [90-55-10/325 Cable baskets](#); [90-55-10/330 Cable ladders](#); and [90-55-10/335 Cable trays](#).

- **Ceiling voids:**

- **Clear distance between underside of cable supports and brackets and topside of ceiling (minimum):** Contractor's choice.

Installing conduit, trunking and ducting

Shared by: [90-55-10/460 Conduit fittings](#); [90-55-10/715 Installing pliable and flexible conduit](#); [90-55-10/720 Installing rigid metallic conduit](#); [90-55-10/725 Installing rigid non metallic conduit](#); [90-55-10/735 Installing conduit connections to equipment](#); and [90-55-10/765 Conduit, trunking and ducting zones](#).

- **Standards:** In accordance with BS 7671 and IET Guidance Note 1.
- **Preparation:** Cut square. Remove burrs and sharp edges to make smooth.
- **Protection of metallic conduit, trunking and ducting:**
 - **Joints and ends:** Remove grease, oil, dirt and rust before applying protective paint. Paint immediately following installation.
 - **Protective paint:**

Generally: Compatible with conduit, trunking and ducting finish.

Type: Match factory finish.
- **Cross-sectional area:** Maintain throughout the conduit, trunking and ducting length.
- **Arrangement:** Position vertically and horizontally in line with equipment served, and parallel with building lines.
- **Spare containment:** Install one spare 25 mm diameter conduit from each distribution board to the nearest accessible void space, terminating in a conduit box with lid.
- **Draw wires:** Install galvanized soft iron wires within spare conduit, trunking and ducting.
- **Distance from other services running parallel (minimum):**
 - **Generally:** 150 mm.
 - **Above radiators:** 1000 mm.
 - **Steam services:** 600 mm.
- **Drainage of conduit, trunking and ducting:** Locate drainage outlets at lowest points in conduit, trunking and ducting installed externally, and where condensation may occur.
- **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, trunking and ducting from building structure.
- **Cleaning:** Clean insides of conduit, trunking and ducting before installing cables.
- **Cabling:** Install when conduit, trunking and ducting enclosure is complete.
- **Submittals:** Submit manufacturer's technical information. Submit drawings showing the proposed routes of conduit, trunking and ducting and the location of service outlets.

Installing conduit generally

Shared by: [90-55-10/715 Installing pliable and flexible conduit](#); [90-55-10/720 Installing rigid metallic conduit](#); [90-55-10/725 Installing rigid non metallic conduit](#); and [90-55-10/735 Installing conduit connections to equipment](#).

- **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:**
 - **Generally:** 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:**
 - **Generally:** Install flush with finished surfaces. Provide extension rings if required.
 - **Fixing screws:** Countersunk, or round-headed screws.
 - **Number of fixings (minimum):** Two.
 - **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):** Two.
 - **Floors:** Do not install draw-in boxes in floors.
- **Conduit in walls:** Avoid concealed horizontal runs.
- **Suspended ceiling installations:** Fasten outlet boxes to structure above ceiling.

Installing rigid metallic conduit

- **General requirements:** Installing conduit generally and Installing conduit, trunking and ducting.
- **Fixings:** Distance saddle;
Saddle;
and Spacer bar saddle.
- **Joints:** Plain and 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.

Installing rigid non metallic conduit

- **General requirements:** Installing conduit generally and Installing conduit, trunking and ducting.
- **Fixings:** Distance saddle;
Saddle;
and Spacer bar saddle.

- **Joints:** Compression and Threaded.
- **Conduit connections to boxes and items of equipment:** Threaded bushed entries.

Installing conduit connections to equipment

Shared by: 90-55-10/360 Flexible conduit; and 90-55-10/380 Rigid conduit.

- **General requirements:** Installing conduit generally and Installing conduit, trunking and ducting.
- **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 of adequate length to facilitate removal of equipment for maintenance. Final termination in swivel connectors.
- **Connections to external equipment:** Flexible conduit.

Installing trunking generally

- **Supports and mounting arrangement:** Wall mounted;
Ceiling mounted;
Floor mounted;
Purpose made brackets;
and Suspension rods and steel channels.
- **Changes of direction:** Manufacturer's bends and tees.
- **Joints:**
 - **Generally:** 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.
- **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.

Conduit, trunking and ducting zones

Shared by: 90-55-10/360 Flexible conduit; 90-55-10/380 Rigid conduit; and 90-55-10/410 Cable trunking and cable ducting systems.

- **General requirements:** Installing conduit, trunking and ducting.
- **Ceiling voids:** Provide clear distance of 150 mm (minimum) between underside of any conduit, trunking or trunking and the topside of ceiling.

Installing low voltage cables

Shared by: 90-55-15/342 Fire resistant, insulated and sheathed cables; 90-55-15/345 PVC insulated cables; 90-55-15/346 PVC insulated cables for interconnecting wiring; 90-55-15/349 Single-core heat resisting insulating cables; 90-55-15/351 Thermosetting insulated cables; 90-55-15/352 Thermosetting insulated and PVC sheathed cables (XLPE/ PVC singles); 90-55-15/355 Thermosetting insulated metal screened LSZH sheathed multicore cables; 90-55-15/665 Installing flexible cords; 90-55-15/670 Installing prefabricated wiring; and 90-55-15/680 Installing low voltage armoured cables.

- **Standard:** In accordance with 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. Clear cable path of debris.
- **Installation temperature (minimum):** 5°C.
- **Cables:** Install in one length. Dress cables flat, free from twists, kinks and strain.
- **Cable pulling:** Do not overstress. Prevent kinks and twisting of the cable.
- **Cable protection:** Cables passing through walls and floors to be sleeved with conduit or pipeduct to a minimum of 300 mm. Bush at both ends. Ensure that appropriate fire stopping materials are used to maintain the original fire integrity of the wall or floor around the penetration.
- **Concealed cable runs to wall accessories:** Run vertically from the accessory.
- **Exposed cable runs:**
- **Distance from other services running parallel (minimum):** 150 mm. Position cables below heating pipes.
- **Jointing and termination:**
 - **Final circuit cables:** At electrical accessories only.
 - **Core connections:** Using compression lugs to equipment without integral clamping terminals.
 - **Terminating cables when not using glands:** Take sheathing of cables into accessory boxes and equipment and protect against abrasion with grommets.

Extra low and low voltage cable routes

Shared by: 90-55-15/342 Fire resistant, insulated and sheathed cables; 90-55-15/343 Fire resistant, insulated and sheathed armoured cables; 90-55-15/344 Mineral insulated cables type A and type B; 90-55-15/345 PVC insulated cables; 90-55-15/346 PVC insulated cables for interconnecting wiring; 90-55-15/351 Thermosetting insulated cables; 90-55-15/352 Thermosetting insulated and PVC sheathed cables (XLPE/ PVC singles); 90-55-15/353 Thermosetting insulated and PVC sheathed armoured cables; 90-55-15/354 Thermosetting insulated and LSZH sheathed armoured cables; 90-55-15/355 Thermosetting insulated metal screened LSZH sheathed multicore cables; 90-55-15/366 Balanced twisted-pair

cables; 90-55-15/385 Prefabricated LSZH insulated singles in flexible conduit; and 90-55-15/386 Prefabricated LSZH insulated and sheathed multi-core.

- **Cables generally:**
 - **Concealed cable runs to wall accessories:** Run vertically from the accessory.
 - **Exposed cable runs:** Contractor's choice.
- **Distance from other services running parallel (minimum):** 150 mm. Position cables below heating pipes.

Low voltage cables concealed in walls and partitions

Shared by: 90-55-15/342 Fire resistant, insulated and sheathed cables; 90-55-15/343 Fire resistant, insulated and sheathed armoured cables; 90-55-15/344 Mineral insulated cables type A and type B; 90-55-15/345 PVC insulated cables; 90-55-15/346 PVC insulated cables for interconnecting wiring; 90-55-15/351 Thermosetting insulated cables; 90-55-15/352 Thermosetting insulated and PVC sheathed cables (XLPE/ PVC singles); 90-55-15/355 Thermosetting insulated metal screened LSZH sheathed multicore cables; 90-55-15/385 Prefabricated LSZH insulated singles in flexible conduit; and 90-55-15/386 Prefabricated LSZH insulated and sheathed multi-core.

- **Position:** In a zone within 150 mm of wall perimeter (except at the floor); and run vertically or horizontally from these zones, or from floor level, to switches, accessories, etc and At least 50 mm from the surface. Ensure all routes are agreed with architect (working drawings) to ensure historic fabric is maintained.
- **Protection:** Rigid conduit and Cover with galvanized steel channel nailed to substrate.

Extra low and low voltage cables in accessible roof spaces

Shared by: 90-55-15/340 Flexible cords; 90-55-15/342 Fire resistant, insulated and sheathed cables; 90-55-15/343 Fire resistant, insulated and sheathed armoured cables; 90-55-15/344 Mineral insulated cables type A and type B; 90-55-15/345 PVC insulated cables; 90-55-15/346 PVC insulated cables for interconnecting wiring; 90-55-15/351 Thermosetting insulated cables; 90-55-15/352 Thermosetting insulated and PVC sheathed cables (XLPE/ PVC singles); 90-55-15/353 Thermosetting insulated and PVC sheathed armoured cables; 90-55-15/354 Thermosetting insulated and LSZH sheathed armoured cables; 90-55-15/355 Thermosetting insulated metal screened LSZH sheathed multicore cables; 90-55-15/366 Balanced twisted-pair cables; 90-55-15/385 Prefabricated LSZH insulated singles in flexible conduit; and 90-55-15/386 Prefabricated LSZH insulated and sheathed multi-core.

- **Cables running across ceiling joists:** Cable baskets; Cable trays; and Cable trunking and cable ducting systems.

Extra low and low voltage surface mounted cables

Shared by: 90-55-15/340 Flexible cords; 90-55-15/342 Fire resistant, insulated and sheathed cables; 90-55-15/343 Fire resistant, insulated and sheathed armoured cables; 90-55-15/344 Mineral insulated cables type A and type B; 90-55-15/345 PVC insulated cables; 90-55-15/346 PVC insulated cables for interconnecting wiring; 90-55-15/351 Thermosetting insulated cables; 90-55-15/352 Thermosetting insulated and PVC sheathed cables (XLPE/ PVC singles); 90-55-15/353 Thermosetting insulated and PVC sheathed armoured cables; 90-55-15/354 Thermosetting insulated and LSZH sheathed armoured cables; 90-55-15/355 Thermosetting insulated metal screened LSZH sheathed multicore cables; and 90-55-15/366 Balanced twisted-pair 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.

Installing low voltage cables in conduit and trunking

Shared by: 90-55-15/342 Fire resistant, insulated and sheathed cables; 90-55-15/343 Fire resistant, insulated and sheathed armoured cables; 90-55-15/344 Mineral insulated cables type A and type B; 90-55-15/345 PVC insulated cables; 90-55-15/346 PVC insulated cables for interconnecting wiring; 90-55-15/349 Single-core heat resisting insulating cables; 90-55-15/351 Thermosetting insulated cables; 90-55-15/352 Thermosetting insulated and PVC sheathed cables (XLPE/ PVC singles); 90-55-15/353 Thermosetting insulated and PVC sheathed armoured cables; 90-55-15/354 Thermosetting insulated and LSZH sheathed armoured cables; 90-55-15/355 Thermosetting insulated metal screened LSZH sheathed multicore cables; 90-55-15/366 Balanced twisted-pair cables; 90-55-15/385 Prefabricated LSZH insulated singles in flexible conduit; and 90-55-15/386 Prefabricated LSZH insulated and sheathed multi-core.

- **Cable installation:** Orderly and capable of being withdrawn.
- **Single core wiring:** Arrange using the loop-in method.
- **Cables within trunking:** Tie at 2 m intervals for cables of the same circuit reference. Label ties with circuit reference number at 10 m intervals.
- **Cables in vertical conduit:** Provide cable clamps in accessible conduit boxes at 5 m intervals.
- **Extra low voltage cables:** Install within a separate partition from low voltage cables where installed in multi compartment trunking.

Installing low voltage armoured cables

Shared by: 90-55-15/343 Fire resistant, insulated and sheathed armoured cables; 90-55-15/353 Thermosetting insulated and PVC sheathed armoured cables; and 90-55-15/354 Thermosetting insulated and LSZH sheathed armoured cables.

- **General requirements:** Installing low voltage cables.
- **Earthing:** Bond armour to equipment and main earthing system.
- **Connections to apparatus:** Moisture proof, sealed glands and shrouds.

Jointing and terminating low voltage armoured cables

Shared by: 90-55-15/343 Fire resistant, insulated and sheathed armoured cables; 90-55-15/353 Thermosetting insulated and PVC sheathed armoured cables; and 90-55-15/354 Thermosetting insulated and LSZH sheathed armoured cables.

- **Preparation:**
 - **Cable ends:** Cut 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:** To BS EN 62444 and fitted with shroud.
- **Cold pour resin and heat shrink joints:** To BS EN 50393.
- **Insulating tape:** To BS EN 60454-1.
- **Plastics sheathed cables:** Seal with proprietary shrink-on end caps.
- **Bolted terminal connections to equipment and switchgear without integral cable clamping terminals:** Compression 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.

Excavations

Shared by: 90-55-15/343 Fire resistant, insulated and sheathed armoured cables; 90-55-15/353 Thermosetting insulated and PVC sheathed armoured cables; and 90-55-15/354 Thermosetting insulated and LSZH sheathed armoured cables.

- **Excavations next to existing underground services:** In accordance with HSG 47.
- **Existing underground services:** Expose and identify.

Cables in ducts

Shared by: 90-55-15/343 Fire resistant, insulated and sheathed armoured cables; 90-55-15/353 Thermosetting insulated and PVC sheathed armoured cables; and 90-55-15/354 Thermosetting insulated and LSZH sheathed armoured cables.

- **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.

Cables in trenches

Shared by: 90-55-15/343 Fire resistant, insulated and sheathed armoured cables; 90-55-15/353 Thermosetting insulated and PVC sheathed armoured cables; and 90-55-15/354 Thermosetting insulated and LSZH sheathed armoured cables.

- **Base:** All cables and ducts to be surrounded by 75 mm sand, free of any sharp stones or flints.
- **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:** Install within duct and derate cable if longer than 10 m. Extend ducts 1 m each side of hardstanding.
- **Cable identification and protection:** Underground plastics cable protection covers and Underground cable marker tape.

Installing underground cable marker tape

Shared by: 90-55-15/343 Fire resistant, insulated and sheathed armoured cables; 90-55-15/353 Thermosetting insulated and PVC sheathed armoured cables; and 90-55-15/354 Thermosetting insulated and LSZH sheathed armoured cables.

- **Installation:** In accordance with ENA 12-23.

Cable installation on channel cable supports, cable tray, cable ladder and cable basket

Shared by: 90-55-15/342 Fire resistant, insulated and sheathed cables; 90-55-15/343 Fire resistant, insulated and sheathed armoured cables; 90-55-15/344 Mineral insulated cables type A and type B; 90-55-15/345 PVC insulated cables; 90-55-15/346 PVC insulated cables for interconnecting wiring; 90-55-15/351 Thermosetting insulated cables; 90-55-15/353 Thermosetting insulated and PVC sheathed armoured cables; 90-55-15/354 Thermosetting insulated and LSZH sheathed armoured cables; and 90-55-15/355 Thermosetting insulated metal screened LSZH sheathed multicore cables.

- **Cabling:** Install when cable supports are complete.
- **Position:** Place single and multi-core cables side by side.
- **Fastening:**
 - **Fastenings generally:** Secure cables, do not indent sheaths. Position to enable any submain cable to be individually removed.
 - **Submain cables <95 mm²:** Cable cleats.
Spacing (maximum): 600 mm.
 - **Submain cables >95 mm²:** Cable cleats and Cable bands.
Spacing (maximum): 600 mm.
 - **Final circuit cabling:** Cable ties.
Spacing (maximum): 600 mm.
 - **Extra low voltage, communications and fibre optic cabling:** Cable ties.
Spacing (maximum): 600 mm.

Cables in vertical trunking and ducts

Shared by: 90-55-15/343 Fire resistant, insulated and sheathed armoured cables; 90-55-15/353 Thermosetting insulated and PVC sheathed armoured cables; and 90-55-15/354 Thermosetting insulated and LSZH sheathed armoured cables.

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

Installing current transformers

- **Standard:** In accordance with BS 7671.
- **Identification details:** Mount current transformers so that polarity markings and name plate details are easily viewed in situ.

Installing electrical monitoring and metering equipment

Shared by: 90-65-55/320 Digital metering equipment; and 90-65-55/360 Loop field strength meters.

- **Standard:** In accordance with BS 7671.

- **Digital metering equipment:** Connect to building management system.

Padlocks and keys

- **Quantity:** Six.
- **Padlock keys:** Two for each padlock.
- **Padlock identification:** Stamp padlock describing its function.

System completion

Inspecting, testing and commissioning of switchgear generally

- **Standard:** To BS 7671.
- **Notice before testing and commissioning:** 7 days.
- **Switches and circuit breakers:** Clean to remove all visible traces of dust.
- **Protective devices settings:** Configure to match the grading study.
- **Switchboard monitoring:** Continuous for 30 minutes following first energizing.
- **Additional inspecting and testing:** Check levelling and alignment of assembly.
Check operation of instruments and metering devices.
Check and adjust tightness of busbar connections and supports.
Check tightness of bolted connections.
Check busbar joints with duct or resistance measurements.
Check earth connections at compartments, switches and earth electrodes.
Check clearance of live parts from direct contact.
Check polarity and phase sequence of protective devices.
Check operation of protective devices using secondary and primary current injection.
Manually operate protective devices.
Carry out earth fault protection simulation tests.
Check functional operation of circuit breakers.
Check operation of switch tripping devices.
- **Testing and commissioning results:** Submit three copies.
- **Certificates of calibration for meters and instruments:** Submit.

Documentation

- **Operating and maintenance instructions:**
 - **Scope:** Submit for the system giving optimum settings for controls.
 - **Product information:** Include product description, date of purchase, performance characteristics, application (suitability for use), method of operation and control, and cleaning and maintenance requirements.
 - **Format:** Electronic
- **Record drawings:**
 - **Content:** Location, route and depth of underground cables;
Location of LV switchgear including distribution boards;
Routes of trunking, conduit, cable tray and cable ladders;
and Schematic drawings showing all low voltage distribution circuits: the cable origin, circuit designation, cable type, size, number of cores, size and type of overcurrent protective device.
 - **Drawing format:** Electronic drawing.
- **Submittal date:** Four weeks before handover.

Spares and consumables

- **Supply the following spares:**
 - **Fuses:** 5% of each type and rating used. e.g. MCB, MCCB, RCBO
 - **Operating handles for circuit breakers and switches:** One per device.

Maintenance

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

Ω End of system

Hard wired low voltage small power system

System outline

Hard wired low voltage small power system

- **Description:** The Electrical Contractor shall supply and install a complete small power system as indicated on the drawings, in the materials and distribution board schedules.

The small power system shall comprise the following elements briefly listed below: -

1. General 13A switched socket outlets and fused connection outlets.
2. Local power supplies to dedicated fixed equipment e.g. water heaters, lifts, display lighting etc.
3. Specialist power supplies to life safety systems, such as fire alarm.
4. Power supplies to mechanical plant and vent systems.
5. For existing circuits that are being reconnected to the new distribution board the contractor shall install Arc Flash Fault Detection beside the appropriate CPD (RCBO/MCB).
6. Power supplies and outlets to museum exhibition equipment and AV equipment.

General Purpose Power Outlets

The Electrical Contractor shall supply and install a complete small power installation as indicated on the drawings, equipment schedule and distribution board schedules.

General purpose power outlets are to be provided by means of 13A twin switched socket outlets, switched and unswitched fuse connection outlets and 13A twin socket outlets, all as detailed on the drawings. These socket outlets shall be wired utilising single stranded LSOH cables drawn into conduits and trunking systems where appropriate. Where cabling is to be installed on historic building fabric unsheathed (bare) MICC cabling shall be used.. The sockets shall also be wired as 32 Amp ring final circuits, or 20A radial circuits (to reduce excess cabling) as detailed in the distribution board schedules and shown on the drawings. All the ring/radial final circuits feeding socket outlets shall be protected by a single module 32A/20A (respectively), 30mA RCBO, these shall be single module type and shall only take up a single way in the distribution board, all in accordance with the latest wiring regulation BS7671:2008.

NB: The Electrical Contractor shall provide all RCBOs of the correct operating type to cater for the various installations within the facility i.e. as standard the passive type shall be provided excluding kitchens, and areas where sockets may supply equipment which, when re-energised unsupervised, may give rise to danger. In these instances the active variety shall be provided requiring manual reset on reinstatement of power.

The majority of the installation shall be fully exposed i.e. trunking, tray, conduit and basket will be run within service zones and ceiling voids. In the majority of areas surface mounted accessories shall be provided. All finishes as indicated on the architects drawings.

Exact positions of all sockets shall be confirmed against room layout details prior to production of working drawings and shall be co-ordinated with all other services present on site.

All socket outlets, fused connection units etc are to be of the same manufacturer and appearance as the lighting switches.

The finishes are generally as follows:-

- i) General areas (corridors, small offices etc) - White plastic finish
- ii) Exhibition Areas & shop - Bronze
- iii) Plantroom, Comms and riser areas - Metal clad
- iv) Makers Room- Bronze
- vi) Exhibition (Gallery) outlets- surface mount plastic on underside of soffit below

All twin socket outlets shall have dual earth terminals for high integrity earthing. All 13A fused connection units and double pole switches shall be complete with neon indicator lamps.

NB: Within certain areas of the facility sockets have been located within close proximity to sinks etc, ensure all electrical sockets and the like are located a minimum of 1 metre away from the sink.

The Electrical Contractor shall allow for labelling all fuse connection units and isolators to give identification as to their use and circuit reference.

Care shall be taken to install the correct back boxes for the relevant accessory.

On the face of each outlet, a screen printed label shall be fitted stating the precise circuit to which the outlet is connected. The lettering shall be black on clear tape. A 2.5mm² stranded green/yellow earth continuity cable is to be connected between the conduit box and the earth termination point on the accessory plate.

Allow for fused connection units and isolating switches to items of fixed equipment. Allow in every case for making final connection to the equipment via cabling of a cross sectional area sufficient for the equipment load under normal operating conditions.

Dado trunking is shown on the drawings and this should be used to accommodate both power and data outlets. The Electrical Contractor shall provide this system complete with all bends, tees, covers etc. All outlets shall be provided with proprietary back boxes such that segregation within the system is maintained.

Electrical Contractor shall allow to install surface vertical dado drops to horizontal

dado trunking

Where fused connection units are as shown on the drawings supplying hand dryers the Electrical Contractor shall supply and install a high level fused connection unit (mounted at 1800mm AFFL), a flex outlet plate (co-ordinated with hand dryer i.e. cable directly feeds rear entry to the associated hand dryer unit). The Electrical Contractor shall make the final connection between the fused connection unit and hand dryer utilising 2.5mm² LSOH/Cu singles. Exact locations for the hand dryers shall be confirmed against Architects drawing.

Power supplies to Museum Exhibition equipment.

The Electrical Contractor shall supply and install a selection socket and data outlets to serve the Ground floor gallery spaces specifically to power the exhibition equipment. These outlets shall be mounted on the ceiling of the Basement, directly below the equipment. A penetration suitably sized to allow a plug top through with sufficient flex, shall be made through the existing floor. The engineered timber floor shall then be made good (utilising the core drilled piece).

Existing floors are concrete filler joist. The steel joists within the floor must not be damaged by formation of service holes. Joist location can often be identified by fine cracks in slab soffit.

The outlets serving the exhibition equipment are detailed on the drawings but shall consist of 1 No. twin switched socket outlet and 1 No. RJ45 outlet as a minimum. The Electrical Contractor shall allow to agree all the locations of these devices prior to installing. Careful coordination with the museum fit out specialist is required. All positions shall be confirmed on working drawings, and finally in the presence of the exhibition specialist prior to penetrations being created.

The cabling for these shall run at high level at basement level on containment, and penetrate the floor at discrete locations to the in-floor boxes.

Cabling on containment in the basement level shall be LSOH cabling, when not on exposed surfaces and walls.

Local Power Supplies

Various supplies via switched/unswitched fuse connection units/isolators are required for individual items of equipment.

The Electrical Contractor shall install a supply to each of the automatic doors and shall terminate this into a 13A surface fuse connection unit adjacent to the door. The Door Trade Contractor shall undertake all wiring and connections from the FCU to the equipment.

The power supplies for the automatic doors shall be wired from local distribution boards utilising single stranded LSF cables drawn into trunking and conduit systems.

The Electrical Contractor shall install a supply to each of the door hold open devices and shall terminate this into a surface fuse connection unit adjacent to the door. The

Door Trade Contractor shall undertake all wiring and connections from the FCU to the equipment.

The Electrical Contractor is deemed to have included for all necessary supplies for specialist systems being supplied and installed by them and accounting for any variation in requirements between the different specialists named. This process must take place during the tender period.

Individual items requiring power supplies are as identified below :-

1. Induction loop amplifiers.
2. Fire alarm equipment.
3. PA equipment.
4. Data cabinets.
5. Automatic opening doors.
6. Mechanical services power supplies i.e. Fan convectors units / water heaters etc, MVHR ventilation units
7. Access control controllers
8. Door hold open devices
9. Fire alarm signal repeaters and boosters
10. Disabled refuge call points
11. Accessible WC alarm call points
12. Door access system mag locks

The Electrical Contractor shall note that the above list is not exhaustive and references should be made to the drawings and other sections of this specification for further details of the systems.

The Electrical Contractor shall be responsible for making all final connections to the above systems, and for the provision of cable containment system within wall, floor and service zones to feed power and data/control into the specialist equipment wiring point. Refer to layout drawings for containment sizes and routes.

Lift Supplies

Provide separate power supplies to the lifts.

Connect a lift ancillary equipment as recommended by the lift specialist.

Data/Server Rooms

Data cabinets (basement comms room) provided by the contractor (see section 75 45 20 Data distribution systems) are to be supplied from the local distribution board via 16A 230V rated industrial sockets using LSOH insulated copper stranded singles enclosed in wall mounted mild steel trunking. Final connection into wiring rack shall be by means of flexible plug assembly.
RCD protection shall not be provided.

Mechanical Supplies

Provide supplies to mechanical control panels as shown on the drawings.
Also liaise with the BMS contractor during the tender period to ensure all required supplies are included in the tender.

Liaise with the BMS contractor during the tender period to ensure all power and control cabling, and all containment required, is included within the tender by either the electrical contractor or the BMS contractor.

Spares

The Electrical Contractor shall be responsible for supplying the following spares prior to handover: -

- 1.. 10 No. MCBs/RCBOs of each type and rating utilised within the distribution boards.
2. 5No MCBs/RCBOs with arc fault flash detection

Ceiling Mounted Power Supplies

Within some rooms, surface/suspended ceiling mounted power supplies are required as indicated on the drawings.

Reception Desk and Fixed Furniture

The Electrical Contractor shall supply and install a system of conduits and pedestal mounting boxes for locations where power, voice and data are shown on fixed furniture and reception desks. All outlets shall be carefully co-ordinated to ensure the 'best possible' location for the end user. Detailed working drawings shall be produced by the Contractor to verify final locations and setting out

The Electrical Contractor shall allow for all necessary co-ordination required with other Contractors to ensure suitable access panels are cut to allow for the installation and future maintenance of the electrical services to the fixed desks. Services supplying the desk/furniture shall be installed within 25mm conduits buried into the floor.

- **System performance:** Provide adequate current for the loads' characteristics whilst remaining within equipment voltage and frequency tolerance. Ensure that all aspects of steady state and transient load characteristics are taken into account in circuit design and selection of circuit components particularly inrush characteristics, harmonics and earth leakage. Ensure that circuit design makes due allowance for anticipated fault levels, installed length, environmental influence, diversity and installation method and that circuit disconnection is achieved safely within periods prescribed limits.

Provide protection grading for complete discrimination under fault conditions. Provide a means of fault clearance and isolation on every circuit and co-ordinate protection of cables and switchgear.

Ensure that outlets are suitable for the connected equipment and the environment in which they are installed.

IET Wiring Regulations BS7671:2008 incorporating the latest amendment
 BASEC Certification
 BS6004, electric cables;
 BS3676, Switches;
 PME Earthing requirements.

Accessory mounting heights:

To comply with Building Regulations Part M:

Sockets - 450mm AFFL to U/S of plate

Switches - 1200mm AFFL to T/S of plate

Sockets & switches at worktop level - 1200mm AFFL to T/S of plate.

The contractor shall allow in the tender for outlets to be moved by up to 3m from the positions shown on the drawings (prior to being installed)

Low voltage small power cables generally;

Selection of conduit, trunking and ducting generally;

and Multi-gang power outlets.

- **Origin of supply:** Low voltage distribution system.
- **Final circuit cabling:**
 - **Types:** Fire resistant, insulated and sheathed cables;
Thermosetting insulated cables;
Thermosetting insulated and LSZH sheathed armoured cables;
and Mineral insulated cables type B.
- **Cable accessories:** Cable cleats and Cable ties.
- **Containment:** Cable baskets;
Cable ladders;
Cable trays;
Flexible conduit;
Rigid conduit;
Cable trunking and cable ducting systems;
- **Containment accessories:** Conduit fittings.
- **Rewireable installation:** Required.
- **Concealed installation:** Required in some areas
- **Final connections:** Required.
- **Partial installation:** Required.
- **Outlets:** Electrical accessories.
- **Controls and starters:** Emergency stop buttons and Direct-on-line starters.
- **Accessories:** Fire barrier units;
Transient overvoltage surge suppression for plug in mains power supplies;
- **Electrical identification:** Electrical shock treatment signs;
Equipment labels and warning notices;
Electrical diagrams generally;
- **Execution:** Small power installation;
Installing cabling to socket outlets;
Installing final connections to fixed equipment;
and Partial installation.
- **System completion:** Inspection, testing and commissioning of harmonic filters;
Inspecting, testing and commissioning UPS equipment;
Documentation;
Spares;
and Maintenance.

System performance

Low voltage small power cables generally

- **Standard:** To BS 7671.
- **Conductor sizes (minimum):**
 - **Power final circuits:** Refer to distribution board schedules

Selection of conduit, trunking and ducting generally

- **Standard:** In accordance with BS 7671.
- **Requirement:** Submit proposals including working drawings, technical information, calculations and manufacturers' literature.
- **Conduit, trunking and ducting sizes not stated:** Submit.

Multi-gang power outlets

- **Quantity:** Refer to drawings

Products

Fire barrier units

- **Manufacturer:** Contractor's choice.
- **Standard:** To BS EN 61439-1 and BS EN 61439-6.
- **Fire protection:** Manufacturer's standard.
- **Circuits:** Match busbar trunking.
- **Accessories:** End covers.
- **Execution:** Installing fire barrier units.

Cable cleats

Shared by: 70-70-45/110 Low voltage distribution system; 70-70-75/110 Hard wired low voltage small power system; and 90-55-15/735 Cable installation on channel cable supports, cable tray, cable ladder and cable basket.

- **Manufacturer:** Contractor's choice.
- **Standard:** To BS EN 61914.
- **Format:** Contractor's choice.
- **Material:** Metallic.
- **Temperatures for permanent installation:**
 - **Maximum:** 105°C.
 - **Minimum:** -25°C.
- **Resistance to impact:** Heavy.
- **Type of retention or resistance to electromechanical forces:** Resistant to electromechanical forces, withstanding one short circuit.
- **Environmental influences:**
 - **Non-metallic and composite components:** Resistant to ultraviolet light.

- **Metallic and composite components:** High resistance to corrosion.

Cable ties

Shared by: 70-70-45/110 Low voltage distribution system; 70-70-75/110 Hard wired low voltage small power system; and 90-55-15/735 Cable installation on channel cable supports, cable tray, cable ladder and cable basket.

- **Manufacturer:** Contractor's choice.
- **Standard:** To BS EN 62275.
- **Format:** Wrap around self-locking releasable.
- **Material:** Nylon and Metal.
- **Loop tensile strength (minimum):** Manufacturer's standard.
- **Temperatures for permanent installation:**
 - **Maximum:** 60°C.
 - **Minimum:** -15°C.
- **Contribution to fire:** Non-flame propagating.
- **Environmental influences:**
 - **Non-metallic and composite components:** Resistant to ultraviolet light.
 - **Metallic and composite components:** Resistant to corrosion.

Cable bands

Shared by: 70-70-45/110 Low voltage distribution system; and 90-55-15/735 Cable installation on channel cable supports, cable tray, cable ladder and cable basket.

- **Manufacturer:** Contractor's choice.
- **Material:** Manufacturer's standard.
- **Protective covering:** Manufacturer's standard.

Cable baskets

Shared by: 70-70-45/110 Low voltage distribution system; 70-70-75/110 Hard wired low voltage small power system; 70-80-35/110 Hard wired general lighting system; 75-45-20/110 Data distribution system; 75-60-10/110 CCTV system; 75-60-40/110 Intruder detection and alarm system; 75-65-30/110 Fire detection and alarm system; and 90-55-15/650 Extra low and low voltage cables in accessible roof spaces.

- **Manufacturer:** Contractor's choice.
- **Material:**
- **Coating material:** Hot dip galvanised, powder coated RAL colour to architectural specification
- **Features:**
 - **Segregation:** Cable dividers.
 - **Protective cover:** Required.
- **Execution:** Installing cable basket;
Multiple cable runs;
and Cable support zones.
- **Standard:** To BS EN 61537.

Cable trays

Shared by: 70-70-45/110 Low voltage distribution system; 70-70-75/110 Hard wired low voltage small power system; 75-60-10/110 CCTV system; and 90-55-15/650 Extra low and low voltage cables in accessible roof spaces.

- **Manufacturer:** Contractor's choice.
- **Standard:** To BS EN 61537.
- **Material:** Steel.
- **Resistance against flame propagation:** Non-Flame propagating.
- **Electrical properties:**
 - **Continuity characteristics:** Without electrical continuity.
 - **Conductivity characteristics:** Without electrical conductive system component.
- **Coating material:** Hot dip galvanised, powder coated RAL colour to architectural specification
- **Temperature properties for transport, storage, installation and application:**
 - **Minimum:** Manufacturer's standard.
 - **Maximum:** Manufacturer's standard.
- **Mechanical properties:**
 - **Cable tray free base area:** Manufacturer's standard.
 - **Resistance to impact:** Manufacturer's standard.
- **Features:**
 - **Flange type:** Return.
 - **Segregation:** Cable dividers.
 - **Protective cover:** Required.
- **Execution:** Installing cable tray and cable ladder; Installing cable supports on roofs; Multiple cable runs; and Cable support zones.

Flexible conduit

- **Manufacturer:** Contractor's choice.
- **Standard:** To BS EN 61386-23.
- **Material:** PVC-U.
- **Mechanical properties:**
 - **Resistance to compression:** Medium.
 - **Resistance to impact:** Medium.
 - **Resistance to bending:** Flexible.
 - **Tensile strength:** Manufacturer's standard.
 - **Suspended load capacity:** Manufacturer's standard.
- **Temperature range:**
 - **Lower temperature (maximum):** -25°C.
 - **Upper temperature (minimum):** 105°C.
- **Electrical properties:** Manufacturer's standard.
- **Ingress protection (minimum):** To BS EN 60529, IP x4.

- **Resistance to corrosion:** To BS EN 61386-1, Class 4.
- **Resistance against flame propagation:** Manufacturer's standard.
- **Special features:** None.
- **Execution:** Installing conduit connections to equipment;
Conduit, trunking and ducting zones;
and Installing pliable and flexible conduit.

Rigid conduit

Shared by: 70-70-25/660 Installing main earthing conductor; 70-70-45/110 Low voltage distribution system; 70-70-75/110 Hard wired low voltage small power system; 70-80-35/110 Hard wired general lighting system; 75-45-40/110 Audio-frequency-induction-loop system; 75-60-05/110 Access control system; 75-60-40/110 Intruder detection and alarm system; 75-65-30/110 Fire detection and alarm system; 75-70-05/110 Assistance call system; and 90-55-15/645 Low voltage cables concealed in walls and partitions.

- **Manufacturer:** Contractor's choice.
- **Standards:** To BS EN 61386-21.
- **Mechanical properties:**
 - **Resistance to compression:** Heavy.
 - **Resistance to impact:** Heavy.
- **Transport, installation and application:**
 - **Lower temperature (minimum):** Manufacturer's standard.
 - **Upper temperature (maximum):** Manufacturer's standard.
- **Resistance to bending:** Rigid.
- **Electrical characteristics:** With electrical continuity properties.
- **Resistance to external influences:**
 - **Protection against ingress of solid objects (minimum):** To BS EN 60529, IP3X.
 - **Protection against ingress of water (minimum):** To BS EN 60529, IPX0.
- **Resistance to corrosion:** To BS EN 61386-1, Class 4.
- **Tensile strength:** Heavy.
- **Resistance to flame propagation:** Manufacturer's standard.
- **Suspended load capacity:** Heavy.
- **Colour:** Submit proposals.
- **Sizes (OD):** 25 mm.
- **Execution:** Installing rigid metallic conduit;
Installing rigid non metallic conduit;
Installing conduit connections to equipment;
and Conduit, trunking and ducting zones.

Cable trunking and cable ducting systems

Shared by: 70-70-45/110 Low voltage distribution system; 70-70-75/110 Hard wired low voltage small power system; 70-80-35/110 Hard wired general lighting system; 75-60-05/110 Access control system; 75-60-40/110 Intruder detection and alarm system; 75-65-30/110 Fire detection and alarm system; 75-70-05/110 Assistance call system; 75-70-05/120 Emergency voice communication system; and 90-55-15/650 Extra low and low voltage cables in accessible roof spaces.

- **Manufacturer:** Contractor's choice.

- **Standards:** To BS EN 50085-1 and BS EN 50085-2-1.
- **Material:** Metallic;
Non-metallic;
and Steel.
- **Construction:** To include means of preventing contact between liquids and insulated conductors and live parts.
- **Temperature properties:**
 - **Storage and transport temperature (maximum):** Manufacturer's standard.
 - **Installation and application temperature (minimum):** Manufacturer's standard.
 - **Application temperature (maximum):** Manufacturer's standard.
- **Resistance to flame propagation:** Required.
- **Electrical properties:** With electrical continuity characteristics.
- **Ingress protection (minimum):** To BS EN 60529, IP x4.
- **Protection against corrosive and polluting substances:** High protection outside and inside.
- **Access method:** With tools.
- **Screening:** Required.
- **Execution:** Conduit, trunking and ducting zones and Installing trunking generally.

Conduit fittings

Shared by: 70-70-45/110 Low voltage distribution system; 70-70-75/110 Hard wired low voltage small power system; 70-80-35/110 Hard wired general lighting system; and 75-45-20/110 Data distribution system.

- **Manufacturer:** Match conduit.
- **Standards:** To BS EN 61386-1 and to BS EN 61386-21, BS EN 61386-22, or BS EN 61386-23 as appropriate; or to BS 4607-1.
- **Material:**
 - **Type:** Steel and PVC-U.
 - **Finish:** Match conduit.
- **Conduit boxes:** Fit covers of same material and finish as boxes. Include brass earthing terminals in PVC-U boxes.
- **Plugs:**
 - **For metallic boxes:** Manufacturer's standard.
 - **For non metallic boxes:** Manufacturer's standard.
- **Locknuts.:**
 - **For metallic boxes:** Manufacturer's standard.
 - **For non metallic boxes:** Manufacturer's standard.
- **Execution:** Installing conduit, trunking and ducting.

Fire resistant, insulated and sheathed cables

Shared by: 70-70-45/110 Low voltage distribution system; 70-70-75/110 Hard wired low voltage small power system; 70-80-35/110 Hard wired general lighting system; and 75-65-30/110 Fire detection and alarm system.

- **Manufacturer:** Batt cables or equal and approved
- **Standard:** To BS 7629-1.

- **Third party certification:** British Approvals Service for Cables (BASEC) certified and LPCB.
- **Size:** Refer to cable schedule
- **Screen:** Copper tape.
- **Execution:** Installing low voltage cables;
Extra low and low voltage cable routes;
Low voltage cables concealed in walls and partitions;
Extra low and low voltage cables in accessible roof spaces;
Extra low and low voltage surface mounted cables;
Installing low voltage cables in conduit and trunking;
and Cable installation on channel cable supports, cable tray, cable ladder and cable basket.

Mineral insulated cables type B

Shared by: 70-70-75/110 Hard wired low voltage small power system; and 75-70-05/120 Emergency voice communication system.

- **Manufacturer:** Contractor's choice.
- **Standard:** To BS EN 60702-1.
- **Third party certification:** British Approvals Service for Cables (BASEC) certified and LPCB.
- **Metallic sheath:** Contractor's choice.
- **Light duty mineral insulated with outer sheath (LD MICS/ LSZH):**
 - **Construction:** To tables 7, 8 and 9.
 - **Size:** Contractor's choice.
- **Heavy duty mineral insulated with outer sheath (HD MICS/ LSZH):**
 - **Construction:** To tables 10, 11 and 12.
 - **Size:** Contractor's choice.
- **Execution:** Extra low and low voltage cable routes;
Low voltage cables concealed in walls and partitions;
Extra low and low voltage cables in accessible roof spaces;
Extra low and low voltage surface mounted cables;
Installing low voltage cables in conduit and trunking;
and Cable installation on channel cable supports, cable tray, cable ladder and cable basket.

Thermosetting insulated cables

Shared by: 70-70-45/110 Low voltage distribution system; 70-70-75/110 Hard wired low voltage small power system; and 70-80-35/110 Hard wired general lighting system.

- **Manufacturer:** Contractor's choice.
- **Standard:** To BS 7211.
- **Third party certification:** British Approvals Service for Cables (BASEC) certified.
- **Rigid thermosetting insulated single core cables (LSZH singles, H07Z):**
 - **Construction:** To table 3a.
 - **Size:** Refer to cable schedule
- **Thermosetting insulated and sheathed single core cables (LSZH/ LSZH singles):**
 - **Construction:** To table 5.

- **Size:** Refer to cable schedule
- **Thermosetting insulated and sheathed cables with circuit protective conductor (LSZH/ LSZH with CPC):**
 - **Construction:** To table 7.
 - **Size:** Refer to cable schedule
- **Execution:** Installing low voltage cables;
Extra low and low voltage cable routes;
Low voltage cables concealed in walls and partitions;
Extra low and low voltage cables in accessible roof spaces;
Extra low and low voltage surface mounted cables;
Installing low voltage cables in conduit and trunking;
and Cable installation on channel cable supports, cable tray, cable ladder and cable basket.

Thermosetting insulated and LSZH sheathed armoured cables

Shared by: 70-70-45/110 Low voltage distribution system; 70-70-75/110 Hard wired low voltage small power system; and 70-80-35/110 Hard wired general lighting system.

- **Manufacturer:** Contractor's choice.
- **Standard:** To BS 6724.
- **Third party certification:** British Approvals Service for Cables (BASEC) certified.
- **Cable type:** Multi-core XLPE/ SWA/ LSZH and Single-core XLPE/ AWA/ LSZH.
- **Insulation:** Cross-linked polyethylene GP 8.
- **Rated voltage:** 600/ 1000 V.
- **Conductors:** Copper.
- **Size:** Refer to cable schedule
- **Execution:** Extra low and low voltage cable routes;
Extra low and low voltage cables in accessible roof spaces;
Extra low and low voltage surface mounted cables;
Installing low voltage cables in conduit and trunking;
Installing low voltage armoured cables;
Jointing and terminating low voltage armoured cables;
Excavations;
Cables in ducts;
Cables in trenches;
Installing underground cable marker tape;
Cable installation on channel cable supports, cable tray, cable ladder and cable basket;
and Cables in vertical trunking and ducts.

Prefabricated LSZH insulated singles in flexible conduit

- **Manufacturer:** Contractor's choice.
- **Standards:**
 - **Cable:** Flexible thermosetting insulated single core (LSZH singles, H07Z-K), to BS 7211, table 3b.
 - **Size:** Refer to Distribution board schedules
 - **Flexible conduit:** To BS EN 61386-23.
- **Approval:** British Approvals Service for Cables (BASEC) certified.

- **Execution:** Extra low and low voltage cable routes;
Low voltage cables concealed in walls and partitions;
Extra low and low voltage cables in accessible roof spaces;
Installing low voltage cables in conduit and trunking;
and Installing prefabricated wiring.

Prefabricated LSZH insulated and sheathed multi-core

- **Manufacturer:** Contractor's choice.
- **Standard:** To BS 7211.
- **Approval:** British Approvals Service for Cables (BASEC)certified.
- **Thermosetting insulated, twin, 3-core, 4-core and 5-core circular sheathed cables:**
 - **Construction:** To table 6.
 - **Sheath colour:** White.
- **Execution:** Extra low and low voltage cable routes;
Low voltage cables concealed in walls and partitions;
Extra low and low voltage cables in accessible roof spaces;
Installing low voltage cables in conduit and trunking;
and Installing prefabricated wiring.

Products generally type A

- **Standards:**
 - **Accessories generally:** To BS 5733.
 - **Switches:** To BS EN 60669-1.

Products generally type B

- **Standards:**
 - **Accessories generally:** To BS 5733.
 - **Switches:** To BS EN 60669-1.

Products generally type C

- **Standards:**
 - **Accessories generally:** To BS 5733.
 - **Switches:** To BS EN 60669-1.

Products generally type D

- **Standards:**
 - **Accessories generally:** To BS 5733.
 - **Switches:** To BS EN 60669-1.

Products generally type E

- **Standards:**
 - **Accessories generally:** To BS 5733.
 - **Switches:** To BS EN 60669-1.

Products generally type F

- **Standards:**
 - **Accessories generally:** To BS 5733.
 - **Switches:** To BS EN 60669-1.

Products generally type G

- **Standards:**
 - **Accessories generally:** To BS 5733.
 - **Switches:** To BS EN 60669-1.

Products generally type H

- **Standards:**
 - **Accessories generally:** To BS 5733.
 - **Switches:** To BS EN 60669-1.

Products generally type I

- **Standards:**
 - **Accessories generally:** To BS 5733.
 - **Switches:** To BS EN 60669-1.

Products generally type J

- **Standards:**
 - **Accessories generally:** To BS 5733.
 - **Switches:** To BS EN 60669-1.

Electrical accessories

- **Manufacturer:** MK or equivalent and approved - finishes to be agreed with architect
- **Cable termination:**
 - **Method:** Manufacturer's standard.
 - **Arrangement:** In line.
 - **Earthing terminal:** Required.
- **Accessory type:** Ceiling light switches;
Ceiling power switches;
Ceiling roses;
Dimmer switches and controls;
Light switches;
Luminaire supporting couplers;
Safety pendant lampholders;
Safety pendant sets;
Switch modules for prefabricated wiring;
Cable couplers;
Cable outlets;
Cooker control units;
Cooker connection units;
Double pole switches;
Fan isolators;

Fused connection units;
Industrial plugs;
Industrial socket outlets;
Round pin socket outlets;
Standard socket outlets;
Shaver supply units;
Single voltage shaver outlets;
Surface and concealed wiring enclosures;
Balanced twisted-pair cable outlets;
Fibre optic cable outlets;
Telecommunication outlets;
and Television outlets.

- **Execution:** Installing electrical accessories and Grid switch plates.

Surface and concealed wiring enclosures

- **Standards:**
 - **Concealed enclosures:** To BS 4662.
 - **Surface enclosures:** To BS 5733.
- **Enclosure:**
 - **Material:** Contractor's choice.
 - **Finish:** Galvanized and Match conduit and trunking.
- **Enclosure depth (minimum):** 35 mm.

Light switches

Shared by: 70-80-35/110 Hard wired general lighting system; and 90-60-25/315 Electrical accessories.

- **General requirements:** Products generally type C.
- **Manufacturer:** As electrical accessories manufacturer.
- **Application:** Internal and External.
- **Degree of ingress protection (minimum):** To BS EN 60529, IP 2X;
To BS EN 60529, IP 44;
To BS EN 60529, IP 56;
and To BS EN 60529, IP 67.
- **Rating:** 20 A.
- **Actuating method:** Pull cord;
Rotary switch;
Secret key switch;
and Standard rocker bar.
- **Mounting:** Architrave;
Flush;
Grid;
and Surface.
- **Poles:** Single pole and Double pole.
- **Execution:** Installing light switches.

Dimmer switches and controls

Shared by: 70-80-35/110 Hard wired general lighting system; and 90-60-25/315 Electrical accessories.

- **Manufacturer:** As electrical accessories manufacturer.
- **Standards:** To BS EN 60669-2-1 and BS EN 55015.
- **Ingress protection (minimum):** To BS EN 60529, IP 2X.
- **Mounting:** Flush;
Grid;
and Surface.
- **Format:** Overload protection and Soft start.
- **Suitable for the following loads:** Resistive;
Extra low voltage;
Low voltage with electronic transformers;
Fluorescent;
LED;
and RGB.
- **Control:** Momentary.

Fused connection units

- **Manufacturer:** As electrical accessories manufacturer.
- **Standard:** To BS 1363-4.
- **Ingress protection (minimum):** To BS EN 60529, IP 2X and To BS EN 60529, IP 56.
- **Mounting:** Flush and Surface.
- **Control:** Switched and Unswitched.
- **Indicator lamp:** Required.
- **Fuse carrier access:** Screw.
- **Poles:** Double pole.
- **Flex outlet:** Base entry.

Cable outlets

- **General requirements:** Products generally type E.
- **Manufacturer:** As electrical accessories manufacturer.
- **Standard:** To BS 5733.
- **Ingress protection (minimum):** To BS EN 60529, IP 2X and To BS EN 60529, IP 4X.
- **Mounting:** Flush;
Grid;
and Surface.
- **Flex outlet:** Base entry.

Standard socket outlets

- **Manufacturer:** As electrical accessories manufacturer.
- **Standard:** To BS 1363-2.
- **Ingress protection (minimum):** To BS EN 60529, IP 2X.
- **Mounting:** Flush;
Grid;
and Surface.
- **Arrangement:** Single;

Twin;
and Triple.

- **Control:**
 - **Type:** Switched and Unswitched.
 - **Switch position:** Inboard.
 - **Indicator lamp:** Not required.
- **Interlock:** 3 pin equal pressure.
- **Accessories:** Dual earth terminals.

Industrial socket outlets

- **Manufacturer:** As electrical accessories manufacturer.
- **Standards:** To BS EN 60309-1 and BS EN 60309-2.
- **Ingress protection (minimum):** To BS EN 60529, IP 44 and To BS EN 60529, IP 67.
- **Mounting:** Panel mount and Surface angle mount.
- **Material:** Polycarbonate.
- **Voltage rating:** 25 V a.c;
50 V a.c;
50–250 V d.c;
100–130 V a.c;
200–250 V a.c;
380–415 V a.c;
and 480–500 V a.c.
- **Current rating:** 16 A;
32 A;
63 A;
and 125 A.
- **Frequency rating:** 50Hz
- **Pin configuration:** 2 pole;
3 pole;
2 pole and earth;
3 pole and earth;
and 3 pole, neutral and earth.
- **Controls:** None and Integral switch with interlock.

Round pin socket outlets

- **Manufacturer:** As electrical accessories manufacturer.
- **Standard:** To BS 546.
- **Ingress protection (minimum):** To BS EN 60529, IP 2X.
- **Mounting:** Flush and Surface.
- **Rating:** 15 A.

Industrial plugs

- **Manufacturer:** As electrical accessories manufacturer.
- **Standards:** To BS EN 60309-1 and BS EN 60309-2.
- **Ingress protection (minimum):** To BS EN 60529, IP 44 and To BS EN 60529, IP 67.

- **Material:** Polycarbonate.
- **Voltage rating:** 25 V a.c;
50 V a.c;
50–250 V d.c;
100–130 V a.c;
200–250 V a.c;
380–415 V a.c;
440–460 V a.c;
and 480–500 V a.c.
- **Current rating:** 16 A;
32 A;
63 A;
and 125 A.
- **Frequency rating:** 50Hz
- **Pin configuration:** 2 pole;
3 pole;
2 pole and earth;
3 pole and earth;
and 3 pole, neutral and earth.

Cable couplers

- **Manufacturer:** As electrical accessories manufacturer.
- **Standard:** To BS 5733 and To BS EN 60309-1 and BS EN 60309-2.
- **Ingress protection (minimum):** Contractor's choice.
- **Material:** Contractor's choice.

Fan isolators

- **Manufacturer:** As electrical accessories manufacturer.
- **Standard:** To BS EN 60947-3.
- **Ingress protection (minimum):** Manufacturer's standard.
- **Mounting:** Flush and Surface.
- **Rating:** 10 A.
- **Poles:** Triple pole.

Single voltage shaver outlets

- **Manufacturer:** As electrical accessories manufacturer.
- **Standard:** To BS 4573.
- **Ingress protection (minimum):** To BS EN 60529, IP 2X.
- **Mounting:** Flush and Surface. Must not be installed in a bathroom or shower room.
- **Output voltage:** 230 V.
- **Rating:** 20 V·A.
- **Control:** Plug insertion.
- **Identification:** Engrave with the wording 'SHAVERS ONLY'.

Shaver supply units

- **Manufacturer:** As electrical accessories manufacturer.
- **Standard:** To BS EN 61558-2-5.

- **Ingress protection (minimum):** Manufacturer's standard.
- **Mounting:** Flush and Surface.
- **Output voltage:** 115 V and 230 V.
- **Rating:** 20 V·A.
- **Isolating transformer:** Integral.

Double pole switches

- **General requirements:** Products generally type G.
- **Manufacturer:** As electrical accessories manufacturer.
- **Ingress protection (minimum):** To BS EN 60529, IP 2X.
- **Mounting:** Flush and Surface.
- **Rating:** 20 A;
32 A;
and 45 A.
- **Indicator lamp:** Dependant on equipment

Cooker control units

- **Manufacturer:** As electrical accessories manufacturer.
- **Standard:** To BS 4177.
- **Ingress protection (minimum):** BS EN 60529, IP 2X.
- **Mounting:** Flush and Surface.
- **Switched socket outlet:** 13 A to BS 1363-2.
- **Indicator lamp:** Required.

Cooker connection units

- **General requirements:** Products generally type F.
- **Manufacturer:** As electrical accessories manufacturer.
- **Ingress protection (minimum):** To BS EN 60529, IP 2X.
- **Mounting:** Flush.
- **Individual terminal block capacity (minimum):** 10 mm² stranded cable.

Ceiling power switches

- **General requirements:** Products generally type B.
- **Manufacturer:** As electrical accessories manufacturer.
- **Ingress protection (minimum):** To BS EN 60529, IP 4X.
- **Mounting:** Flush and Surface.
- **Rating:** 50 A.
- **Poles:** Double pole.
- **Neon indicator:** Required.
- **Flag indicator:** Mechanical on/ off indication.

Switch modules for prefabricated wiring

- **General requirements:** Products generally.
- **Manufacturer:** As electrical accessories manufacturer.

- **Arrangement:** One way switch 'T';
Two way switch 'T';
Two way intermediate switch 'T';
and Key switch 'T'.
- **Rating:** 16 A.
- **Cable:**
 - **Type:** Prefabricated LSZH insulated singles in flexible conduit and Prefabricated LSZH insulated and sheathed multi-core.
 - **Number of cores:** 5.
 - **Size:** 2.5 mm².
 - **Length:** 5 m.
- **Connectors:**
 - **Standard:** Manufacturer's standard.
 - **Arrangement:** Manufacturer's standard.
- **Poles:** Manufacturer's standard.

Ceiling light switches

- **General requirements:** Products generally type A.
- **Manufacturer:** As electrical accessories manufacturer.
- **Standard:** To BS EN 61058-2-1.
- **Ingress protection (minimum):** To BS EN 60529, IP 4X.
- **Mounting:** Flush and Surface.
- **Rating:** 6 A.
- **Configuration:** One way.
- **Cord colour:** White.

Ceiling roses

Shared by: 70-80-35/110 Hard wired general lighting system; and 90-60-25/315 Electrical accessories.

- **Manufacturer:** As electrical accessories manufacturer.
- **Standard:** To BS 67.
- **Rating:** 6 A.
- **Mounting type:** Surface.
- **Colour:** White.

Luminaire supporting couplers

Shared by: 70-80-35/110 Hard wired general lighting system; 90-60-25/315 Electrical accessories; 90-60-50/630 Luminaire cable connections; and 90-60-50/640 Luminaires mounted as part of a suspended ceiling.

- **General requirements:** Products generally type D.
- **Manufacturer:** Contractor's choice.
- **Standard:** To BS 7001.
- **Plug type:** Rewireable, independent.
- **Pin configuration:** 3 pin and 4 pin.
- **Colour:** Red and White.

- **Cable type:** Low smoke zero halogen.
- **Cable size:** 0.75 mm².
- **Flex length (maximum):** 3 m.

Safety pendant lampholders

Shared by: 70-80-35/110 Hard wired general lighting system; and 90-60-25/315 Electrical accessories.

- **Manufacturer:** As electrical accessories manufacturer.
- **Standard:** To BS EN 61184.
- **Colour:** White.
- **Execution:** Installing suspended lampholders.

Safety pendant sets

Shared by: 70-80-35/110 Hard wired general lighting system; and 90-60-25/315 Electrical accessories.

- **Manufacturer:** As electrical accessories manufacturer.
- **Standards:** To BS 67, BS 6500 and BS EN 61184.
- **Cable:**
 - **Colour:** White.
 - **Size:** 0.75 mm².
 - **Length:** 150 mm and 225 mm.

Television outlets

- **General requirements:** Products generally type J.
- **Manufacturer:** As electrical accessories manufacturer.
- **Mounting:** Flush.
- **Frequency range:** Manufacturer's standard.
- **Signal loss:** Manufacturer's standard.

Telecommunication outlets

- **General requirements:** Products generally type I.
- **Manufacturer:** As electrical accessories manufacturer
- **Standards:** To BS 6312-2-1 and BS BS 6312-2-2.
- **Types:** BT line jack unit series 3 and RJ 45 socket.
- **Mounting:** Flush and Surface.
- **Cable termination:** BT insulation displacement connection type.

Balanced twisted-pair cable outlets

- **General requirements:** Products generally type H.
- **Manufacturer:** As electrical accessories manufacturer
- **Standard:** ISO/IEC 11801, EN 50173, TIA 568, EN41003
- **Arrangement:** Single RJ-45 and Twin RJ-45.
- **Screening:** Required.
- **Mounting:** Flush straight.
- **Cable termination:** Manufacturer's standard.

- **Spring loaded shutter:** Manufacturer's standard.
- **Circuit designation label with transparent cover:** Manufacturer's standard.

Fibre optic cable outlets

- **Format:** SC.
- **Mode of operation:** Duplex.
- **Mounting:** Flush straight.
- **Circuit designation label with transparent cover:** Required.

Transient overvoltage surge suppression for plug in mains power supplies

- **Manufacturer:** To be completed by user
- **Standards:** To BS 1363-1, and BS EN 61643-11, Type 3.
- **Operating voltage and frequency (nominal):** 230 V at 50 Hz.
- **Surge current (minimum) between any two conductors:** 10 kA.
- **Let-through voltage (maximum):** 600 V.
- **Thermal overload protection:** Manufacturer's standard.
- **Current rating:** 13 A.
- **Mode of protection:** Line to earth, line to neutral, neutral to earth.
- **Protection status indicators:** Manufacturer's standard.
- **Effect on mains power supplies during normal operation:** No corruption to normal mains supply.
No break or shutdown of mains supply.
No excessive earth leakage current.
- **Number of outlets:** 2.
- **Outlet type:** To BS 1363-2.
- **Cord length:** 2 m.
- **Execution:** Installing transient overvoltage surge suppression for plug in mains power supplies.

Direct-on-line starters

- **Manufacturer:** Contractor's choice.
- **Standard:** To BS EN 60947-4-1.
- **Rated operational voltage (Ue):** 230 V a.c and 400 V a.c.
- **Rated power (kW):** To be completed by user
- **Rated operational frequency:** 50 Hz.
- **Utilization category:** Contractor's choice.
- **Number of poles:** 3.
- **Interrupting medium:** Air.
- **Reverse mode:** Not required.
- **Control coil:** Manufacturer's standard.
- **Overload relay:**
 - **Type:** Manufacturer's standard.
 - **Features:** Manufacturer's standard.
- **Enclosure:**
 - **Mounting arrangement:** Surface and Panel (open frame).

- **Material:** Polycarbonate.
 Finish: Manufacturer's standard.
 Colour: Manufacturer's standard.
- **Ingress protection (minimum):** To BS EN 60529, IP 41.
- **Integral control buttons:** Start and Stop.
- **Motor control switch:** To BS EN 60947-3.
- **Accessories:** 2 pole auxiliary contact module, 10 A rated, with one normally open and one normally closed contact;
 2 pole auxiliary contact module, 10 A rated, with two normally closed contacts;
 4 pole auxiliary contact module, 10 A rated, with two normally open and two normally closed contacts;
 and 4 pole auxiliary contact module, 10 A rated, with four normally open contacts.

Emergency stop buttons

- **Manufacturer:** Contractor's choice.
- **Standard:** To BS EN 60947-5-5.
- **Format:** Red 40 mm mushroom head, with twist release.
- **Shroud:** Required.
- **Enclosure:**
 - **Material:** Polycarbonate.
 - **Ingress protection (minimum):** To BS EN 60529, IP 41 and To BS EN 60529, IP 65.
- **Execution:** Installing emergency stop buttons.

Electrical shock treatment signs

Shared by: 70-70-25/110 Earthing and bonding system; 70-70-45/110 Low voltage distribution system; 70-70-75/110 Hard wired low voltage small power system; and 70-80-35/110 Hard wired general lighting system.

- **Manufacturer:** Contractor's choice.
- **Format:** Plastics encapsulated.

Equipment labels and warning notices

Shared by: 70-70-25/110 Earthing and bonding system; 70-70-45/110 Low voltage distribution system; 70-70-75/110 Hard wired low voltage small power system; and 70-80-35/110 Hard wired general lighting system.

- **Manufacturer:** Contractor's choice.
- **Material:** Face engraved rigid plastic laminate.
- **Label size:** Submit proposals.
- **Colour:**
 - **Background:** Manufacturer's standard.
 - **Lettering:** Manufacturer's standard.
- **Typography:**
 - **Font:** Manufacturer's standard.
 - **Size:** Manufacturer's standard.
- **System notice wording:** Manufacturer's standard.

Electrical diagrams generally

Shared by: 70-70-25/110 Earthing and bonding system; 70-70-45/110 Low voltage distribution system; 70-70-75/110 Hard wired low voltage small power system; and 70-80-35/110 Hard wired general lighting system.

- **Material:** Engraved plastics laminate and 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.

Execution

Small power installation

- **Standard:** In accordance with BS 7671.

Installing cabling to socket outlets

- **General:** Wire socket outlets in ring final circuits without spurs where hard wiring is employed and Wire socket outlets in radial circuits where prefabricated cable is employed.

Installing final connections to fixed equipment

- **Alarm panels:** Light duty PVC insulated and sheathed flexible cords (LD PVC/ PVC cord, H03VV-F) in steel conduit recessed between connection unit and alarm panel.
- **Automatic doors:** Light duty PVC insulated and sheathed flexible cords (LD PVC/ PVC cord, H03VV-F) in black flexible conduit between connection unit and door motor.
- **Catering equipment:**
 - **Heavy duty:** Heavy duty, heat resisting EPR insulated and sheathed flexible cords (HD HR rubber cord, H07BB-F) with industrial plug.
 - **Light duty:** Ordinary duty PVC insulated and sheathed flexible cords (PVC/ PVC cord, H05VV-F).
- **Mechanical services equipment:**
 - **Heating plant:**
 - Boilers:** Fire resistant, insulated and sheathed cables.
 - Central heating pumps:** Light duty mineral insulated with outer sheath (LD MICS/ LSZH); Ordinary duty 90° C PVC insulated and sheathed flexible cords (HR PVC/ PVC cord, H05V2V2-F); and Thermosetting insulated and sheathed single core cables (LSZH/ LSZH singles) in flexible conduit.
 - DHW pumps:** Ordinary duty 90° C PVC insulated and sheathed flexible cords (HR PVC/ PVC cord, H05V2V2-F) and Thermosetting insulated and sheathed single core cables (LSZH/ LSZH singles) in flexible conduit.
 - **Cooling plant:**

Chillers: Thermosetting insulated and sheathed single core cables (LSZH/ LSZH singles) in flexible conduit.

Chilled water pumps: Ordinary duty 90° C PVC insulated and sheathed flexible cords (HR PVC/ PVC cord, H05V2V2-F) and Thermosetting insulated and sheathed single core cables (LSZH/ LSZH singles) in flexible conduit.

– **Air conditioning and ventilation plant:**

Supply fans: Light duty mineral insulated with outer sheath (LD MICS/ LSZH) and Thermosetting insulated and sheathed single core cables (LSZH/ LSZH singles) in flexible conduit.

Extract fans: Light duty mineral insulated with outer sheath (LD MICS/ LSZH) and Thermosetting insulated and sheathed single core cables (LSZH/ LSZH singles) in flexible conduit.

– **Controls generally:**

Internal thermostats: Balanced twisted-pair cables.

External thermostats: Balanced twisted-pair cables.

Actuators: Single core type CK flexible heat resisting cables (single core tri-rated) in flexible conduit. Thermosetting insulated and sheathed single core cables (LSZH/ LSZH singles) in flexible conduit.

Motorized valves: Single core type CK flexible heat resisting cables (single core tri-rated) in flexible conduit and Thermosetting insulated and sheathed single core cables (LSZH/ LSZH singles) in flexible conduit.

Flow sensors: Balanced twisted-pair cables;
Single core type CK flexible heat resisting cables (single core tri-rated) in flexible conduit;
and Thermosetting insulated and sheathed single core cables (LSZH/ LSZH singles) in flexible conduit.

- **Passenger and goods lifts:** Fire resistant, insulated and sheathed armoured cables.

- **Window controls:**

- **Motorized windows:** Ordinary duty PVC insulated and sheathed flexible cords (PVC/ PVC cord, H05VV-F) in steel conduit recessed between connection unit and window motors.

- **Motorized blinds:** Ordinary duty PVC insulated and sheathed flexible cords (PVC/ PVC cord, H05VV-F) in steel conduit recessed between connection unit and window motors.

- **Length of final connection:** Sufficient to allow for equipment cleaning, maintenance and removal.

Partial installation

- **Equipment to be installed only:**
- **Equipment requiring power supplies and final connection only:**
- **Containment:**
 - **Provide for the following systems:**
 - **Draw cords:** Required.

Installing fire barrier units

- **Generally:** In accordance with BS 7671.

- **Position:** At all fire walls.

Installing cable tray and cable ladder

Shared by: [90-55-10/330 Cable ladders](#); and [90-55-10/335 Cable trays](#).

- **Standards:** To BS 7671 and in accordance with IET guidance note 1.
- **Preparation:**
 - **Burrs and sharp edges:** Make smooth.
 - **Cutting:** Minimize and make good edges. Cuts to cable tray to be square along an unperforated line.
 - **Treatment of cut surface:** Extend 25 mm beyond the cut. Match finish of cable supports.
- **Access:** Provide space around cable ladder and tray 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 ladder and tray:** Maximize.
 - **Ends:** Blank with end plates.
- **Changes of size and direction:** Manufacturer's accessories of the same material type, pattern, finish and thickness as cable supports.
- **Fire barriers:** Provide where required to maintain fire performance of fabric.
- **Protective covers:** Provide to cables requiring mechanical protection.
- **Support:**
 - **Fixing arrangement:** Independently fix and support from building structure using threaded rod fixed to channel cable support with shake proof washers and hex nuts;
Independently fix and support from building structure using threaded rod fixed into expanding anchors;
and Independently fix and support from building structure using threaded rod fixed into resin injection anchors.
 - **Clearance from building fabric (minimum):** 20 mm.
- **Components:** Avoid contact between dissimilar metals.
- **Routing of cable ladder and tray:** Submit working drawings showing the final routes.

Installing cable basket

- **Standards:** To BS 7671 and in accordance with IEE Guidance Note 1.
- **Joints:**
 - **Cut:** Adjacent cross basket wires. Make smooth any burrs or edges.
 - **Earth conductors:** Connect across joints.
- **Accessories:** Form on site and connect with basket manufacturer's coupling components.
- **Fire barriers:** Provide where required to maintain fire performance of fabric.
- **Support:**
 - **Fixing arrangement:** Independently fix and support from building structure using threaded rod fixed to channel cable support with shake proof washers and hex nuts;

Independently fix and support from building structure using threaded rod fixed into expanding anchors;
and Independently fix and support from building structure using threaded rod fixed into resin injection anchors.

- **Clearance from building fabric (minimum):** 20 mm.
- **Components:** Avoid contact between dissimilar metals.
- **Routing of cable basket:** Submit working drawings showing the final routes.

Installing cable supports on roofs

Shared by: [90-55-10/330 Cable ladders](#); and [90-55-10/335 Cable trays](#).

- **Position:** Elevate above roof.
- **Mounting:** Load spreading supports.

Multiple cable runs

Shared by: [90-55-10/325 Cable baskets](#); [90-55-10/330 Cable ladders](#); and [90-55-10/335 Cable trays](#).

- **Requirement:**

Cable support zones

Shared by: [90-55-10/325 Cable baskets](#); [90-55-10/330 Cable ladders](#); and [90-55-10/335 Cable trays](#).

- **Ceiling voids:**
 - **Clear distance between underside of cable supports and brackets and topside of ceiling (minimum):** Contractor's choice.

Installing conduit, trunking and ducting

Shared by: [90-55-10/460 Conduit fittings](#); [90-55-10/715 Installing pliable and flexible conduit](#); [90-55-10/720 Installing rigid metallic conduit](#); [90-55-10/725 Installing rigid non metallic conduit](#); [90-55-10/735 Installing conduit connections to equipment](#); and [90-55-10/765 Conduit, trunking and ducting zones](#).

- **Standards:** In accordance with BS 7671 and IET Guidance Note 1.
- **Preparation:** Cut square. Remove burrs and sharp edges to make smooth.
- **Protection of metallic conduit, trunking and ducting:**
 - **Joints and ends:** Remove grease, oil, dirt and rust before applying protective paint. Paint immediately following installation.
 - **Protective paint:**

Generally: Compatible with conduit, trunking and ducting finish.

Type: Match factory finish.
- **Cross-sectional area:** Maintain throughout the conduit, trunking and ducting length.
- **Arrangement:** Position vertically and horizontally in line with equipment served, and parallel with building lines.
- **Spare containment:** Install one spare 25 mm diameter conduit from each distribution board to the nearest accessible void space, terminating in a conduit box with lid.
- **Draw wires:** Install galvanized soft iron wires within spare conduit, trunking and ducting.

- **Distance from other services running parallel (minimum):**
 - **Generally:** 150 mm.
 - **Above radiators:** 1000 mm.
 - **Steam services:** 600 mm.
- **Drainage of conduit, trunking and ducting:** Locate drainage outlets at lowest points in conduit, trunking and ducting installed externally, and where condensation may occur.
- **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, trunking and ducting from building structure.
- **Cleaning:** Clean insides of conduit, trunking and ducting before installing cables.
- **Cabling:** Install when conduit, trunking and ducting enclosure is complete.
- **Submittals:** Submit manufacturer's technical information. Submit drawings showing the proposed routes of conduit, trunking and ducting and the location of service outlets.

Installing conduit generally

Shared by: [90-55-10/715 Installing pliable and flexible conduit](#); [90-55-10/720 Installing rigid metallic conduit](#); [90-55-10/725 Installing rigid non metallic conduit](#); and [90-55-10/735 Installing conduit connections to equipment](#).

- **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:**
 - **Generally:** 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:**
 - **Generally:** Install flush with finished surfaces. Provide extension rings if required.
 - **Fixing screws:** Countersunk, or round-headed screws.
 - **Number of fixings (minimum):** Two.
 - **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):** Two.
 - **Floors:** Do not install draw-in boxes in floors.

- **Conduit in walls:** Avoid concealed horizontal runs.
- **Suspended ceiling installations:** Fasten outlet boxes to structure above ceiling.

Installing pliable and flexible conduit

- **General requirements:** Installing conduit generally and Installing conduit, trunking and ducting.
- **Fixings:** Distance saddle;
Saddle;
Spacer bar saddle;
and Steel p-clip with PVC insert.
- **Joints:** Push fit and Threaded.
- **Connections to trunking:** Female adaptors and externally screwed brass bushes.
- **Connections to equipment:** Flange mount and Threaded bush.

Installing rigid metallic conduit

- **General requirements:** Installing conduit generally and Installing conduit, trunking and ducting.
- **Fixings:** Distance saddle;
Saddle;
and Spacer bar saddle.
- **Joints:** Plain and 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.

Installing rigid non metallic conduit

- **General requirements:** Installing conduit generally and Installing conduit, trunking and ducting.
- **Fixings:** Distance saddle;
Saddle;
and Spacer bar saddle.
- **Joints:** Compression and Threaded.
- **Conduit connections to boxes and items of equipment:** Threaded bushed entries.

Installing conduit connections to equipment

Shared by: 90-55-10/360 Flexible conduit; and 90-55-10/380 Rigid conduit.

- **General requirements:** Installing conduit generally and Installing conduit, trunking and ducting.
- **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 of adequate length to facilitate removal of equipment for maintenance. Final termination in swivel connectors.

- **Connections to external equipment:** Flexible conduit.

Installing trunking generally

- **Supports and mounting arrangement:** Wall mounted;
Ceiling mounted;
Floor mounted;
Purpose made brackets;
and Suspension rods and steel channels.
- **Changes of direction:** Manufacturer's bends and tees.
- **Joints:**
 - **Generally:** 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.
- **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.

Conduit, trunking and ducting zones

Shared by: [90-55-10/360 Flexible conduit](#); [90-55-10/380 Rigid conduit](#); and [90-55-10/410 Cable trunking and cable ducting systems](#).

- **General requirements:** [Installing conduit, trunking and ducting](#).
- **Ceiling voids:** Provide clear distance of 150 mm (minimum) between underside of any conduit, trunking or trunking and the topside of ceiling.

Installing low voltage cables

Shared by: [90-55-15/342 Fire resistant, insulated and sheathed cables](#); [90-55-15/345 PVC insulated cables](#); [90-55-15/346 PVC insulated cables for interconnecting wiring](#); [90-55-15/349 Single-core heat resisting insulating cables](#); [90-55-15/351 Thermosetting insulated cables](#); [90-55-15/352 Thermosetting insulated and PVC sheathed cables \(XLPE/ PVC singles\)](#); [90-55-15/355 Thermosetting insulated metal screened LSZH sheathed multicore cables](#); [90-55-15/665 Installing flexible cords](#); [90-55-15/670 Installing prefabricated wiring](#); and [90-55-15/680 Installing low voltage armoured cables](#).

- **Standard:** In accordance with 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. Clear cable path of debris.
- **Installation temperature (minimum):** 5°C.
- **Cables:** Install in one length. Dress cables flat, free from twists, kinks and strain.
- **Cable pulling:** Do not overstress. Prevent kinks and twisting of the cable.
- **Cable protection:** Cables passing through walls and floors to be sleeved with conduit or pipeduct to a minimum of 300 mm. Bush at both ends. Ensure that appropriate fire stopping materials are used to maintain the original fire integrity of the wall or floor around the penetration.
- **Concealed cable runs to wall accessories:** Run vertically from the accessory.
- **Exposed cable runs:**
- **Distance from other services running parallel (minimum):** 150 mm. Position cables below heating pipes.
- **Jointing and termination:**
 - **Final circuit cables:** At electrical accessories only.
 - **Core connections:** Using compression lugs to equipment without integral clamping terminals.
 - **Terminating cables when not using glands:** Take sheathing of cables into accessory boxes and equipment and protect against abrasion with grommets.

Extra low and low voltage cable routes

Shared by: 90-55-15/342 Fire resistant, insulated and sheathed cables; 90-55-15/343 Fire resistant, insulated and sheathed armoured cables; 90-55-15/344 Mineral insulated cables type A and type B; 90-55-15/345 PVC insulated cables; 90-55-15/346 PVC insulated cables for interconnecting wiring; 90-55-15/351 Thermosetting insulated cables; 90-55-15/352 Thermosetting insulated and PVC sheathed cables (XLPE/ PVC singles); 90-55-15/353 Thermosetting insulated and PVC sheathed armoured cables; 90-55-15/354 Thermosetting insulated and LSZH sheathed armoured cables; 90-55-15/355 Thermosetting insulated metal screened LSZH sheathed multicore cables; 90-55-15/366 Balanced twisted-pair cables; 90-55-15/385 Prefabricated LSZH insulated singles in flexible conduit; and 90-55-15/386 Prefabricated LSZH insulated and sheathed multi-core.

- **Cables generally:**
 - **Concealed cable runs to wall accessories:** Run vertically from the accessory.
 - **Exposed cable runs:** Contractor's choice.
- **Distance from other services running parallel (minimum):** 150 mm. Position cables below heating pipes.

Low voltage cables concealed in walls and partitions

Shared by: 90-55-15/342 Fire resistant, insulated and sheathed cables; 90-55-15/343 Fire resistant, insulated and sheathed armoured cables; 90-55-15/344 Mineral insulated cables type A and type B; 90-55-15/345 PVC insulated cables; 90-55-15/346 PVC insulated cables for interconnecting wiring; 90-55-15/351 Thermosetting insulated cables; 90-55-15/352 Thermosetting insulated and PVC sheathed cables (XLPE/ PVC singles); 90-55-15/353 Thermosetting insulated metal screened LSZH sheathed multicore cables; 90-55-15/385 Prefabricated LSZH insulated singles in flexible conduit; and 90-55-15/386 Prefabricated LSZH insulated and sheathed multi-core.

- **Position:** In a zone within 150 mm of wall perimeter (except at the floor); and run vertically or horizontally from these zones, or from floor level, to switches,

accessories, etc and At least 50 mm from the surface. Ensure all routes are agreed with architect (working drawings) to ensure historic fabric is maintained.

- **Protection:** Rigid conduit and Cover with galvanized steel channel nailed to substrate.

Extra low and low voltage cables in accessible roof spaces

Shared by: 90-55-15/340 Flexible cords; 90-55-15/342 Fire resistant, insulated and sheathed cables; 90-55-15/343 Fire resistant, insulated and sheathed armoured cables; 90-55-15/344 Mineral insulated cables type A and type B; 90-55-15/345 PVC insulated cables; 90-55-15/346 PVC insulated cables for interconnecting wiring; 90-55-15/351 Thermosetting insulated cables; 90-55-15/352 Thermosetting insulated and PVC sheathed cables (XLPE/ PVC singles); 90-55-15/353 Thermosetting insulated and PVC sheathed armoured cables; 90-55-15/354 Thermosetting insulated and LSZH sheathed armoured cables; 90-55-15/355 Thermosetting insulated metal screened LSZH sheathed multicore cables; 90-55-15/366 Balanced twisted-pair cables; 90-55-15/385 Prefabricated LSZH insulated singles in flexible conduit; and 90-55-15/386 Prefabricated LSZH insulated and sheathed multi-core.

- **Cables running across ceiling joists:** Cable baskets;
Cable trays;
and Cable trunking and cable ducting systems.

Extra low and low voltage surface mounted cables

Shared by: 90-55-15/340 Flexible cords; 90-55-15/342 Fire resistant, insulated and sheathed cables; 90-55-15/343 Fire resistant, insulated and sheathed armoured cables; 90-55-15/344 Mineral insulated cables type A and type B; 90-55-15/345 PVC insulated cables; 90-55-15/346 PVC insulated cables for interconnecting wiring; 90-55-15/351 Thermosetting insulated cables; 90-55-15/352 Thermosetting insulated and PVC sheathed cables (XLPE/ PVC singles); 90-55-15/353 Thermosetting insulated and PVC sheathed armoured cables; 90-55-15/354 Thermosetting insulated and LSZH sheathed armoured cables; 90-55-15/355 Thermosetting insulated metal screened LSZH sheathed multicore cables; and 90-55-15/366 Balanced twisted-pair 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.

Installing low voltage cables in conduit and trunking

Shared by: 90-55-15/342 Fire resistant, insulated and sheathed cables; 90-55-15/343 Fire resistant, insulated and sheathed armoured cables; 90-55-15/344 Mineral insulated cables type A and type B; 90-55-15/345 PVC insulated cables; 90-55-15/346 PVC insulated cables for interconnecting wiring; 90-55-15/349 Single-core heat resisting insulating cables; 90-55-15/351 Thermosetting insulated cables; 90-55-15/352 Thermosetting insulated and PVC sheathed cables (XLPE/ PVC singles); 90-55-15/353 Thermosetting insulated and PVC sheathed armoured cables; 90-55-15/354 Thermosetting insulated and LSZH sheathed armoured cables; 90-55-15/355 Thermosetting insulated metal screened LSZH sheathed multicore cables; 90-55-15/366 Balanced twisted-pair cables; 90-55-15/385 Prefabricated LSZH insulated singles in flexible conduit; and 90-55-15/386 Prefabricated LSZH insulated and sheathed multi-core.

- **Cable installation:** Orderly and capable of being withdrawn.
- **Single core wiring:** Arrange using the loop-in method.

- **Cables within trunking:** Tie at 2 m intervals for cables of the same circuit reference. Label ties with circuit reference number at 10 m intervals.
- **Cables in vertical conduit:** Provide cable clamps in accessible conduit boxes at 5 m intervals.
- **Extra low voltage cables:** Install within a separate partition from low voltage cables where installed in multi compartment trunking.

Installing prefabricated wiring

Shared by: 90-55-15/385 Prefabricated LSZH insulated singles in flexible conduit; and 90-55-15/386 Prefabricated LSZH insulated and sheathed multi-core.

- **General requirements:** Installing low voltage cables.
- **Connection arrangement:** Form circuits using a male connector working away from any master distribution boxes.
- **Fixing distribution boxes:** Contractor's choice.
- **Fixing cabling:**
 - **Maximum distance between clips:**

Prefabricated LSZH insulated singles in flexible conduit: 1500 mm.
Prefabricated LSZH insulated and sheathed multi-core: 500 mm.
 - **Adjacent to connectors:** Clip within 100 mm.
 - **Bends:** Not permitted within 150 mm of connectors.

Installing low voltage armoured cables

Shared by: 90-55-15/343 Fire resistant, insulated and sheathed armoured cables; 90-55-15/353 Thermosetting insulated and PVC sheathed armoured cables; and 90-55-15/354 Thermosetting insulated and LSZH sheathed armoured cables.

- **General requirements:** Installing low voltage cables.
- **Earthing:** Bond armour to equipment and main earthing system.
- **Connections to apparatus:** Moisture proof, sealed glands and shrouds.

Jointing and terminating low voltage armoured cables

Shared by: 90-55-15/343 Fire resistant, insulated and sheathed armoured cables; 90-55-15/353 Thermosetting insulated and PVC sheathed armoured cables; and 90-55-15/354 Thermosetting insulated and LSZH sheathed armoured cables.

- **Preparation:**
 - **Cable ends:** Cut 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:** To BS EN 62444 and fitted with shroud.

- **Cold pour resin and heat shrink joints:** To BS EN 50393.
- **Insulating tape:** To BS EN 60454-1.
- **Plastics sheathed cables:** Seal with proprietary shrink-on end caps.
- **Bolted terminal connections to equipment and switchgear without integral cable clamping terminals:** Compression 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.

Excavations

Shared by: 90-55-15/343 Fire resistant, insulated and sheathed armoured cables; 90-55-15/353 Thermosetting insulated and PVC sheathed armoured cables; and 90-55-15/354 Thermosetting insulated and LSZH sheathed armoured cables.

- **Excavations next to existing underground services:** In accordance with HSG 47.
- **Existing underground services:** Expose and identify.

Cables in ducts

Shared by: 90-55-15/343 Fire resistant, insulated and sheathed armoured cables; 90-55-15/353 Thermosetting insulated and PVC sheathed armoured cables; and 90-55-15/354 Thermosetting insulated and LSZH sheathed armoured cables.

- **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.

Cables in trenches

Shared by: 90-55-15/343 Fire resistant, insulated and sheathed armoured cables; 90-55-15/353 Thermosetting insulated and PVC sheathed armoured cables; and 90-55-15/354 Thermosetting insulated and LSZH sheathed armoured cables.

- **Base:** All cables and ducts to be surrounded by 75 mm sand, free of any sharp stones or flints.
- **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:** Install within duct and derate cable if longer than 10 m. Extend ducts 1 m each side of hardstanding.
- **Cable identification and protection:** Underground plastics cable protection covers and Underground cable marker tape.

Installing underground cable marker tape

Shared by: 90-55-15/343 Fire resistant, insulated and sheathed armoured cables; 90-55-15/353 Thermosetting insulated and PVC sheathed armoured cables; and 90-55-15/354 Thermosetting insulated and LSZH sheathed armoured cables.

- **Installation:** In accordance with ENA 12-23.

Cable installation on channel cable supports, cable tray, cable ladder and cable basket

Shared by: 90-55-15/342 Fire resistant, insulated and sheathed cables; 90-55-15/343 Fire resistant, insulated and sheathed armoured cables; 90-55-15/344 Mineral insulated cables type A and type B; 90-55-15/345 PVC insulated cables; 90-55-15/346 PVC insulated cables for interconnecting wiring; 90-55-15/351 Thermosetting insulated cables; 90-55-15/353 Thermosetting insulated and PVC sheathed armoured cables; 90-55-15/354 Thermosetting insulated and LSZH sheathed armoured cables; and 90-55-15/355 Thermosetting insulated metal screened LSZH sheathed multicore cables.

- **Cabling:** Install when cable supports are complete.
- **Position:** Place single and multi-core cables side by side.
- **Fastening:**
 - **Fastenings generally:** Secure cables, do not indent sheaths. Position to enable any submain cable to be individually removed.
 - **Submain cables <95 mm²:** Cable cleats.
Spacing (maximum): 600 mm.
 - **Submain cables >95 mm²:** Cable cleats and Cable bands.
Spacing (maximum): 600 mm.
 - **Final circuit cabling:** Cable ties.
Spacing (maximum): 600 mm.
 - **Extra low voltage, communications and fibre optic cabling:** Cable ties.
Spacing (maximum): 600 mm.

Cables in vertical trunking and ducts

Shared by: 90-55-15/343 Fire resistant, insulated and sheathed armoured cables; 90-55-15/353 Thermosetting insulated and PVC sheathed armoured cables; and 90-55-15/354 Thermosetting insulated and LSZH sheathed armoured cables.

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

Installing electrical accessories

- **Standard:** Good practice
- **Accessory faceplates:** Free from any traces of plaster, grout, paint or similar.
- **Positioning:** Coordinate with other wall or ceiling mounted equipment.
- **Alignment:** Align adjacent accessories on the same vertical or horizontal axis.
- **Fixing:** Fix securely, plumb and level to vertical and horizontal axes.
- **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.

- **Telecommunications and data outlets:** 450 mm where not mounted on trunking system.
- **Separation distance between adjacent accessories (minimum):** 30 mm.

Grid switch plates

- **Spare modules:** Provide blank inserts.

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.

Installing suspended lampholders

- **Flex length:** 0.3 m.

Installation of surge suppression devices generally type A

- **Type:** A
- **Standards:** To BS 7671;
To DD CLC/TS 61643-12;
and To DD CLC/TS 61643-22.
- **Equipment:** Provide electrical supplies to equipment requiring power.
- **Fixings:** Non-corroding and compatible with the environment where they are installed.

Installing transient overvoltage surge suppression for plug in mains power supplies

- **General requirements:** Installation of surge suppression devices generally type A.
- **Point of installation:** As required.

Installing emergency stop buttons

- **Standards:** Submit proposals.

System completion

Inspection, testing and commissioning of harmonic filters

- **Standard:** To BS 7671.
- **Commissioning of filters:** By manufacturer.
- **Notice before testing and commissioning:** 7 d.
- **Filters, CTs, wiring, components, connections and equipment installation:** Inspect.
- **Operation of instruments and displays:**
 - **Check and confirm correct operation including:** Supply current (rms) L1, L2, L3 and neutral current.
Load current (rms) L1, L2, L3 and neutral current.

Supply THD % L1, L2, L3.

Load THD % L1, L2, L3.

Supply voltage.

Load on the filter expressed as a percentage for L1, L2, L3.

Detailed load current spectrum display including individual measurement of the fundamental, and each harmonic up to and including 25th expressed as a percentage, and the TDHI of the current absorbed by the load.

Detailed supply current spectrum display including individual measurement of the fundamental, and each harmonic up to and including 25th expressed as a percentage, and the TDHI of the current supplied by the Electricity Distributor.

Reactive compensation.

Selection of harmonic orders for mitigation.

Number of parallel connected filters.

Alarm functions.

Communication port function.

Identification function.

- **Controls:** Commission and adjust for optimum harmonic mitigation and reactive power compensation.
- **Inspection, testing and commissioning results:** Submit three copies.

Inspecting, testing and commissioning UPS equipment

- **Standards:** In accordance with BS 7671 and BS EN 62040-3.
- **Method statement:** Submit.
- **Phase rotation:** Verify.
- **Emergency and safety circuits:** Check.
- **Correct operation of alarms and controls:** Confirm.
- **Insulation resistance tests:** Test interconnecting cables and Test forced cooling fan motors.
- **Site tests:** In accordance with BS EN 62040-3.
- **Operational tests:** a.c. input failure test;
a.c. input return test;
Acoustic noise test;
Battery ripple current measurement;
Current division test;
Earth fault test;
Overload capability test;
Rated restored energy time;
Rated stored energy time test;
Restart test;
Short circuit test;
Short circuit protection device test;
Simulation of parallel redundant UPS fault test;
Synchronization test;
Transfer test;
UPS efficiency test;
UPS auxiliary devices test;
and Ventilation test.
- **Output tests:** Harmonic components measurement;
Frequency variation test;
Output over voltage test;
Output frequency slew rate test;

Periodic output voltage variation test;
and Radiofrequency interference and conducted noise test.

- **Load tests:** Light load test;
Unbalanced load test;
Balanced load test;
and Full load test.
- **Standby generator compatibility tests:** Required.

Documentation

- **Operating and maintenance instructions:**
 - **Scope:** Submit for the system giving optimum settings for controls.
 - **Product information:** Include product description, date of purchase, performance characteristics, application (suitability for use), method of operation and control, and cleaning and maintenance requirements.
 - **Format:** Paper copy.
 - **Number of copies:** Three.
- **Record drawings:**
 - **Content:** For all low voltage final circuits, the cable origin, circuit designation, route, loading, conductor material and c.s.a, insulation type and colour, number of cores per cable, number of cables in trunking and conduit; Whether cables are run on surface, concealed in walls, floors, above suspended ceilings or within roof spaces;
Location, route and depth of underground cables;
Location of LV switchgear including distribution boards;
Routes of trunking, conduit, cable tray and cable ladders;
and Location of all electrical outlets, including isolators, starters, control equipment and electrical accessories Schematic drawings showing all low voltage final circuits, the cable origin, circuit designation, cable type, size, number of cores, size and type of overcurrent protective device..
 - **Format:** A1 paper print drawing and Electronic drawing.
 - **Number of copies:** Three.
- **Submittal date:** At handover.

Spares

- **Plugs:** Supply two for each socket outlet type.
- **Fuse links:** Supply ten of each rating.

Maintenance

- **Servicing and maintenance:** Submit proposals.
- **Duration:** Until 12 months after Practical Completion.

Ω End of system

Hard wired general lighting system

System outline

Hard wired general lighting system

- **Description:** The Electrical Contractor shall supply and install a complete lighting installation, complete with manual and automatic controls as detailed in the following clauses, equipment schedule and on the associated drawings.

All services with the exception as listed below and as noted on the drawings shall be isolated, stripped out and made safe, prior to the demolition.

The redundant equipment shall be stripped out and safely removed and disposed, and/or handed back to the Client.

All services stripped out to the area demarcation line to be made safe at this point. The redundant services should not pose a health and safety risk. All cable containment and pipes shall be capped off at this point. The Contractor should ensure no sharp edges.

All circuits to be disconnected from the point of the origin and clearly labelled as redundant. Other areas are to be retained in use during the course of the works.

It is therefore imperative that these systems are maintained through out these works and any downtime is agreed with the Client.

The lighting installation shall be wired using LSOH insulated cables in stranded copper conductors contained within trunking throughout the back of house and non historic building fabric elements. Unsheathed MICC cabling shall be utilised where installed on historic building fabric.

Accessories for switches etc shall generally be grid switch type with cover plates as per the small power accessory finish.

The majority of the installation shall be fully exposed i.e. trunking, tray, conduit and basket. Care shall be taken with final circuitry. MICC surface mounted cabling shall be used for light switch cabling and wall mounted cabling. Final circuitry to luminaires on the ceiling shall use MICC cabling where containment is not provided. Chasing of historic building fabric is not permitted.

Within the Makers Room, Gallery spaces, and Retail Shop Area the luminaires, (detailed specification colour fixing suspensions etc.) are to be confirmed with the specialist prior to placement of orders. All final locations and setting out is to be confirmed with the museum specialist, and all controls commissioning elements are to be confirmed with the museum specialist. The specification and layout shown on the tender drawings are for costing purposes only prior to installation.

The Contractor shall allow for the supply installation, test and commission of the Ref J luminaires as shown on the electrical layouts. The Contractor shall also allow for the supply for an additional 62 luminaires. These shall be installed tested and

commissioned by the museum specialist. 110 Sylvania Beacon Muse luminaires in total.

General Lighting Installation

1. The Electrical Contractor shall supply, erect and connect all luminaires complete with all glassware, diffusers, gasket seals, etc. Luminaires shall be switched as detailed on the layout drawings and connected to final distribution board circuits detailed within the distribution board schedules.
2. All luminaires shall be installed in accordance with the individual lighting manufacturer's requirements.
3. Luminaire details are given in the Luminaire Schedule. Where the tenderer wishes to propose differing manufacturers or products this should be clearly stated within the tender return.
4. All lighting circuits shall be wired as radial circuits using a minimum of 2.5mm² stranded single LSOH or unsheathed MICC cable protected circuit breaker as indicated on the distribution board schedules.
5. Prior to commencing the first fix operations, the exact locations of all fittings and light switches shall be agreed with the Architect , and shown on Contractor's working drawings.
6. All luminaires shall be complete with high frequency control gear, and fused terminal blocks.
7. The Electrical Contractor shall supply and install all light switches and lighting control system as shown on the drawings. Generally switches shall be 20 Amp inductive rated grid switch type.
8. Luminaires within gallery spaces, retail areas and makers room are to be confirmed (prior to order) with the Museum Specialist. All locations connections and dimming settings shall be confirmed with the museum specialist also.

Where multi-gang switches are detailed with more than one phase present at the switch then suitable proprietary phase barriers and 'DANGER 400V' labels shall be fitted to maintain segregation.

Final position of switches to be agreed with the Architect and shown on Contractor's working drawings. Allow within the tender for relocating switches within 2m of the position shown. Switching shall generally be via local one way or two way switches or by local movement sensors.

9. Where installation is in or below suspended ceiling areas luminaires shall be independently fixed from the soffit using 8mm diameter galvanised drop rods, such that the weight of the luminaires is not borne by the suspended ceiling grid.
10. Where recessed downlighters are specified, these are to be supported by means of a plywood pattress fitted to the back of the ceiling tile. Additional supports shall be provided to ensure the luminaire is not supported by the ceiling grid. A suitable hole shall be provided through the tile and liner so that the fitting can be fixed using the standard manufacturers support clip.

11. Final connections to luminaires, shall be via plug in ceiling roses complete with flexible leads to luminaires no longer than one metre in length. Final connections to surface mounted luminaires within exposed soffit areas shall be hard wired. All flexible leads shall be discretely coloured to ensure the installation is aesthetically pleasing.

12. The Electrical Contractor shall ensure that no luminaires or switches, are damaged/spoiled by decoration, finishes or other trades. Any damage to the units shall be replaced at no cost to the employer such that the installation is new at the day of handover. The Electrical Contractor is thus advised not to install luminaires prior to decoration. The installation shall not be used for temporary/site lighting.

13. Care shall be taken to co-ordinate with the Main Contractor, all luminaires, sensors etc that are ceiling mounted, but require cutting of the ceiling tile. In all cases the Electrical Contractor shall provide a plywood support behind the ceiling tile. In the case of sensors this shall be independently supported. The plywood panels shall be the same shape as the associated items of equipment and shall be painted as agreed with the Architect where located above perforated ceilings.

14. Luminaire details given in the equipment schedule represent those that are of an acceptable quality in terms of their appearance, longevity, performance, and quality of construction.

15. The Electrical Contractor shall include for providing 1 No. sample of each of the luminaires specified, for consideration by the Engineer or the Architect. This procedure shall be completed early in the contract period to ensure delivery of all luminaires to suit the main contractor's programme.

16. The lighting layouts shown on the drawings have been co-ordinated with major items of mechanical equipment. It is anticipated that these positions will require further adjustment to ensure that the luminaires are ideally located during final co-ordination. For tendering purposes allow for relocating the luminaires within a 2m radius. Final locations shall be shown on the Contractor's working drawings

17. All presence detectors located within offices and general areas shall be mounted at the same height as the suspended light fitting(s) via a suitable proprietary fixing to give a 360o 6M diameter detection range.

18. All microwave detectors located within corridors shall be wall mounted at a height of 2.7m AFFL and suitably angled to cover the whole corridor via either a 15m or 30m detection range.

19. The positions of the presence/absence detectors are shown on the drawings for tendering purposes only. The Electrical Contractor shall allow for positioning the detectors for optimum performance.

20. Dimmable luminaires are required throughout except for the Gallery spaces. The Gallery space luminaires are complete with "onboard dimming" and shall be adjusted manually on site to meet minimum lux level requirements and uniformity

Emergency Lighting:

The Electrical Contractor shall supply, install and commission a complete system of

emergency lighting, to comply with the design requirements. The installation and associated equipment shall comply in full with the requirements of BS 5266, relevant clauses BS 7671:2008 and requirements of the local Authorities.

The system shall be fully addressable and shall incorporate an auto self-testing system.

The emergency escape lighting system shall consist of self-contained luminaires suitable for a 3 hour duration under electrical supply failure. The level of lighting provided will be approximately 1 lux average i.e. suitable for escape purposes. In publically accessed areas the emergency luminaires shall be the maintained variety. In staff back of house areas, non-maintained emergency luminaires shall be utilised.

The emergency lighting will operate virtually instantaneously on an electrical supply failure.

The emergency luminaires shall generally consist of a combination of integral emergency battery packs within standard luminaires and stand alone, self contained, bulkheads, minimum three hour duration type luminaires in the positions shown on the drawings.

In some instances remote battery packs will be provided by the manufacturers. In all cases remote battery packs shall be located a maximum of 2 metres away from the luminaire they are supplying and will be independently supported and not laid on ceiling tiles. Where battery packs are provided remote from the luminaire, the cable (and all glanding etc) shall be fire rated in accordance with BS5266 and be provided as a proprietary item intrinsic to the battery pack.

Legends shall be affixed where necessary to comply with the requirements of the relevant standards/regulations and these shall be of the 'green man' type in accordance with BS 5499. Visible LEDs are to be provided in all cases to identify that the battery/inverter is working correctly. LEDs are to be contained within the luminaire or mounted remotely in a suitable surface or flush mounting housing.

At a date to be agreed, the Electrical Contractor shall carry out a full test on the emergency lighting installation in the presence of the Client and the Engineer. This will be carried out in the hours of darkness, when the Electrical Contractor shall provide a calibrated meter to check the emergency lighting installation throughout the building. All other manufacturer's recommendations regarding cable lengths, sizes, types, mounting locations etc., shall be strictly adhered to.

The Electrical Contractor shall provide each emergency luminaire with individual labels complete with number (e.g. XX/G/E001, where XX is the room number, /G is the floor level and E001 is the emergency luminaire number), in order that it can be cross referenced with the emergency lighting test log book/records.

The Electrical Contractor shall note that once the emergency luminaires have been connected to the mains supply, the lighting circuits shall not be continually isolated by means of switching off the main MCB's, isolators, site supply etc. This is to prevent the charging and discharging of the batteries.

- **System Performance:** General lighting:

To provide a complete internal artificial lighting system, throughout the building, that will meet the design criteria and reflect the architectural and aesthetic requirements

of each area and location respectively.

To ensure the internal lighting system solution and installation provides a good safe, comfortable, balanced and interesting visual environment. To consider the vertical illuminance of surfaces within an environment, in conjunction with, the recommended horizontal working plane illuminance.

In accordance with Wiring Regulations BS 7671:2008 incorporating latest amendments

The base building lighting installation shall provide illumination levels as outlined in in accordance with BS EN 12464-1, CIBSE Guides LG7, CIBSE LG3, CIBSE LG8, CIBSE LG5-1991 and the interior code for Lighting 2006.

The system shall be installed in accordance with all relevant Standards, Regulations and best practice. The complete installation is to be carried out in accordance with the latest edition and amendments of the documents specified below, which is not exhaustive:-

Emergency Lighting:

To provide emergency lighting illumination to allow safe egress of occupants during failure of the general lighting installation.

The emergency lighting system shall indicate clearly all escape routes; internally and externally as required, provide illuminance along such routes so as to allow safe movement towards all exits. Ensure that fire call points and fire fighting equipment can be easily located when the normal lighting fails and external routes are illuminated.

The system shall provide an automatic addressable emergency lighting system that carries out tests to minimise inconvenience.

BS 5266: part 1 2016 emergency lighting.

BS EN 1838:2013 Lighting applications. Emergency lighting

CIBSE: Technical memorandum TM12 Emergency Lighting 2004

Regulatory Reform (Fire Safety) order 2005.

ICEL 1003: 1982 Emergency Lighting Applications Guide.

BS 5499: Part 1 Specification for fire safety signs .

The requirements of the local fire officer.

Escape route lighting;

Open area (anti-panic) lighting;

High risk task area lighting;

Lighting performance;

Luminaire and lamp maintenance properties;

Lighting cables generally;

and Conduit, trunking and ducting generally.

- **Final circuit cabling:**

- **Type:** Fire resistant, insulated and sheathed cables;

- Thermosetting insulated cables;

- MICC Cabling

- and Thermosetting insulated and LSZH sheathed armoured cables.

- **Containment:** Cable baskets;
Rigid conduit;
and Cable trunking and cable ducting systems.
- **Containment accessories:** Conduit fittings.
- **Rewireable installation:** Required.
- **Concealed installation:** Where appropriate
- **Luminaire types:** Combined emergency luminaires;
General purpose luminaires;
and Self contained emergency luminaires.
- **Connections to luminaires:** Ceiling roses;
Luminaire supporting couplers;
Safety pendant lampholders;
Safety pendant sets;
Bayonet lampholders;
Edison screw lampholders;
and Lighting distribution boxes.
- **Lighting controls:** Light switches;
Dimmer switches and controls;

Central controllers;
Combined daylight and occupancy detectors;
Daylight sensors;
Mains voltage occupancy detectors;
Photoelectric control units;
Remote infrared controllers;
and Time switches.
- **Accessories:** Externally illuminated emergency exit signs;
Lighting tracks;
- **Electrical identification:** Electrical shock treatment signs;
Equipment labels and warning notices;
and Electrical diagrams generally.
- **Execution:** Installing general lighting systems;
Installing emergency lighting systems;
Installing d.c. central battery and static inverter power supply units;
Installing electrical low mounted way-guidance lighting systems;
Installing photoluminescent low mounted way-guidance lighting systems;
Installing optical fibre emergency lighting;
Assembling ceiling roses, flex and lampholders;
Installing emergency exit signs;
and Labelling of lighting controls.
- **System Completion:** Testing and commissioning of general lighting systems;
Testing and commissioning emergency lighting systems;
Photometric survey of general lighting systems;
Photometric survey of emergency lighting systems;
Documentation relating to general lighting;
Documentation relating to emergency lighting;
Spares;
and Maintenance.

System performance

Escape route lighting

- **Position:** As emergency lighting drawing.

Open area (anti-panic) lighting

- **Position:** As emergency lighting drawing.

High risk task area lighting

- **Position:** As emergency lighting drawing.

Lighting cables generally

- **Standard:** To BS 7671.
- **Proposed selection of low voltage cables:** Submit drawings, technical information, calculations and manufacturer's literature.
- **Conductor sizes (minimum):**
 - **Lighting circuits:** Refer to Distribution board schedules
 - **Final connection:** Refer to Distribution board schedules
- **Cable sizes not stated:** Submit.

Conduit, trunking and ducting generally

- **Standard:** In accordance with BS 7671.
- **Requirement:** Submit proposals, including detailed design drawings, technical information, calculations and manufacturers' literature.
- **Conduit, trunking and ducting sizes not stated:** Submit.

Products

Lighting distribution boxes

- **Manufacturer:** CP Electronics
- **Standards:** To BS 5733.
- **Distribution box:** Galvanized sheet steel with recessed input and outgoing connections.
- **Rating:** 16 A.
- **Connectors:**
 - **Power input connection:** Starter cable and Extender lead from master distribution box.
 - **Power output connector type:** Fully shrouded female connector.
- **Outgoing connections:**
 - **Quantity:** 8.
 - **Poles:** 4.

Cable cleats

Shared by: 70-70-45/110 Low voltage distribution system; 70-70-75/110 Hard wired low voltage small power system; and 90-55-15/735 Cable installation on channel cable supports, cable tray, cable ladder and cable basket.

- **Manufacturer:** Contractor's choice.
- **Standard:** To BS EN 61914.
- **Format:** Contractor's choice.
- **Material:** Metallic.
- **Temperatures for permanent installation:**
 - **Maximum:** 105°C.
 - **Minimum:** -25°C.
- **Resistance to impact:** Heavy.
- **Type of retention or resistance to electromechanical forces:** Resistant to electromechanical forces, withstanding one short circuit.
- **Environmental influences:**
 - **Non-metallic and composite components:** Resistant to ultraviolet light.
 - **Metallic and composite components:** High resistance to corrosion.

Cable ties

Shared by: 70-70-45/110 Low voltage distribution system; 70-70-75/110 Hard wired low voltage small power system; and 90-55-15/735 Cable installation on channel cable supports, cable tray, cable ladder and cable basket.

- **Manufacturer:** Contractor's choice.
- **Standard:** To BS EN 62275.
- **Format:** Wrap around self-locking releasable.
- **Material:** Nylon and Metal.
- **Loop tensile strength (minimum):** Manufacturer's standard.
- **Temperatures for permanent installation:**
 - **Maximum:** 60°C.
 - **Minimum:** -15°C.
- **Contribution to fire:** Non-flame propagating.
- **Environmental influences:**
 - **Non-metallic and composite components:** Resistant to ultraviolet light.
 - **Metallic and composite components:** Resistant to corrosion.

Cable bands

Shared by: 70-70-45/110 Low voltage distribution system; and 90-55-15/735 Cable installation on channel cable supports, cable tray, cable ladder and cable basket.

- **Manufacturer:** Contractor's choice.
- **Material:** Manufacturer's standard.
- **Protective covering:** Manufacturer's standard.

Cable baskets

Shared by: 70-70-45/110 Low voltage distribution system; 70-70-75/110 Hard wired low voltage small power system; 70-80-35/110 Hard wired general lighting system; 75-45-20/110 Data distribution system; 75-60-10/110 CCTV system; 75-60-40/110 Intruder detection and alarm system; 75-65-30/110 Fire detection and alarm system; and 90-55-15/650 Extra low and low voltage cables in accessible roof spaces.

- **Manufacturer:** Contractor's choice.
- **Material:**
- **Coating material:** Hot dip galvanised, powder coated RAL colour to architectural specification
- **Features:**
 - **Segregation:** Cable dividers.
 - **Protective cover:** Required.
- **Execution:** Installing cable basket; Multiple cable runs; and Cable support zones.
- **Standard:** To BS EN 61537.

Cable trays

Shared by: 70-70-45/110 Low voltage distribution system; 70-70-75/110 Hard wired low voltage small power system; 75-60-10/110 CCTV system; and 90-55-15/650 Extra low and low voltage cables in accessible roof spaces.

- **Manufacturer:** Contractor's choice.
- **Standard:** To BS EN 61537.
- **Material:** Steel.
- **Resistance against flame propagation:** Non-Flame propagating.
- **Electrical properties:**
 - **Continuity characteristics:** Without electrical continuity.
 - **Conductivity characteristics:** Without electrical conductive system component.
- **Coating material:** Hot dip galvanised, powder coated RAL colour to architectural specification
- **Temperature properties for transport, storage, installation and application:**
 - **Minimum:** Manufacturer's standard.
 - **Maximum:** Manufacturer's standard.
- **Mechanical properties:**
 - **Cable tray free base area:** Manufacturer's standard.
 - **Resistance to impact:** Manufacturer's standard.
- **Features:**
 - **Flange type:** Return.
 - **Segregation:** Cable dividers.
 - **Protective cover:** Required.
- **Execution:** Installing cable tray and cable ladder; Installing cable supports on roofs;

Multiple cable runs;
and Cable support zones.

Rigid conduit

Shared by: 70-70-25/660 Installing main earthing conductor; 70-70-45/110 Low voltage distribution system; 70-70-75/110 Hard wired low voltage small power system; 70-80-35/110 Hard wired general lighting system; 75-45-40/110 Audio-frequency-induction-loop system; 75-60-05/110 Access control system; 75-60-40/110 Intruder detection and alarm system; 75-65-30/110 Fire detection and alarm system; 75-70-05/110 Assistance call system; and 90-55-15/645 Low voltage cables concealed in walls and partitions.

- **Manufacturer:** Contractor's choice.
- **Standards:** To BS EN 61386-21.
- **Mechanical properties:**
 - **Resistance to compression:** Heavy.
 - **Resistance to impact:** Heavy.
- **Transport, installation and application:**
 - **Lower temperature (minimum):** Manufacturer's standard.
 - **Upper temperature (maximum):** Manufacturer's standard.
- **Resistance to bending:** Rigid.
- **Electrical characteristics:** With electrical continuity properties.
- **Resistance to external influences:**
 - **Protection against ingress of solid objects (minimum):** To BS EN 60529, IP3X.
 - **Protection against ingress of water (minimum):** To BS EN 60529, IPX0.
- **Resistance to corrosion:** To BS EN 61386-1, Class 4.
- **Tensile strength:** Heavy.
- **Resistance to flame propagation:** Manufacturer's standard.
- **Suspended load capacity:** Heavy.
- **Colour:** Submit proposals.
- **Sizes (OD):** 25 mm.
- **Execution:** Installing rigid metallic conduit;
Installing rigid non metallic conduit;
Installing conduit connections to equipment;
and Conduit, trunking and ducting zones.

Cable trunking and cable ducting systems

Shared by: 70-70-45/110 Low voltage distribution system; 70-70-75/110 Hard wired low voltage small power system; 70-80-35/110 Hard wired general lighting system; 75-60-05/110 Access control system; 75-60-40/110 Intruder detection and alarm system; 75-65-30/110 Fire detection and alarm system; 75-70-05/110 Assistance call system; 75-70-05/120 Emergency voice communication system; and 90-55-15/650 Extra low and low voltage cables in accessible roof spaces.

- **Manufacturer:** Contractor's choice.
- **Standards:** To BS EN 50085-1 and BS EN 50085-2-1.
- **Material:** Metallic;
Non-metallic;
and Steel.

- **Construction:** To include means of preventing contact between liquids and insulated conductors and live parts.
- **Temperature properties:**
 - **Storage and transport temperature (maximum):** Manufacturer's standard.
 - **Installation and application temperature (minimum):** Manufacturer's standard.
 - **Application temperature (maximum):** Manufacturer's standard.
- **Resistance to flame propagation:** Required.
- **Electrical properties:** With electrical continuity characteristics.
- **Ingress protection (minimum):** To BS EN 60529, IP x4.
- **Protection against corrosive and polluting substances:** High protection outside and inside.
- **Access method:** With tools.
- **Screening:** Required.
- **Execution:** Conduit, trunking and ducting zones and Installing trunking generally.

Conduit fittings

Shared by: 70-70-45/110 Low voltage distribution system; 70-70-75/110 Hard wired low voltage small power system; 70-80-35/110 Hard wired general lighting system; and 75-45-20/110 Data distribution system.

- **Manufacturer:** Match conduit.
- **Standards:** To BS EN 61386-1 and to BS EN 61386-21, BS EN 61386-22, or BS EN 61386-23 as appropriate; or to BS 4607-1.
- **Material:**
 - **Type:** Steel and PVC-U.
 - **Finish:** Match conduit.
- **Conduit boxes:** Fit covers of same material and finish as boxes. Include brass earthing terminals in PVC-U boxes.
- **Plugs:**
 - **For metallic boxes:** Manufacturer's standard.
 - **For non metallic boxes:** Manufacturer's standard.
- **Locknuts.:**
 - **For metallic boxes:** Manufacturer's standard.
 - **For non metallic boxes:** Manufacturer's standard.
- **Execution:** Installing conduit, trunking and ducting.

Flexible cords

Shared by: 70-80-35/690 Assembling ceiling roses, flex and lampholders; and 90-60-50/630 Luminaire cable connections.

- **Manufacturer:** Contractor's choice.
- **Standard:** To BS 6500.
- **Third party certification:** British Approvals Service for Cables (BASEC) certified.
- **Light duty PVC insulated and sheathed flexible cords (LD PVC/ PVC cord, H03VV-F):**
 - **Construction:** To table 26.

- **Sheath colour:** Manufacturer's standard.
 - **Size:** Refer to Distribution board schedules
- **Ordinary duty PVC insulated and sheathed flexible cords (PVC/ PVC cord, H05VV-F):**
 - **Construction:** To table 27.
 - **Sheath colour:** Manufacturer's standard.
 - **Size:** Refer to Distribution board schedules
- **Ordinary duty 90° C PVC insulated and sheathed flexible cords (HR PVC/ PVC cord, H05V2V2-F):**
 - **Construction:** To table 29.
 - **Sheath colour:** Manufacturer's standard.
 - **Size:** Refer to Distribution board schedules
- **Execution:** Extra low and low voltage cables in accessible roof spaces;
Extra low and low voltage surface mounted cables;
and Installing flexible cords.

Fire resistant, insulated and sheathed cables

Shared by: 70-70-45/110 Low voltage distribution system; 70-70-75/110 Hard wired low voltage small power system; 70-80-35/110 Hard wired general lighting system; and 75-65-30/110 Fire detection and alarm system.

- **Manufacturer:** Batt cables or equal and approved
- **Standard:** To BS 7629-1.
- **Third party certification:** British Approvals Service for Cables (BASEC) certified and LPCB.
- **Size:** Refer to cable schedule
- **Screen:** Copper tape.
- **Execution:** Installing low voltage cables;
Extra low and low voltage cable routes;
Low voltage cables concealed in walls and partitions;
Extra low and low voltage cables in accessible roof spaces;
Extra low and low voltage surface mounted cables;
Installing low voltage cables in conduit and trunking;
and Cable installation on channel cable supports, cable tray, cable ladder and cable basket.

PVC insulated cables

Shared by: 70-70-25/110 Earthing and bonding system; 70-70-45/110 Low voltage distribution system; 75-45-40/110 Audio-frequency-induction-loop system; 90-65-05/630 Installing combined daylight and occupancy sensors; 90-65-05/640 Installing daylight sensors; 90-65-05/660 Installing mains voltage occupancy detectors; and 90-65-05/670 Installing photoelectric control units.

- **Manufacturer:** Contractor's choice.
- **Standard:** To BS 6004.
- **Third party certification:** British Approvals Service for Cables (BASEC) certified.
- **Rigid PVC insulated cables (PVC singles, H07V):**
 - **Construction:** To table 4a.
 - **Size:** Refer to cable schedule

- **PVC insulated and PVC sheathed cables (PVC/ PVC):**
 - **Construction:** To table 7.
 - **Sheath colour:** Manufacturer's standard.
 - **Size:** Refer to cable schedule
- **PVC insulated, PVC sheathed cables with circuit protective conductor (PVC/ PVC with CPC):**
 - **Construction:** To table 8.
 - **Size:** Refer to cable schedule
- **Heat resisting PVC insulated cables (HR PVC singles, H07V-K):**
 - **Construction:** To table 11a.
 - **Size:** Refer to cable schedule
- **Execution:** Installing low voltage cables;
Extra low and low voltage cable routes;
Low voltage cables concealed in walls and partitions;
Extra low and low voltage cables in accessible roof spaces;
Extra low and low voltage surface mounted cables;
Installing low voltage cables in conduit and trunking;
and Cable installation on channel cable supports, cable tray, cable ladder and cable basket.

Single-core heat resisting insulating cables

- **Manufacturer:** Contractor's choice.
- **Standard:** To BS 6007.
- **Third party certification:** British Approvals Service for Cables (BASEC) certified.
- **Heat resisting rubber insulated cable (HR rubber singles, H07G-U):**
 - **Construction:** To table 3.
 - **Size:** Refer to Distribution board schedules
- **Execution:** Installing low voltage cables and Installing low voltage cables in conduit and trunking.

Thermosetting insulated cables

Shared by: 70-70-45/110 Low voltage distribution system; 70-70-75/110 Hard wired low voltage small power system; and 70-80-35/110 Hard wired general lighting system.

- **Manufacturer:** Contractor's choice.
- **Standard:** To BS 7211.
- **Third party certification:** British Approvals Service for Cables (BASEC) certified.
- **Rigid thermosetting insulated single core cables (LSZH singles, H07Z):**
 - **Construction:** To table 3a.
 - **Size:** Refer to cable schedule
- **Thermosetting insulated and sheathed single core cables (LSZH/ LSZH singles):**
 - **Construction:** To table 5.
 - **Size:** Refer to cable schedule
- **Thermosetting insulated and sheathed cables with circuit protective conductor (LSZH/ LSZH with CPC):**
 - **Construction:** To table 7.

- **Size:** Refer to cable schedule
- **Execution:** Installing low voltage cables;
Extra low and low voltage cable routes;
Low voltage cables concealed in walls and partitions;
Extra low and low voltage cables in accessible roof spaces;
Extra low and low voltage surface mounted cables;
Installing low voltage cables in conduit and trunking;
and Cable installation on channel cable supports, cable tray, cable ladder and cable basket.

Thermosetting insulated and PVC sheathed cables (XLPE/ PVC singles)

Shared by: 70-70-45/110 Low voltage distribution system; and 90-65-05/670 Installing photoelectric control units.

- **Manufacturer:** Contractor's choice.
- **Standard:** To BS 7889.
- **Third party certification:** British Approvals Service for Cables (BASEC) certified.
- **Conductors:** Copper.
- **Size:** Refer to cable schedule
- **Execution:** Installing low voltage cables;
Extra low and low voltage cable routes;
Low voltage cables concealed in walls and partitions;
Extra low and low voltage cables in accessible roof spaces;
Extra low and low voltage surface mounted cables;
and Installing low voltage cables in conduit and trunking.

Thermosetting insulated and LSZH sheathed armoured cables

Shared by: 70-70-45/110 Low voltage distribution system; 70-70-75/110 Hard wired low voltage small power system; and 70-80-35/110 Hard wired general lighting system.

- **Manufacturer:** Contractor's choice.
- **Standard:** To BS 6724.
- **Third party certification:** British Approvals Service for Cables (BASEC) certified.
- **Cable type:** Multi-core XLPE/ SWA/ LSZH and Single-core XLPE/ AWA/ LSZH.
- **Insulation:** Cross-linked polyethylene GP 8.
- **Rated voltage:** 600/ 1000 V.
- **Conductors:** Copper.
- **Size:** Refer to cable schedule
- **Execution:** Extra low and low voltage cable routes;
Extra low and low voltage cables in accessible roof spaces;
Extra low and low voltage surface mounted cables;
Installing low voltage cables in conduit and trunking;
Installing low voltage armoured cables;
Jointing and terminating low voltage armoured cables;
Excavations;
Cables in ducts;
Cables in trenches;
Installing underground cable marker tape;
Cable installation on channel cable supports, cable tray, cable ladder and cable basket;
and Cables in vertical trunking and ducts.

Balanced twisted-pair cables

Shared by: 75-60-10/110 CCTV system; 90-65-05/620 Installing central controllers; 90-65-05/630 Installing combined daylight and occupancy sensors; 90-65-05/640 Installing daylight sensors; and 90-65-05/670 Installing photoelectric control units.

- **Manufacturer:** Contractor's choice.
- **Standard:** To BS EN 50288-2-1;
To BS EN 50288-3-1;
To BS EN 50288-4-1;
To BS EN 50288-5-1;
and To BS EN 50288-6-1.
- **Category:** 6.
- **Nominal impedance:** 100 ohm.
- **Screening:** Required.
- **Number of pairs:** 4.
- **Conductors:** Solid.
- **Size:** Manufacturer's standard.
- **Sheath:**
 - **Type:** Low smoke zero halogen (LSZH).
 - **Colour:** Manufacturer's standard.
- **Execution:** Extra low and low voltage cable routes;
Extra low and low voltage cables in accessible roof spaces;
Extra low and low voltage surface mounted cables;
and Installing low voltage cables in conduit and trunking.

Products generally type C

- **Standards:**
 - **Accessories generally:** To BS 5733.
 - **Switches:** To BS EN 60669-1.

Products generally type D

- **Standards:**
 - **Accessories generally:** To BS 5733.
 - **Switches:** To BS EN 60669-1.

Light switches

Shared by: 70-80-35/110 Hard wired general lighting system; and 90-60-25/315 Electrical accessories.

- **General requirements:** Products generally type C.
- **Manufacturer:** As electrical accessories manufacturer.
- **Application:** Internal and External.
- **Degree of ingress protection (minimum):** To BS EN 60529, IP 2X;
To BS EN 60529, IP 44;
To BS EN 60529, IP 56;
and To BS EN 60529, IP 67.
- **Rating:** 20 A.

- **Actuating method:** Pull cord;
Rotary switch;
Secret key switch;
and Standard rocker bar.
- **Mounting:** Architrave;
Flush;
Grid;
and Surface.
- **Poles:** Single pole and Double pole.
- **Execution:** Installing light switches.

Dimmer switches and controls

Shared by: 70-80-35/110 Hard wired general lighting system; and 90-60-25/315 Electrical accessories.

- **Manufacturer:** As electrical accessories manufacturer.
- **Standards:** To BS EN 60669-2-1 and BS EN 55015.
- **Ingress protection (minimum):** To BS EN 60529, IP 2X.
- **Mounting:** Flush;
Grid;
and Surface.
- **Format:** Overload protection and Soft start.
- **Suitable for the following loads:** Resistive;
Extra low voltage;
Low voltage with electronic transformers;
Fluorescent;
LED;
and RGB.
- **Control:** Momentary.

Ceiling roses

Shared by: 70-80-35/110 Hard wired general lighting system; and 90-60-25/315 Electrical accessories.

- **Manufacturer:** As electrical accessories manufacturer.
- **Standard:** To BS 67.
- **Rating:** 6 A.
- **Mounting type:** Surface.
- **Colour:** White.

Luminaire supporting couplers

Shared by: 70-80-35/110 Hard wired general lighting system; 90-60-25/315 Electrical accessories; 90-60-50/630 Luminaire cable connections; and 90-60-50/640 Luminaires mounted as part of a suspended ceiling.

- **General requirements:** Products generally type D.
- **Manufacturer:** Contractor's choice.
- **Standard:** To BS 7001.
- **Plug type:** Rewireable, independent.
- **Pin configuration:** 3 pin and 4 pin.

- **Colour:** Red and White.
- **Cable type:** Low smoke zero halogen.
- **Cable size:** 0.75 mm².
- **Flex length (maximum):** 3 m.

Safety pendant lampholders

Shared by: 70-80-35/110 Hard wired general lighting system; and 90-60-25/315 Electrical accessories.

- **Manufacturer:** As electrical accessories manufacturer.
- **Standard:** To BS EN 61184.
- **Colour:** White.
- **Execution:** Installing suspended lampholders.

Safety pendant sets

Shared by: 70-80-35/110 Hard wired general lighting system; and 90-60-25/315 Electrical accessories.

- **Manufacturer:** As electrical accessories manufacturer.
- **Standards:** To BS 67, BS 6500 and BS EN 61184.
- **Cable:**
 - **Colour:** White.
 - **Size:** 0.75 mm².
 - **Length:** 150 mm and 225 mm.

Bayonet lampholders

- **Manufacturer:** As electrical accessories manufacturer
- **Standard:** To BS EN 61184.
- **Arrangement:** 2-pin and 3-pin.
- **Material:** Plastics.
- **Protective skirt:** Manufacturer's standard.
- **Mounting:** Suspended from ceiling rose.

Edison screw lampholders

- **Manufacturer:** As electrical accessories manufacturer
- **Standard:** To BS EN 60238.
- **Material:** Plastics.
- **Protective skirt:** Manufacturer's standard.
- **Mounting:** Suspended from ceiling rose.

General purpose luminaires

- **Manufacturer:** As Electrical Equipment Schedule
- **Standards:** To BS EN 60598-1;
To BS 4533-102-1;
To BS 4533-102-19;
To BS EN 60598-2-2;
To BS EN 60598-2-3;
To BS EN 60598-2-5;

To BS EN 60598-2-13;
To BS EN 60598-2-23;
and To BS EN 60598-2-25.

- **Photometric performance:** To BS EN 13032-1.
- **Supply circuit conductor connections:** Screw terminals.
- **Internal fuse:** Manufacturer's standard.
- **Input voltage:** 230 V a.c.
- **Execution:** Luminaire samples;
Installing luminaires and lamps generally;
Luminaire cable connections;
Luminaires mounted as part of a suspended ceiling;
Installing extra low voltage luminaires;
Installing controlgear;
and Installing luminaire supports.

Self contained emergency luminaires

- **Standards:** To BS EN 60598-1 and BS EN 60598-2-22;
To BS 4533-102-1;
To BS 4533-102-19;
To BS EN 60598-2-2;
To BS EN 60598-2-3;
To BS EN 60598-2-5;
To BS EN 60598-2-13;
and To BS EN 60598-2-25.
- **Third party certification:** ICEL 1001 and ICEL 1004.
- **Photometric performance:** To BS EN 13032-1 and BS EN 13032-3.
- **Supply circuit conductor connections:** Screw terminals.
- **Internal fuse:** Manufacturer's standard.
- **Input voltage:** 230 V a.c.
- **Luminaire power factor:** Correct to minimum 0.9 lagging.
- **Duration:** 3 h.
- **Features:** Manufacturer's standard.
- **Ingress protection (minimum):** To BS EN 60529, IP20;
To BS EN 60529, IP23;
To BS EN 60529, IP54;
and To BS EN 60529, IP65.
- **Ballasts CELMA energy efficiency index (minimum):** A1 and A2.
- **Control gear position:** Locate components necessary for the operation of the luminaire within the luminaire body and Remote within separate enclosure.
- **Indicators:**
 - **Charging:** Manufacturer's standard.
 - **Fault:** Manufacturer's standard.
 - **Position within luminaire:** Readily visible. Fix to luminaire body.
- **Batteries:**
 - **Standard:** To BS EN 61951.
 - **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.
- **Execution:** Luminaire samples;
Installing luminaires and lamps generally;
Luminaire cable connections;
Luminaires mounted as part of a suspended ceiling;
Installing extra low voltage luminaires;
Installing controlgear;
and Installing luminaire supports.

Lighting tracks

- **Standard:** To BS EN 60570.
- **Class:** Mixed.
- **Conductor rating:** 25 A.
- **Housing material:** Extruded aluminium.
- **Mounting:** Surface and Suspended.
- **Execution:** Installing lighting track.

Central controllers

- **Manufacturer:** CP Electronics
- **Controller type:** Microprocessor controlled.
- **Equipment interconnectivity:** Wired.
- **Control protocol:** Digital addressable lighting interface (DALI) to BS EN 60929. Annex E and Digital serial interface (DSI).
- **Enclosure:**
 - **Ingress protection (minimum):** Manufacturer's standard.
 - **Material and construction:** Manufacturer's standard.
 - **Finish:** Manufacturer's standard.
 - **Mounting:** Surface.
- **Execution:** Installing central controllers.

Combined daylight and occupancy detectors

- **Manufacturer:** CP Electronics
- **Daylight sensitivity:** Adjustable.
- **Equipment interconnectivity:** Wired.
- **Occupancy sensitivity:** Adjustable.
- **Range:** Adjustable.
- **Field of view:** Adjustable.
- **Remote setup/ override:** Manufacturer's standard.
- **Mounting:** Ceiling;
Flush;
and Surface.
- **Ingress protection (minimum):** Manufacturer's standard.
- **Adjustable sensor settings:** Required.
- **Execution:** Installing combined daylight and occupancy sensors.

Daylight sensors

- **Manufacturer:** CP Electronics
- **Equipment interconnectivity:** Wired.
- **Daylight sensitivity:** Adjustable.
- **Remote setup/ override:** Manufacturer's standard.
- **Mounting:** Ceiling;
Flush;
Indoor;
Outdoor;
Surface;
and Wall.
- **Ingress protection (minimum):** Dependant on location
- **Adjustable sensor settings:** Required.
- **Execution:** Installing daylight sensors.

Mains voltage occupancy detectors

- **Manufacturer:** CP Electronics
- **Format:** Microwave and Passive infrared. Dependant on location and range.
- **Inductive switching capacity:** 10 A.
- **Occupancy sensitivity:** Adjustable.
- **Range:** Adjustable.
- **Field of view:** Adjustable.
- **Switching delay:** Adjustable.
- **Remote setup/ override:** Manufacturer's standard.
- **Mounting:** Ceiling;
Flush;
and Surface.
- **Ingress protection (minimum):** To BS EN 60529, IP44 and To BS EN 60529, IP66. To suit the location and area.
- **Adjustable sensor settings:** Required.
- **Execution:** Installing mains voltage occupancy detectors.

Photoelectric control units

- **Manufacturer:** CP Electronics
- **Standard:** To BS 5972.
- **Equipment interconnectivity:** Wired.
- **Inductive switching capacity:** 10 A and 25 A.
- **Remote setup/ override:** Manufacturer's standard.
- **Mounting:** Column top;
Outdoor;
Surface;
and Wall.
- **Ingress protection (minimum):** To BS EN 60529, IP56 and To BS EN 60529, IP67. Dependant on location
- **Execution:** Installing photoelectric control units.

Time switches

- **Manufacturer:** CP Electronics
- **Standards:** To BS EN 60730-1 and BS EN 60730-2-7.
- **Third party certification:** British Electrotechnical Approvals Board (BEAB).
- **Equipment interconnectivity:** Wired.
- **Format:** Electronic digital.
- **Display:** Liquid crystal display (LCD).
- **Programme capability:** Manufacturer's standard.
- **Number of switching channels:** Manufacturer's standard.
- **Inductive switching capacity:** 20 A.
- **Cable termination capacity:** 6 mm².
- **Override facility:** Manual.
- **GMT/BST daylight saving:** Automatic.
- **Enclosure:**
 - **Ingress protection (minimum):** Dependant on location
 - **Material and construction:** Manufacturers' standard.
- **Battery backup:** Not required.
- **Execution:** Installing time switches.

Electrical shock treatment signs

Shared by: 70-70-25/110 Earthing and bonding system; 70-70-45/110 Low voltage distribution system; 70-70-75/110 Hard wired low voltage small power system; and 70-80-35/110 Hard wired general lighting system.

- **Manufacturer:** Contractor's choice.
- **Format:** Plastics encapsulated.

Equipment labels and warning notices

Shared by: 70-70-25/110 Earthing and bonding system; 70-70-45/110 Low voltage distribution system; 70-70-75/110 Hard wired low voltage small power system; and 70-80-35/110 Hard wired general lighting system.

- **Manufacturer:** Contractor's choice.
- **Material:** Face engraved rigid plastic laminate.
- **Label size:** Submit proposals.
- **Colour:**
 - **Background:** Manufacturer's standard.
 - **Lettering:** Manufacturer's standard.
- **Typography:**
 - **Font:** Manufacturer's standard.
 - **Size:** Manufacturer's standard.
- **System notice wording:** Manufacturer's standard.

Electrical diagrams generally

Shared by: 70-70-25/110 Earthing and bonding system; 70-70-45/110 Low voltage

distribution system; 70-70-75/110 Hard wired low voltage small power system; and 70-80-35/110 Hard wired general lighting system.

- **Material:** Engraved plastics laminate and 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.

Execution

Installing general lighting systems

- **Standard:** To BS 7671 and in accordance with CIBSE Commissioning Code L.
- **Commissioning method statement:** Submit prior to commissioning.
- **Luminaire layout:** As per lighting drawings
- **Fixing master/ lighting distribution boxes:** Direct to underside of floor slab and Suspended from drop rods.
- **Connection of luminaire supporting couplers:**
 - **Flex length (maximum):** Contractor's choice.
- **Switches and controls:**
 - **Location:** As per lighting drawings
 - **Staircases:** Two way switching at top and bottom landings with intermediate at full landings.
- **Rooms smaller than 4 m²:** Restrict lighting circuits to one electrical phase.

Installing emergency lighting systems

- **Standards:** To BS 7671 and in accordance with BS 5266-1.
- **Connection of luminaire supporting couplers:**
 - **Emergency luminaires:** Red plug with red cover.
- **Permanent electrical supplies to self contained emergency luminaires:** Derive from the closest general lighting circuit.
- **Switches and controls:**
 - **Location:** As per drawings

Assembling ceiling roses, flex and lampholders

- **Connections:** Interconnect flex between ceiling rose and lampholder.
- **Cable:**
 - **Standard:** Flexible cords.
 - **Colour:** White.
 - **Size:** 0.75 mm².
 - **Length:** 225 mm.

Installing emergency exit signs

- **Standard:** To BS EN 50172.

- **Position:** As per lighting drawings. Illuminated signs should be located centrally over doors in accordance with BS5266
- **Fixing:** To building fabric such that the removal of the sign requires a special tool.
- **Orientation:** Plumb and level.

Labelling of lighting controls

- **Equipment and sensor identification labels:** Provide.
- **Central controller:** Label describing its purpose.
- **Output circuits:** Label.

Installing cable tray and cable ladder

Shared by: 90-55-10/330 Cable ladders; and 90-55-10/335 Cable trays.

- **Standards:** To BS 7671 and in accordance with IET guidance note 1.
- **Preparation:**
 - **Burrs and sharp edges:** Make smooth.
 - **Cutting:** Minimize and make good edges. Cuts to cable tray to be square along an unperforated line.
 - **Treatment of cut surface:** Extend 25 mm beyond the cut. Match finish of cable supports.
- **Access:** Provide space around cable ladder and tray 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 ladder and tray:** Maximize.
 - **Ends:** Blank with end plates.
- **Changes of size and direction:** Manufacturer's accessories of the same material type, pattern, finish and thickness as cable supports.
- **Fire barriers:** Provide where required to maintain fire performance of fabric.
- **Protective covers:** Provide to cables requiring mechanical protection.
- **Support:**
 - **Fixing arrangement:** Independently fix and support from building structure using threaded rod fixed to channel cable support with shake proof washers and hex nuts;
Independently fix and support from building structure using threaded rod fixed into expanding anchors;
and Independently fix and support from building structure using threaded rod fixed into resin injection anchors.
 - **Clearance from building fabric (minimum):** 20 mm.
- **Components:** Avoid contact between dissimilar metals.
- **Routing of cable ladder and tray:** Submit working drawings showing the final routes.

Installing cable basket

- **Standards:** To BS 7671 and in accordance with IEE Guidance Note 1.
- **Joints:**

- **Cut:** Adjacent cross basket wires. Make smooth any burrs or edges.
- **Earth conductors:** Connect across joints.
- **Accessories:** Form on site and connect with basket manufacturer's coupling components.
- **Fire barriers:** Provide where required to maintain fire performance of fabric.
- **Support:**
 - **Fixing arrangement:** Independently fix and support from building structure using threaded rod fixed to channel cable support with shake proof washers and hex nuts;
Independently fix and support from building structure using threaded rod fixed into expanding anchors;
and Independently fix and support from building structure using threaded rod fixed into resin injection anchors.
 - **Clearance from building fabric (minimum):** 20 mm.
- **Components:** Avoid contact between dissimilar metals.
- **Routing of cable basket:** Submit working drawings showing the final routes.

Installing cable supports on roofs

Shared by: 90-55-10/330 Cable ladders; and 90-55-10/335 Cable trays.

- **Position:** Elevate above roof.
- **Mounting:** Load spreading supports.

Multiple cable runs

Shared by: 90-55-10/325 Cable baskets; 90-55-10/330 Cable ladders; and 90-55-10/335 Cable trays.

- **Requirement:**

Cable support zones

Shared by: 90-55-10/325 Cable baskets; 90-55-10/330 Cable ladders; and 90-55-10/335 Cable trays.

- **Ceiling voids:**
 - **Clear distance between underside of cable supports and brackets and topside of ceiling (minimum):** Contractor's choice.

Installing conduit, trunking and ducting

Shared by: 90-55-10/460 Conduit fittings; 90-55-10/715 Installing pliable and flexible conduit; 90-55-10/720 Installing rigid metallic conduit; 90-55-10/725 Installing rigid non metallic conduit; 90-55-10/735 Installing conduit connections to equipment; and 90-55-10/765 Conduit, trunking and ducting zones.

- **Standards:** In accordance with BS 7671 and IET Guidance Note 1.
- **Preparation:** Cut square. Remove burrs and sharp edges to make smooth.
- **Protection of metallic conduit, trunking and ducting:**
 - **Joints and ends:** Remove grease, oil, dirt and rust before applying protective paint. Paint immediately following installation.
 - **Protective paint:**

Generally: Compatible with conduit, trunking and ducting finish.

Type: Match factory finish.

- **Cross-sectional area:** Maintain throughout the conduit, trunking and ducting length.
- **Arrangement:** Position vertically and horizontally in line with equipment served, and parallel with building lines.
- **Spare containment:** Install one spare 25 mm diameter conduit from each distribution board to the nearest accessible void space, terminating in a conduit box with lid.
- **Draw wires:** Install galvanized soft iron wires within spare conduit, trunking and ducting.
- **Distance from other services running parallel (minimum):**
 - **Generally:** 150 mm.
 - **Above radiators:** 1000 mm.
 - **Steam services:** 600 mm.
- **Drainage of conduit, trunking and ducting:** Locate drainage outlets at lowest points in conduit, trunking and ducting installed externally, and where condensation may occur.
- **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, trunking and ducting from building structure.
- **Cleaning:** Clean insides of conduit, trunking and ducting before installing cables.
- **Cabling:** Install when conduit, trunking and ducting enclosure is complete.
- **Submittals:** Submit manufacturer's technical information. Submit drawings showing the proposed routes of conduit, trunking and ducting and the location of service outlets.

Installing conduit generally

Shared by: [90-55-10/715 Installing pliable and flexible conduit](#); [90-55-10/720 Installing rigid metallic conduit](#); [90-55-10/725 Installing rigid non metallic conduit](#); and [90-55-10/735 Installing conduit connections to equipment](#).

- **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:**
 - **Generally:** 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:**
 - **Generally:** Install flush with finished surfaces. Provide extension rings if required.
 - **Fixing screws:** Countersunk, or round-headed screws.

- **Number of fixings (minimum):** Two.
 - **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):** Two.
 - **Floors:** Do not install draw-in boxes in floors.
- **Conduit in walls:** Avoid concealed horizontal runs.
- **Suspended ceiling installations:** Fasten outlet boxes to structure above ceiling.

Installing rigid metallic conduit

- **General requirements:** Installing conduit generally and Installing conduit, trunking and ducting.
- **Fixings:** Distance saddle; Saddle; and Spacer bar saddle.
- **Joints:** Plain and 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.

Installing rigid non metallic conduit

- **General requirements:** Installing conduit generally and Installing conduit, trunking and ducting.
- **Fixings:** Distance saddle; Saddle; and Spacer bar saddle.
- **Joints:** Compression and Threaded.
- **Conduit connections to boxes and items of equipment:** Threaded bushed entries.

Installing conduit connections to equipment

Shared by: 90-55-10/360 Flexible conduit; and 90-55-10/380 Rigid conduit.

- **General requirements:** Installing conduit generally and Installing conduit, trunking and ducting.
- **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 of adequate length to facilitate removal of equipment for maintenance. Final termination in swivel connectors.
- **Connections to external equipment:** Flexible conduit.

Installing trunking generally

- **Supports and mounting arrangement:** Wall mounted;
Ceiling mounted;
Floor mounted;
Purpose made brackets;
and Suspension rods and steel channels.
- **Changes of direction:** Manufacturer's bends and tees.
- **Joints:**
 - **Generally:** 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.
- **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.

Conduit, trunking and ducting zones

Shared by: [90-55-10/360 Flexible conduit](#); [90-55-10/380 Rigid conduit](#); and [90-55-10/410 Cable trunking and cable ducting systems](#).

- **General requirements:** [Installing conduit, trunking and ducting](#).
- **Ceiling voids:** Provide clear distance of 150 mm (minimum) between underside of any conduit, trunking or trunking and the topside of ceiling.

Installing low voltage cables

Shared by: [90-55-15/342 Fire resistant, insulated and sheathed cables](#); [90-55-15/345 PVC insulated cables](#); [90-55-15/346 PVC insulated cables for interconnecting wiring](#); [90-55-15/349 Single-core heat resisting insulating cables](#); [90-55-15/351 Thermosetting insulated cables](#); [90-55-15/352 Thermosetting insulated and PVC sheathed cables \(XLPE/ PVC singles\)](#); [90-55-15/355 Thermosetting insulated metal screened LSZH sheathed multicore cables](#); [90-55-15/665 Installing flexible cords](#); [90-55-15/670 Installing prefabricated wiring](#); and [90-55-15/680 Installing low voltage armoured cables](#).

- **Standard:** In accordance with 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. Clear cable path of debris.
- **Installation temperature (minimum):** 5°C.
- **Cables:** Install in one length. Dress cables flat, free from twists, kinks and strain.
- **Cable pulling:** Do not overstress. Prevent kinks and twisting of the cable.
- **Cable protection:** Cables passing through walls and floors to be sleeved with conduit or pipeduct to a minimum of 300 mm. Bush at both ends. Ensure that appropriate fire stopping materials are used to maintain the original fire integrity of the wall or floor around the penetration.
- **Concealed cable runs to wall accessories:** Run vertically from the accessory.
- **Exposed cable runs:**
- **Distance from other services running parallel (minimum):** 150 mm. Position cables below heating pipes.
- **Jointing and termination:**
 - **Final circuit cables:** At electrical accessories only.
 - **Core connections:** Using compression lugs to equipment without integral clamping terminals.
 - **Terminating cables when not using glands:** Take sheathing of cables into accessory boxes and equipment and protect against abrasion with grommets.

Extra low and low voltage cable routes

Shared by: 90-55-15/342 Fire resistant, insulated and sheathed cables; 90-55-15/343 Fire resistant, insulated and sheathed armoured cables; 90-55-15/344 Mineral insulated cables type A and type B; 90-55-15/345 PVC insulated cables; 90-55-15/346 PVC insulated cables for interconnecting wiring; 90-55-15/351 Thermosetting insulated cables; 90-55-15/352 Thermosetting insulated and PVC sheathed cables (XLPE/ PVC singles); 90-55-15/353 Thermosetting insulated and PVC sheathed armoured cables; 90-55-15/354 Thermosetting insulated and LSZH sheathed armoured cables; 90-55-15/355 Thermosetting insulated metal screened LSZH sheathed multicore cables; 90-55-15/366 Balanced twisted-pair cables; 90-55-15/385 Prefabricated LSZH insulated singles in flexible conduit; and 90-55-15/386 Prefabricated LSZH insulated and sheathed multi-core.

- **Cables generally:**
 - **Concealed cable runs to wall accessories:** Run vertically from the accessory.
 - **Exposed cable runs:** Contractor's choice.
- **Distance from other services running parallel (minimum):** 150 mm. Position cables below heating pipes.

Low voltage cables concealed in walls and partitions

Shared by: 90-55-15/342 Fire resistant, insulated and sheathed cables; 90-55-15/343 Fire resistant, insulated and sheathed armoured cables; 90-55-15/344 Mineral insulated cables type A and type B; 90-55-15/345 PVC insulated cables; 90-55-15/346 PVC insulated cables for interconnecting wiring; 90-55-15/351 Thermosetting insulated cables; 90-55-15/352 Thermosetting insulated and PVC sheathed cables (XLPE/ PVC singles); 90-55-15/353 Thermosetting insulated metal screened LSZH sheathed multicore cables; 90-55-15/385 Prefabricated LSZH insulated singles in flexible conduit; and 90-55-15/386 Prefabricated LSZH insulated and sheathed multi-core.

- **Position:** In a zone within 150 mm of wall perimeter (except at the floor); and run vertically or horizontally from these zones, or from floor level, to switches,

accessories, etc and At least 50 mm from the surface. Ensure all routes are agreed with architect (working drawings) to ensure historic fabric is maintained.

- **Protection:** Rigid conduit and Cover with galvanized steel channel nailed to substrate.

Extra low and low voltage cables in accessible roof spaces

Shared by: 90-55-15/340 Flexible cords; 90-55-15/342 Fire resistant, insulated and sheathed cables; 90-55-15/343 Fire resistant, insulated and sheathed armoured cables; 90-55-15/344 Mineral insulated cables type A and type B; 90-55-15/345 PVC insulated cables; 90-55-15/346 PVC insulated cables for interconnecting wiring; 90-55-15/351 Thermosetting insulated cables; 90-55-15/352 Thermosetting insulated and PVC sheathed cables (XLPE/ PVC singles); 90-55-15/353 Thermosetting insulated and PVC sheathed armoured cables; 90-55-15/354 Thermosetting insulated and LSZH sheathed armoured cables; 90-55-15/355 Thermosetting insulated metal screened LSZH sheathed multicore cables; 90-55-15/366 Balanced twisted-pair cables; 90-55-15/385 Prefabricated LSZH insulated singles in flexible conduit; and 90-55-15/386 Prefabricated LSZH insulated and sheathed multi-core.

- **Cables running across ceiling joists:** Cable baskets;
Cable trays;
and Cable trunking and cable ducting systems.

Extra low and low voltage surface mounted cables

Shared by: 90-55-15/340 Flexible cords; 90-55-15/342 Fire resistant, insulated and sheathed cables; 90-55-15/343 Fire resistant, insulated and sheathed armoured cables; 90-55-15/344 Mineral insulated cables type A and type B; 90-55-15/345 PVC insulated cables; 90-55-15/346 PVC insulated cables for interconnecting wiring; 90-55-15/351 Thermosetting insulated cables; 90-55-15/352 Thermosetting insulated and PVC sheathed cables (XLPE/ PVC singles); 90-55-15/353 Thermosetting insulated and PVC sheathed armoured cables; 90-55-15/354 Thermosetting insulated and LSZH sheathed armoured cables; 90-55-15/355 Thermosetting insulated metal screened LSZH sheathed multicore cables; and 90-55-15/366 Balanced twisted-pair 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.

Installing low voltage cables in conduit and trunking

Shared by: 90-55-15/342 Fire resistant, insulated and sheathed cables; 90-55-15/343 Fire resistant, insulated and sheathed armoured cables; 90-55-15/344 Mineral insulated cables type A and type B; 90-55-15/345 PVC insulated cables; 90-55-15/346 PVC insulated cables for interconnecting wiring; 90-55-15/349 Single-core heat resisting insulating cables; 90-55-15/351 Thermosetting insulated cables; 90-55-15/352 Thermosetting insulated and PVC sheathed cables (XLPE/ PVC singles); 90-55-15/353 Thermosetting insulated and PVC sheathed armoured cables; 90-55-15/354 Thermosetting insulated and LSZH sheathed armoured cables; 90-55-15/355 Thermosetting insulated metal screened LSZH sheathed multicore cables; 90-55-15/366 Balanced twisted-pair cables; 90-55-15/385 Prefabricated LSZH insulated singles in flexible conduit; and 90-55-15/386 Prefabricated LSZH insulated and sheathed multi-core.

- **Cable installation:** Orderly and capable of being withdrawn.
- **Single core wiring:** Arrange using the loop-in method.

- **Cables within trunking:** Tie at 2 m intervals for cables of the same circuit reference. Label ties with circuit reference number at 10 m intervals.
- **Cables in vertical conduit:** Provide cable clamps in accessible conduit boxes at 5 m intervals.
- **Extra low voltage cables:** Install within a separate partition from low voltage cables where installed in multi compartment trunking.

Installing flexible cords

- **General requirements:** Installing low voltage cables.
- **Cords:** Grip securely at connections. Where cord grips do not form an integral part of the accessory or equipment, provide separate proprietary cord grips.

Installing low voltage armoured cables

Shared by: 90-55-15/343 Fire resistant, insulated and sheathed armoured cables; 90-55-15/353 Thermosetting insulated and PVC sheathed armoured cables; and 90-55-15/354 Thermosetting insulated and LSZH sheathed armoured cables.

- **General requirements:** Installing low voltage cables.
- **Earthing:** Bond armour to equipment and main earthing system.
- **Connections to apparatus:** Moisture proof, sealed glands and shrouds.

Jointing and terminating low voltage armoured cables

Shared by: 90-55-15/343 Fire resistant, insulated and sheathed armoured cables; 90-55-15/353 Thermosetting insulated and PVC sheathed armoured cables; and 90-55-15/354 Thermosetting insulated and LSZH sheathed armoured cables.

- **Preparation:**
 - **Cable ends:** Cut 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:** To BS EN 62444 and fitted with shroud.
- **Cold pour resin and heat shrink joints:** To BS EN 50393.
- **Insulating tape:** To BS EN 60454-1.
- **Plastics sheathed cables:** Seal with proprietary shrink-on end caps.
- **Bolted terminal connections to equipment and switchgear without integral cable clamping terminals:** Compression 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.

Excavations

Shared by: 90-55-15/343 Fire resistant, insulated and sheathed armoured cables; 90-55-15/353 Thermosetting insulated and PVC sheathed armoured cables; and 90-55-15/354 Thermosetting insulated and LSZH sheathed armoured cables.

- **Excavations next to existing underground services:** In accordance with HSG 47
- **Existing underground services:** Expose and identify.

Cables in ducts

Shared by: 90-55-15/343 Fire resistant, insulated and sheathed armoured cables; 90-55-15/353 Thermosetting insulated and PVC sheathed armoured cables; and 90-55-15/354 Thermosetting insulated and LSZH sheathed armoured cables.

- **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.

Cables in trenches

Shared by: 90-55-15/343 Fire resistant, insulated and sheathed armoured cables; 90-55-15/353 Thermosetting insulated and PVC sheathed armoured cables; and 90-55-15/354 Thermosetting insulated and LSZH sheathed armoured cables.

- **Base:** All cables and ducts to be surrounded by 75 mm sand, free of any sharp stones or flints.
- **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:** Install within duct and derate cable if longer than 10 m. Extend ducts 1 m each side of hardstanding.
- **Cable identification and protection:** Underground plastics cable protection covers and Underground cable marker tape.

Installing underground cable marker tape

Shared by: 90-55-15/343 Fire resistant, insulated and sheathed armoured cables; 90-55-15/353 Thermosetting insulated and PVC sheathed armoured cables; and 90-55-15/354 Thermosetting insulated and LSZH sheathed armoured cables.

- **Installation:** In accordance with ENA 12-23.

Cable installation on channel cable supports, cable tray, cable ladder and cable basket

Shared by: 90-55-15/342 Fire resistant, insulated and sheathed cables; 90-55-15/343 Fire resistant, insulated and sheathed armoured cables; 90-55-15/344 Mineral insulated cables type A and type B; 90-55-15/345 PVC insulated cables; 90-55-15/346 PVC insulated cables for interconnecting wiring; 90-55-15/351 Thermosetting insulated cables; 90-55-15/353 Thermosetting insulated and PVC sheathed armoured cables; 90-55-15/354 Thermosetting insulated and LSZH sheathed armoured cables; and 90-55-15/355 Thermosetting insulated metal screened LSZH sheathed multicore cables.

- **Cabling:** Install when cable supports are complete.

- **Position:** Place single and multi-core cables side by side.
- **Fastening:**
 - **Fastenings generally:** Secure cables, do not indent sheaths. Position to enable any submain cable to be individually removed.
 - **Submain cables <95 mm²:** Cable cleats.
Spacing (maximum): 600 mm.
 - **Submain cables >95 mm²:** Cable cleats and Cable bands.
Spacing (maximum): 600 mm.
 - **Final circuit cabling:** Cable ties.
Spacing (maximum): 600 mm.
 - **Extra low voltage, communications and fibre optic cabling:** Cable ties.
Spacing (maximum): 600 mm.

Cables in vertical trunking and ducts

Shared by: 90-55-15/343 Fire resistant, insulated and sheathed armoured cables; 90-55-15/353 Thermosetting insulated and PVC sheathed armoured cables; and 90-55-15/354 Thermosetting insulated and LSZH sheathed armoured cables.

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

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.

Installing suspended lampholders

- **Flex length:** 0.3 m.

Luminaire samples

Shared by: 90-60-50/405 General purpose luminaires; 90-60-50/410 Combined emergency luminaires; and 90-60-50/420 Self contained emergency luminaires.

- **Sample luminaires:**
- **Submittals:** Include manufacturer's technical information with each sample.
- **Identification:** Label samples with the luminaire references.

Installing luminaires and lamps generally

Shared by: 90-60-50/405 General purpose luminaires; 90-60-50/410 Combined emergency luminaires; and 90-60-50/420 Self contained emergency luminaires.

- **Orientation:** Linear luminaires to be installed parallel with ceiling.
- **Lamps and accessories:** Provide.
- **Supports:** Adequate for weight of luminaire.

Luminaire cable connections

Shared by: 90-60-50/405 General purpose luminaires; 90-60-50/410 Combined emergency luminaires; and 90-60-50/420 Self contained emergency luminaires.

- **Cable connection size (minimum):** Refer to Distribution board schedules
- **Connection of luminaire supporting couplers:**
 - **General luminaires:** White plug with white cover.
 - **Flex length (maximum):** Contractor's choice.
- **Conduit mounted:**
 - **Final connection:** In a ceramic terminal block within a conduit box and Directly within luminaire.
 - **Cable type:** Flexible cords;
Final circuit cabling;
and Single-core heat resisting insulating cables.
- **Trunking mounted:**
 - **Final connection:** In a ceramic terminal block within a conduit box and Directly within luminaire.
 - **Cable type:** Flexible cords;
Single-core heat resisting insulating cables;
and Final circuit cabling.
- **Suspended trunking:**
 - **Final connection:** Luminaire supporting couplers and Plug and socket outlet to BS 546.
 - **Mounting arrangement:** From cable connection on side of trunking.
 - **Cable type:** Flexible cords
- **Rod or chain suspended:**
 - **Final connection:** Luminaire supporting couplers and Plug and socket outlet to BS 546.
 - **Cable type:** Flexible cords.
 - **Connection arrangement:** Clipped to chain or rod. Do not pass cord through chain links.
- **Cable entry:** Grommited.
- **Class 1 earth connections:** Connect to luminaire circuit protective conductor.
- **Wiring within luminaires:** Minimize. Clip at 300 mm intervals.

Luminaires mounted as part of a suspended ceiling

Shared by: 90-60-50/405 General purpose luminaires; 90-60-50/410 Combined emergency luminaires; and 90-60-50/420 Self contained emergency luminaires.

- **Luminaire supports:** Independent suspension wires;
Independent suspension rods;
and Support from ceiling.
- **Luminaire final connection:** Luminaire supporting couplers and Plug and socket outlet to BS 546.
- **Mounting arrangement:** From cable connection on side of trunking.
- **Length (maximum):** Contractor's choice.

Installing lighting track

- **Orientation:** Level with ceiling.
- **Track suspensions:**
 - **Type:** Flexible and Rigid.
 - **Position:** Within 500 mm of each joint and end of track.
Provide dedicated suspension point for supply feed.

Installing extra low voltage luminaires

Shared by: 90-60-50/405 General purpose luminaires; 90-60-50/410 Combined emergency luminaires; and 90-60-50/420 Self contained emergency luminaires.

- **Transformer location:** Accessible.
- **Conductor size for cables connecting transformers and luminaires (minimum):** As per distribution board schedules
- **Multi-point transformers:**
 - **Cabling to luminaire:** Equal size and length.
 - **Lamps:** Same power rating.
 - **Fixing:** Secure to non-flammable materials.

Installing controlgear

Shared by: 90-60-50/405 General purpose luminaires; 90-60-50/410 Combined emergency luminaires; and 90-60-50/420 Self contained emergency luminaires.

- **Position:** Adjacent to luminaire.
- **Fixing:** Secure to building fabric.

Installing luminaire supports

Shared by: 90-60-50/405 General purpose luminaires; 90-60-50/410 Combined emergency luminaires; and 90-60-50/420 Self contained emergency luminaires.

- **Support and fixing arrangement:** Contractor's choice.
- **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:** Two.
 - **Luminaire width >300 mm:** Four.

Installing automatic lighting controls generally

Shared by: [90-65-05/620 Installing central controllers](#); [90-65-05/630 Installing combined daylight and occupancy sensors](#); [90-65-05/640 Installing daylight sensors](#); [90-65-05/660 Installing mains voltage occupancy detectors](#); and [90-65-05/670 Installing photoelectric control units](#).

- **Standard:** To BS 7671.
- **Equipment and sensor identification labels:** Provide.

Installing central controllers

- **General requirements:** [Installing automatic lighting controls generally](#).
- **Position:** As per drawings
- **Clearance (minimum):**
 - **Front access controllers:** 1000 mm in front of enclosure.
- **Connection to building monitoring and management system:** Required.
- **Interconnections with detectors, sensors and luminaires:**
 - **Connection topology:** Interconnect between control panel and detectors, sensors and luminaire in a loop and Interconnect between control panel and detectors, sensors and luminaire on a radial.
 - **Cable type:** [Balanced twisted-pair cables](#).
- **Software addressing:** Assign individual, unique software address to detectors, sensors and luminaires.
- **Central controller:** Label describing its purpose.
- **Output circuits:** Label.

Installing combined daylight and occupancy sensors

- **General requirements:** [Installing automatic lighting controls generally](#).
- **Position:** Ceiling mounted, located to suit the occupancy pattern of the area under control. Shielded from erroneous influences.
- **Interconnection:** To adjacent luminaire and To central controllers.
- **Cable type:** [PVC insulated cables](#) and [Balanced twisted-pair cables](#).

Installing daylight sensors

- **General requirements:** [Installing automatic lighting controls generally](#).
- **Position:** Ceiling mounted, located to suit the occupancy pattern of the area under control. Shielded from erroneous influences.
- **Interconnection:** To adjacent luminaire and To central controllers.
- **Cable type:** [PVC insulated cables](#) and [Balanced twisted-pair cables](#).

Installing mains voltage occupancy detectors

- **General requirements:** [Installing automatic lighting controls generally](#).
- **Position:** Ceiling mounted, located to suit the occupancy pattern of the area under control. Shielded from erroneous influences.
- **Interconnection:** To adjacent luminaire and To central controllers.
- **Cable type:** [PVC insulated cables](#).

Installing photoelectric control units

- **General requirements:** Installing automatic lighting controls generally.
- **Position:** Ceiling mounted, located to suit the occupancy pattern of the area under control. Shielded from erroneous influences and Wall mounted, located to suit the occupancy pattern of the area under control. Shielded from erroneous influences.
- **Interconnection:** To adjacent luminaire and To central controllers.
- **Cable type:** PVC insulated cables;
Thermosetting insulated and PVC sheathed cables (XLPE/ PVC singles);
and Balanced twisted-pair cables.

Installing time switches

- **Position:** Adjacent to low voltage switchgear.
- **Interconnection:**
 - **Input:** From low voltage switchgear.
 - **Output:** Radial circuit to luminaires.
 - **Cable type:** LSZH singles and LSZH/ LSZH with CPC.

System completion

Testing and commissioning of general lighting systems

- **Commissioning:** In accordance with CIBSECommissioning Code L.
- **Test results:** Submit two copies of system commissioning completion certificate.
- **Certificates of calibration for meters and instruments:** Submit.

Testing and commissioning emergency lighting systems

- **Commissioning:** In accordance with BS 5266-1, Annex F.
- **Results:** Submit two copies of emergency lighting completion certificates, F1, F2, F3, and F4 and Submit two copies of emergency lighting completion certificate G2.
- **Certificates of calibration for meters and instruments:** Submit.

Photometric survey of general lighting systems

- **Standard:** In accordance with CIBSE SLL code for lighting.
- **Position:** Contractor's choice.
- **Test conditions:** Full blackout.
Allow lamps and luminaire output to stabilize prior to beginning measurement.
- **Average illuminance measurement method:** Full grid.
- **Results:**
 - **Submit for the following:** Maintained average illuminance.
Diversity.
Uniformity.
 - **Format:** A4 paper print and Electronic.
 - **Number of copies:** Three.
- **Survey photographs:** Not Required.

Photometric survey of emergency lighting systems

- **Standard:** In accordance with BS 5266-1, Annex B.
- **Position:** In accordance with BS5266
- **Test conditions:** Full blackout.
Minimize extraneous light.
- **Results:**
 - **Format:** A4 paper print and Electronic.
 - **Number of copies:** Three.

Documentation relating to general lighting

- **Operating and maintenance instructions:**
 - **Scope:** Submit for the system giving optimum settings for controls.
 - **Product information:** Include product description, date of purchase, performance characteristics, application (suitability for use), method of operation and control, and cleaning and maintenance requirements.
 - **Format:** Paper copy.
 - **Number of copies:** Three.
- **Record drawings:**
 - **Content:** General arrangement drawings showing the location of luminaires, lighting circuit distribution boxes, master and slave distribution boxes, switch modules, manual and automatic switches and controls including timeswitches, passive infra red detectors, and daylight sensors and Schematic diagram showing all final circuit cabling, the cable origin, device addresses for automated controls, route from controls to luminaires, and the location of all joints and tees. Include conductor material and c.s.a, insulation type and colour, number of cores per cable, number of cables in ducts, on tray or ladder.
 - **Format:** A1 paper print drawing and Electronic drawing.
 - **Number of copies:** Three.
- **Submittal date:** At handover

Documentation relating to emergency lighting

- **Operating and maintenance instructions:**
 - **Scope:** Submit for the system giving optimum settings for controls.
 - **Product information:** Include product description, date of purchase, performance characteristics, application (suitability for use), method of operation and control, and cleaning and maintenance requirements.
 - **Format:** Paper copy.
 - **Number of copies:** Three.
- **Record drawings:**
 - **Content:** General arrangement drawings showing the location of emergency luminaires, lighting circuit distribution boxes, master and slave distribution boxes, switch modules, manual and automatic emergency lighting test panels and Schematic diagram showing all final circuit cabling, the cable origin, device addresses for automated controls, route from controls to luminaires, and the location of all joints and tees. Include conductor material and c.s.a, insulation

type and colour, number of cores per cable, number of cables in ducts, on tray or ladder.

- **Format:** A1 paper print drawing and Electronic drawing.
- **Number of copies:** Three.
- **Submittal date:** At handover.
- **Certification for re-engineered luminaires:** Submit completed ICEL 1004 model test record certificate.
- **Log book:**
 - **Submit including the following information:** In accordance with BS EN 50172

Spares

- **Test keys for secret keyswitches:** Three.
- **Sensors:** One of each type.
- **Lamps:**
 - **Quantity of each type to be supplied:** Two.
 - **Labelling:** Label the lamps with the corresponding luminaire reference.

Maintenance

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

Ω End of system

Data distribution system

System outline

Data distribution system

- **Description:**

The Contractor shall provide cabling and containment for a fully wired and wireless data system.

All services with the exception as listed below and as noted on the drawings shall be isolated, stripped out and made safe, prior to the demolition.

The redundant equipment shall be stripped out and safely removed and disposed, and/or handed back to the Client.

All services stripped out to the area demarcation line to be made safe at this point.

The redundant services should not pose a health and safety risk. All cable containment and pipes shall be capped off at this point. The Contractor should ensure no sharp edges.

All circuits to be disconnected from the point of the origin and clearly labelled as redundant. Other areas are to be retained in use during the course of the works.

It is therefore imperative that these systems are maintained through out these works and any downtime is agreed with the Client.

Cat 6 cabling shall be supplied installed test and commissioned at positions as indicated on the drawings.

Wireless Access points have been indicated on electrical layout drawings. These shall be wired back to a dedicated "WIFI" patch panel, and clearly labelled.

Comms cabinet

The contractor shall provide a 36U comms cabinet within the basement comms rooms, and agreed with the ICT department.

These cabinets shall then be connected back to the main cabinet in the Town hall via an existing fibre within the basement. Final connection details to be confirmed with the ICT department and electrical contractor's data installer

Contractor shall allow for liaison with the Client's ICT department to ensure the timely connection of fibre links and potentially copper links (by client) to the new comms cabinet.

These shall be equipped with fully openable door to enable access from the front of the ICT cabinet.

The mains comm cabinet and area shall house CCTV control and recording equipment.

The ICT infrastructure shall provide maximum flexibility so that future upgrades and adaptations can be achieved with minimum disruptions to the museum area.

A wireless solution shall be provided throughout the building in addition to the wired ICT infrastructure. Data points only will be provided to enable use of the wireless infrastructure. All active components of the systems should be supplied by the Client.

It is envisaged that wireless routers will be powered over the Ethernet.

All Data connections on each level shall be distributed from the local comms cabinet and through local penetrations as risers from comms room to high level through the staff office.

All data cabling shall be Cat6 (unless otherwise stated) and run within dedicated compartment containment basket to reduce the potential for interference from power distribution cables.

The contractor shall ensure bending radii as per the cable manufacturer's recommendations are adhered to at all times

The Main Contractor shall provide suitable Containment systems, as indicated on Ramboll's drawings, to set to work these systems. The data outlets shall consist of an RJ45 socket mounted in a manner that is compatible with the building trunking/ducting system. These will be required in all work areas, as indicated on the layout drawings.

- **System performance:**
- **Cabling hierarchy:**
 - **Building backbone cabling:** Optical fibre cables type B.
 - **Consolidation point cabling:**
 - **Telecommunications outlets (TO):** As shown at lifts and EPOS. TO be agreed with ICT department and openreach allowance.
- **Containment:** Cable baskets.
- **Containment accessories:** Conduit fittings.
- **Rewireable installation:** Required.
- **Concealed installation:** Required where appropriate. Surface otherwise.
- **System accessories:** Transient overvoltage surge suppression for data and telecom supplies.
- **Execution:** Removing data distribution systems;
Installing information technology cabling;
and Installing cabinets.
- **System completion:** Testing and inspection of data distribution systems.

Products

Cable baskets

Shared by: 70-70-45/110 Low voltage distribution system; 70-70-75/110 Hard wired low voltage small power system; 70-80-35/110 Hard wired general lighting system; 75-45-20/110 Data distribution system; 75-60-10/110 CCTV system; 75-60-40/110 Intruder

detection and alarm system; 75-65-30/110 Fire detection and alarm system; and 90-55-15/650 Extra low and low voltage cables in accessible roof spaces.

- **Manufacturer:** Contractor's choice.
- **Material:**
- **Coating material:** Hot dip galvanised, powder coated RAL colour to architectural specification
- **Features:**
 - **Segregation:** Cable dividers.
 - **Protective cover:** Required.
- **Execution:** Installing cable basket;
Multiple cable runs;
and Cable support zones.
- **Standard:** To BS EN 61537.

Conduit fittings

Shared by: 70-70-45/110 Low voltage distribution system; 70-70-75/110 Hard wired low voltage small power system; 70-80-35/110 Hard wired general lighting system; and 75-45-20/110 Data distribution system.

- **Manufacturer:** Match conduit.
- **Standards:** To BS EN 61386-1 and to BS EN 61386-21, BS EN 61386-22, or BS EN 61386-23 as appropriate; or to BS 4607-1.
- **Material:**
 - **Type:** Steel and PVC-U.
 - **Finish:** Match conduit.
- **Conduit boxes:** Fit covers of same material and finish as boxes. Include brass earthing terminals in PVC-U boxes.
- **Plugs:**
 - **For metallic boxes:** Manufacturer's standard.
 - **For non metallic boxes:** Manufacturer's standard.
- **Locknuts.:**
 - **For metallic boxes:** Manufacturer's standard.
 - **For non metallic boxes:** Manufacturer's standard.
- **Execution:** Installing conduit, trunking and ducting.

Transient overvoltage surge suppression for data and telecom supplies

Shared by: 75-45-20/110 Data distribution system; and 75-60-10/110 CCTV system.

- **Manufacturer:** Furze
- **Standards:** To BS EN 61643-21.
- **Operating voltage (nominal):** Contractor's choice.
- **Bandwidth:** Contractor's choice.
- **Operating voltage (maximum):** Contractor's choice.
- **Surge current (minimum) per signal wire:** Contractor's choice.
- **Let-through voltage (maximum):** Contractor's choice.
- **Current rating (signal):** Contractor's choice.
- **Thermal overload protection:** Contractor's choice.

- **Mode of protection:** Lines to earth, lines to lines.
- **Enclosure:** Manufacturer's standard.
- **Execution:** Installing transient overvoltage surge suppression devices for mains power supplies and data and telecom supplies.

Execution

Installing information technology cabling

- **Standards:**
 - **Generally:** To BS 6701, BS EN 50174-1 and in accordance with BS 7671.
 - **Indoor installations:** To BS EN 50174-2.
 - **Outdoor installations:** To BS EN 50174-3.
- **Timing:** Do not start internal cabling until building enclosure provides permanently dry conditions.
- **Cables:** Install in one uninterrupted run.
- **Arrangement:** Position vertically and horizontally in line with equipment served, and parallel with building lines.
- **Orientation:** Dress cables flat, free from twists, kinks and strain. Optical fibre cables to be run parallel to, or on top of, copper cables.
- **Cable pulling:** Do not overstress.
- **Cable binders:**
 - **Type:**
 - **Spacing (minimum):** Where used to tie multiple cables together, irregularly space with maximum distance on horizontal cabling runs of 1000 mm and on vertical runs of 300 mm. All cable binders to be loosely fitted.
- **Jointing:** At equipment and terminal fittings only.
- **External cabling:** Terminate within 2 m of entrance to building.
- **Cables routes generally:**
 - **Concealed cable runs to wall accessories:** Run vertically from the accessory.
 - **Exposed cable runs:** Submit proposals.
- **Cable segregation:**
 - **Cables from other systems:** Segregate from other cabling and cross at right angles. Where installed in trunking, locate in a dedicated telecommunications compartment.
 - **Distance from other cables:** In accordance with BS EN 50174-2, section 6.2.
 - **Distance from steam and low temperature hot water systems running parallel:** 500 mm minimum.
- **Terminations:** Support cable within 150 mm of termination.
- **Balanced twisted-pair cabling:**
 - **Pin assignment:**
 - **Maximum untwist at terminations:** 12 mm.

Installing cabinets

- **Cable termination sequence:** Left to right and bottom to top.

- **Clear access (minimum):**
 - **Cabinet front:**
 - **Cabinet rear:**
 - **Cabinet sides:**
- **Fixing:** Level and secure to floor or wall. Group wall-mounted cabinets into logical arrangements.
- **Cable route:** Do not exceed 24 cables in any loom. Maximum distance between cable supports: 300 mm.
- **Patch panels:** Install any fibre optic patch panels at top of cabinet with copper patch panels below.
- **Interconnecting cabinets:** Connect without side panels with manufacturer's baying kit.
- **Cabinet identification:**
 - **Type:**
 - **Colour:**
 - Background:**
 - Lettering:**
 - **Typography:**
 - Font:**
 - Size:**

Installing cable basket

- **Standards:** To BS 7671 and in accordance with IEE Guidance Note 1.
- **Joints:**
 - **Cut:** Adjacent cross basket wires. Make smooth any burrs or edges.
 - **Earth conductors:** Connect across joints.
- **Accessories:** Form on site and connect with basket manufacturer's coupling components.
- **Fire barriers:** Provide where required to maintain fire performance of fabric.
- **Support:**
 - **Fixing arrangement:** Independently fix and support from building structure using threaded rod fixed to channel cable support with shake proof washers and hex nuts;
Independently fix and support from building structure using threaded rod fixed into expanding anchors;
and Independently fix and support from building structure using threaded rod fixed into resin injection anchors.
 - **Clearance from building fabric (minimum):** 20 mm.
- **Components:** Avoid contact between dissimilar metals.
- **Routing of cable basket:** Submit working drawings showing the final routes.

Multiple cable runs

Shared by: 90-55-10/325 Cable baskets; 90-55-10/330 Cable ladders; and 90-55-10/335 Cable trays.

- **Requirement:**

Cable support zones

Shared by: 90-55-10/325 Cable baskets; 90-55-10/330 Cable ladders; and 90-55-10/335 Cable trays.

- **Ceiling voids:**
 - **Clear distance between underside of cable supports and brackets and topside of ceiling (minimum):** Contractor's choice.

Installing conduit, trunking and ducting

Shared by: 90-55-10/460 Conduit fittings; 90-55-10/715 Installing pliable and flexible conduit; 90-55-10/720 Installing rigid metallic conduit; 90-55-10/725 Installing rigid non metallic conduit; 90-55-10/735 Installing conduit connections to equipment; and 90-55-10/765 Conduit, trunking and ducting zones.

- **Standards:** In accordance with BS 7671 and IET Guidance Note 1.
- **Preparation:** Cut square. Remove burrs and sharp edges to make smooth.
- **Protection of metallic conduit, trunking and ducting:**
 - **Joints and ends:** Remove grease, oil, dirt and rust before applying protective paint. Paint immediately following installation.
 - **Protective paint:**
 - Generally:** Compatible with conduit, trunking and ducting finish.
 - Type:** Match factory finish.
- **Cross-sectional area:** Maintain throughout the conduit, trunking and ducting length.
- **Arrangement:** Position vertically and horizontally in line with equipment served, and parallel with building lines.
- **Spare containment:** Install one spare 25 mm diameter conduit from each distribution board to the nearest accessible void space, terminating in a conduit box with lid.
- **Draw wires:** Install galvanized soft iron wires within spare conduit, trunking and ducting.
- **Distance from other services running parallel (minimum):**
 - **Generally:** 150 mm.
 - **Above radiators:** 1000 mm.
 - **Steam services:** 600 mm.
- **Drainage of conduit, trunking and ducting:** Locate drainage outlets at lowest points in conduit, trunking and ducting installed externally, and where condensation may occur.
- **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, trunking and ducting from building structure.
- **Cleaning:** Clean insides of conduit, trunking and ducting before installing cables.
- **Cabling:** Install when conduit, trunking and ducting enclosure is complete.
- **Submittals:** Submit manufacturer's technical information. Submit drawings showing the proposed routes of conduit, trunking and ducting and the location of service outlets.

Installation of surge suppression devices generally type B

- **Standards:** To BS 7671;
To DD CLC/TS 61643-12;
and To DD CLC/TS 61643-22.
- **Equipment:** Provide electrical supplies to equipment requiring power.
- **Fixings:** Non-corroding and compatible with the environment where they are installed.

Installing transient overvoltage surge suppression devices for mains power supplies and data and telecom supplies

- **General requirements:** Installation of surge suppression devices generally type B.
- **Point of installation:** At main low voltage switchboard and At main telephone distribution panel.
- **Transient overvoltage suppression devices:** Interconnect.
- **Control cables between transient overvoltage suppression devices and BMS:** Interconnect.
- **Interconnecting cable:**
 - **Cable type:** Device manufacturer's standard.
 - **Cable size:** Device manufacturer's standard.
 - **Cable length (maximum):** 250 mm.
 - **Cable installation:** Tightly bind connecting leads together.
- **Fuse protection:** Provide fuse protection to transient overvoltage surge suppression devices.
- **Isolation:** Required.

System completion

Testing and inspection of data distribution systems

- **Standards:** To BS EN 50346.
- **Testing and inspection agent:**
- **Notice before commencing tests (minimum):**
- **Inspection of cabling:** Inspect cables for kinks, bends, snags and compression and deformation damage.
- **Permanent link:** Measure length of each cabling segment (connector to connector).
- **Pin assignment and continuity:** Verify and submit results.
- **Cable temperature during testing:** Submit.
- **Results:** Submit in accordance with BS EN 50346, Annex A.
- **Certificates of calibration for meters and instruments:** Submit.

Ω End of system

Audio-frequency-induction-loop system

System outline

Audio-frequency-induction-loop system

- **Description:** The contractor is to design, supply, test and commission a complete induction loop system to the following areas:-

The Shop/Retail Area desk
Makers' Space
Learning Space

The audio loop is to be wired at high level on the ceiling back to the wall mounted induction loop located in a discrete location as agreed with the architect and the museum fit out specialist. The induction loop is to be connected into the audio/visual system installed within the galleries and the Makers area

The systems are to be designed to limit overspill to adjacent areas by using phase shifting loops.

The reception/retail area is to be fitted with desk type audio induction loop.

Each system shall allow easy transfer between areas without having to readjust or change inputs on the user's device. The systems shall consist of a main control box and a concealed loop of cable installed in the room at high level.

In addition, two plug-in portable systems shall be provided which can be taken to any room as and when required.

- **System Performance:** The systems shall be designed and installed in accordance with all relevant Standards, Regulations and best practice:-
 - BS 8300
 - BS 7594
 - BS 5839-9

Design of induction loop systems;
System objectives;
and Multiple loops.

- **System manufacturer:** Gordon Morris Ltd
- **Registration:** Member of Professional Lighting and Sound Association Ltd (PLASA).
- **Arrangement:** Spatial and Reception desk
- **Site assessment:** Site assessment.
- **Source equipment:** Public address system and Microphones, exhibition AV equipment
- **Distribution equipment:** Induction loop amplifiers and Induction loop transformers
- **Equipment interconnectivity:** Wired & wireless.
- **Loop arrangement:** Induction loop pads.

- **Loop cabling:**
 - **Cable type:** PVC insulated cables.
 - **Containment:** Rigid conduit
 - **Rewireable installation:** Required.
 - **Concealed installation:** Required.
- **Trial loop:** Trial loop.
- **System accessories:** Induction-loop monitor receivers;
Induction loop signal generator;
and Loop field strength meters.
- **Execution:** Installing induction-loop systems generally;
Installing induction loop amplifiers;
Installing induction-loop cabling;
Installing MICS/LSZH loop cables;
and Installing loop pads.
- **System completion:** Testing and commissioning induction-loop systems generally;
Equipment labelling and system diagrams;
Documentation;
Spares;
Maintenance;
System re-commissioning;
and Subjective testing.

System performance

Design of induction loop systems

- **Design:** Complete the design of the induction-loop system.
- **Qualifications of designer:** Member of the Institute of Sound and Communication Engineers and Member of the Professional Lighting and Sound Association.
- **Standard:** In accordance with BS 7594, class A2;
In accordance with BS 7594, class A3;
In accordance with BS 7594, class A4;
In accordance with BS 7594, class A5;
and In accordance with BS 7594, class A7.
- **Variations:** None.
- **Requirement:** Submit proposals including detailed design drawings, technical information including location, type and size of loop cable, calculations and manufacturers' literature.
- **System design certificate:** Submit with design proposals.
- **Equipment:** Provide electrical supplies to equipment requiring power.

System objectives

- **Environment:** Indoors.
- **Standard:** In accordance with BS 7594.
- **System objectives:** As system description
- **Listening plane:** Horizontal plane 1450 mm above finished floor level.
- **Coverage area:** As shown on drawings
- **Working area:** To be determined by induction loop specialist

- **Frequency response:** Maximum variation of ± 3 dB over the range 100 Hz–5 kHz.
- **Speech transmission index value (minimum):** 0.74.

Multiple loops

- **Objective:** To cover a large area;
To improve coverage in areas with interference caused by steel in the building fabric;
and To minimize overspill.

Products

Cable cleats

Shared by: 70-70-45/110 Low voltage distribution system; 70-70-75/110 Hard wired low voltage small power system; and 90-55-15/735 Cable installation on channel cable supports, cable tray, cable ladder and cable basket.

- **Manufacturer:** Contractor's choice.
- **Standard:** To BS EN 61914.
- **Format:** Contractor's choice.
- **Material:** Metallic.
- **Temperatures for permanent installation:**
 - **Maximum:** 105°C.
 - **Minimum:** -25°C.
- **Resistance to impact:** Heavy.
- **Type of retention or resistance to electromechanical forces:** Resistant to electromechanical forces, withstanding one short circuit.
- **Environmental influences:**
 - **Non-metallic and composite components:** Resistant to ultraviolet light.
 - **Metallic and composite components:** High resistance to corrosion.

Cable ties

Shared by: 70-70-45/110 Low voltage distribution system; 70-70-75/110 Hard wired low voltage small power system; and 90-55-15/735 Cable installation on channel cable supports, cable tray, cable ladder and cable basket.

- **Manufacturer:** Contractor's choice.
- **Standard:** To BS EN 62275.
- **Format:** Wrap around self-locking releasable.
- **Material:** Nylon and Metal.
- **Loop tensile strength (minimum):** Manufacturer's standard.
- **Temperatures for permanent installation:**
 - **Maximum:** 60°C.
 - **Minimum:** -15°C.
- **Contribution to fire:** Non-flame propagating.
- **Environmental influences:**
 - **Non-metallic and composite components:** Resistant to ultraviolet light.
 - **Metallic and composite components:** Resistant to corrosion.

Cable bands

Shared by: 70-70-45/110 Low voltage distribution system; and 90-55-15/735 Cable installation on channel cable supports, cable tray, cable ladder and cable basket.

- **Manufacturer:** Contractor's choice.
- **Material:** Manufacturer's standard.
- **Protective covering:** Manufacturer's standard.

Cable baskets

Shared by: 70-70-45/110 Low voltage distribution system; 70-70-75/110 Hard wired low voltage small power system; 70-80-35/110 Hard wired general lighting system; 75-45-20/110 Data distribution system; 75-60-10/110 CCTV system; 75-60-40/110 Intruder detection and alarm system; 75-65-30/110 Fire detection and alarm system; and 90-55-15/650 Extra low and low voltage cables in accessible roof spaces.

- **Manufacturer:** Contractor's choice.
- **Material:**
- **Coating material:** Hot dip galvanised, powder coated RAL colour to architectural specification
- **Features:**
 - **Segregation:** Cable dividers.
 - **Protective cover:** Required.
- **Execution:** Installing cable basket;
Multiple cable runs;
and Cable support zones.
- **Standard:** To BS EN 61537.

Cable trays

Shared by: 70-70-45/110 Low voltage distribution system; 70-70-75/110 Hard wired low voltage small power system; 75-60-10/110 CCTV system; and 90-55-15/650 Extra low and low voltage cables in accessible roof spaces.

- **Manufacturer:** Contractor's choice.
- **Standard:** To BS EN 61537.
- **Material:** Steel.
- **Resistance against flame propagation:** Non-Flame propagating.
- **Electrical properties:**
 - **Continuity characteristics:** Without electrical continuity.
 - **Conductivity characteristics:** Without electrical conductive system component.
- **Coating material:** Hot dip galvanised, powder coated RAL colour to architectural specification
- **Temperature properties for transport, storage, installation and application:**
 - **Minimum:** Manufacturer's standard.
 - **Maximum:** Manufacturer's standard.
- **Mechanical properties:**
 - **Cable tray free base area:** Manufacturer's standard.
 - **Resistance to impact:** Manufacturer's standard.

- **Features:**
 - **Flange type:** Return.
 - **Segregation:** Cable dividers.
 - **Protective cover:** Required.
- **Execution:** Installing cable tray and cable ladder;
Installing cable supports on roofs;
Multiple cable runs;
and Cable support zones.

Rigid conduit

Shared by: 70-70-25/660 Installing main earthing conductor; 70-70-45/110 Low voltage distribution system; 70-70-75/110 Hard wired low voltage small power system; 70-80-35/110 Hard wired general lighting system; 75-45-40/110 Audio-frequency-induction-loop system; 75-60-05/110 Access control system; 75-60-40/110 Intruder detection and alarm system; 75-65-30/110 Fire detection and alarm system; 75-70-05/110 Assistance call system; and 90-55-15/645 Low voltage cables concealed in walls and partitions.

- **Manufacturer:** Contractor's choice.
- **Standards:** To BS EN 61386-21.
- **Mechanical properties:**
 - **Resistance to compression:** Heavy.
 - **Resistance to impact:** Heavy.
- **Transport, installation and application:**
 - **Lower temperature (minimum):** Manufacturer's standard.
 - **Upper temperature (maximum):** Manufacturer's standard.
- **Resistance to bending:** Rigid.
- **Electrical characteristics:** With electrical continuity properties.
- **Resistance to external influences:**
 - **Protection against ingress of solid objects (minimum):** To BS EN 60529, IP3X.
 - **Protection against ingress of water (minimum):** To BS EN 60529, IPX0.
- **Resistance to corrosion:** To BS EN 61386-1, Class 4.
- **Tensile strength:** Heavy.
- **Resistance to flame propagation:** Manufacturer's standard.
- **Suspended load capacity:** Heavy.
- **Colour:** Submit proposals.
- **Sizes (OD):** 25 mm.
- **Execution:** Installing rigid metallic conduit;
Installing rigid non metallic conduit;
Installing conduit connections to equipment;
and Conduit, trunking and ducting zones.

Cable trunking and cable ducting systems

Shared by: 70-70-45/110 Low voltage distribution system; 70-70-75/110 Hard wired low voltage small power system; 70-80-35/110 Hard wired general lighting system; 75-60-05/110 Access control system; 75-60-40/110 Intruder detection and alarm system; 75-65-30/110 Fire detection and alarm system; 75-70-05/110 Assistance call system; 75-70-

05/120 Emergency voice communication system; and 90-55-15/650 Extra low and low voltage cables in accessible roof spaces.

- **Manufacturer:** Contractor's choice.
- **Standards:** To BS EN 50085-1 and BS EN 50085-2-1.
- **Material:** Metallic;
Non-metallic;
and Steel.
- **Construction:** To include means of preventing contact between liquids and insulated conductors and live parts.
- **Temperature properties:**
 - **Storage and transport temperature (maximum):** Manufacturer's standard.
 - **Installation and application temperature (minimum):** Manufacturer's standard.
 - **Application temperature (maximum):** Manufacturer's standard.
- **Resistance to flame propagation:** Required.
- **Electrical properties:** With electrical continuity characteristics.
- **Ingress protection (minimum):** To BS EN 60529, IP x4.
- **Protection against corrosive and polluting substances:** High protection outside and inside.
- **Access method:** With tools.
- **Screening:** Required.
- **Execution:** Conduit, trunking and ducting zones and Installing trunking generally.

PVC insulated cables

Shared by: 70-70-25/110 Earthing and bonding system; 70-70-45/110 Low voltage distribution system; 75-45-40/110 Audio-frequency-induction-loop system; 90-65-05/630 Installing combined daylight and occupancy sensors; 90-65-05/640 Installing daylight sensors; 90-65-05/660 Installing mains voltage occupancy detectors; and 90-65-05/670 Installing photoelectric control units.

- **Manufacturer:** Contractor's choice.
- **Standard:** To BS 6004.
- **Third party certification:** British Approvals Service for Cables (BASEC) certified.
- **Rigid PVC insulated cables (PVC singles, H07V):**
 - **Construction:** To table 4a.
 - **Size:** Refer to cable schedule
- **PVC insulated and PVC sheathed cables (PVC/ PVC):**
 - **Construction:** To table 7.
 - **Sheath colour:** Manufacturer's standard.
 - **Size:** Refer to cable schedule
- **PVC insulated, PVC sheathed cables with circuit protective conductor (PVC/ PVC with CPC):**
 - **Construction:** To table 8.
 - **Size:** Refer to cable schedule
- **Heat resisting PVC insulated cables (HR PVC singles, H07V-K):**
 - **Construction:** To table 11a.
 - **Size:** Refer to cable schedule

- **Execution:** Installing low voltage cables;
Extra low and low voltage cable routes;
Low voltage cables concealed in walls and partitions;
Extra low and low voltage cables in accessible roof spaces;
Extra low and low voltage surface mounted cables;
Installing low voltage cables in conduit and trunking;
and Cable installation on channel cable supports, cable tray, cable ladder and cable basket.

Loop field strength meters

- **Manufacturer:** Specialist manufacturer
- **Format:** Peak programme meter (PPM).
- **Quantity:** Manufacturer's standard.
- **Frequency response:**
 - **Response range (relative to 0 dB at 0.56 A/m):** Manufacturer's standard.
 - **Characteristics:** Normal and EQ (equalized).
- **Display:** Manufacturer's standard.
- **Battery low indicator:** Required.
- **Execution:** Installing electrical monitoring and metering equipment.

Microphones

- **Manufacturer:** To be completed by user
- **Standard:** To BS EN 60268-4.
- **Element:** Induction loop specialists recommendation
- **Frequency response:** Match system parameters.
- **Polar pattern:** Omni-directional.
- **Sensitivity (open circuit):** Manufacturer's standard.
- **Impedance (maximum):** 600 ohm.
- **Controls:** Manufacturer's standard.
- **Cable connector:** XLR male connection.
- **Accessories:** Fixed microphone stand;
Gooseneck stand;
and Separate power supply.
- **Mounting:** Desktop.

Induction loop pads

- **Manufacturer:** To be completed by user
- **Loop cables:** Encapsulated within flexible plastic cover.

Induction loop amplifiers

- **Manufacturer:** To be completed by user
- **Standard:** To BS EN 60118-4 and BS 7594.
- **Format:** Current drive.
- **Inputs:**
 - **Quantity:** As required for each loop
 - Type:** XLR socket.

- **Mix control:** Not required.
- **Total harmonic distortion:** 0.5 %.
- **Light emitting diode (LED) indication:** Loop active.
Power on/ off.
- **Output loop impedance:**
 - **Minimum:** Manufacturer's standard.
 - **Maximum:** Manufacturer's standard.
- **Phantom power:** Manufacturer's standard.
- **Features:** Manufacturer's standard.
- **Auxiliary voltage output:** Manufacturer's standard.
- **Mounting:** Rack mounted;
Under counter;
and Wall.

Induction-loop monitor receivers

- **Manufacturer:** To be completed by user
- **Format:** Fixed.
- **Frequency response:**
 - **Response range (relative to 0 dB at 0.56 A/m):** -40 dB to 3 dB.
 - **Characteristics:** Normal and EQ (equalized).
- **Loudspeaker output:** Required.
- **Headphone output:** Required.
- **On/ off with volume control:** Required.
- **Alarm output:** Manufacturer's standard.
- **Battery low indicator:** Manufacturer's standard.

Induction loop signal generator

- **Manufacturer:**
- **Purpose:**
- **Power supply:** Battery.
- **Output connector:** Stereo 3.5 mm audio.
- **Magnetic field strength (relative to 0 dB at 0.56 A/m):**
- **Duty (on:off):** 1:4.

Induction loop transformers

- **Manufacturer:**
- **Format:**
- **Enclosure:**
 - **Ingress protection (minimum):** To BS EN 60529, IP65
 - **Material:**
 - **Finish:**

Execution

Site assessment

- **Site assessment:** Determine the suitability of the site for use with induction-loop systems.
 - **Qualifications of assessor:** Member of the Institute of Sound and Communication Engineers and Member of the Professional Lighting and Sound Association.
- **Report:**
 - **Submit the following information:**
 - Content:** Use of the premises.
Location and dimensions of the working
Building construction and its impact on an induction-loop system. area.
The presence of electrical equipment and its impact on an induction-loop system.
Background magnetic field measurements.
The impact on equipment due to the presence of an induction-loop system.
Incoming low voltage connection earthing type.
Suggested routes for microphone and loop wiring.
Location and details of existing induction-loop system equipment
 - Quantity:** Contractor's choice.

Installing induction-loop systems generally

- **Installation:** In accordance with BS 7594 and BS 7671.
- **Equipment interconnectivity:** All components of the induction loop system to be derived from the same electrical phase.

Installing induction-loop cabling

- **Position:** Ceiling level and Floor level.
- **Timing:** Keep cabling dry. Commence internal cabling when building enclosure provides permanently dry conditions.
- **Cables:** Install in one length. Segregate from band II voltages.
- **Cable pulling:** Submit proposals.
- **Cables passing through walls:** Sleeve with conduit or pipeduct. Bush at both ends.
- **Jointing:** At equipment and terminal fittings only.
- **Separation from other audio cables when run in parallel (minimum):** 1 m.
- **Cable route:** Permanently identify.

Installing loop pads

- **Position:** Concealed below counter top.
- **Fixing:** Self adhesive hook and loop tape.

Trial loop

- **Position:** Contractor's choice.
- **Measurements:**
 - **Meter:** Loop field strength meter.
 - **Measurement grid:** Contractor's choice.
 - **Magnetic field strength:** Measure.
 - **Coverage area:** Determine.
 - **Results:** Submit.

Installing cable tray and cable ladder

Shared by: 90-55-10/330 Cable ladders; and 90-55-10/335 Cable trays.

- **Standards:** To BS 7671 and in accordance with IET guidance note 1.
- **Preparation:**
 - **Burrs and sharp edges:** Make smooth.
 - **Cutting:** Minimize and make good edges. Cuts to cable tray to be square along an unperforated line.
 - **Treatment of cut surface:** Extend 25 mm beyond the cut. Match finish of cable supports.
- **Access:** Provide space around cable ladder and tray 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 ladder and tray:** Maximize.
 - **Ends:** Blank with end plates.
- **Changes of size and direction:** Manufacturer's accessories of the same material type, pattern, finish and thickness as cable supports.
- **Fire barriers:** Provide where required to maintain fire performance of fabric.
- **Protective covers:** Provide to cables requiring mechanical protection.
- **Support:**
 - **Fixing arrangement:** Independently fix and support from building structure using threaded rod fixed to channel cable support with shake proof washers and hex nuts;
Independently fix and support from building structure using threaded rod fixed into expanding anchors;
and Independently fix and support from building structure using threaded rod fixed into resin injection anchors.
 - **Clearance from building fabric (minimum):** 20 mm.
- **Components:** Avoid contact between dissimilar metals.
- **Routing of cable ladder and tray:** Submit working drawings showing the final routes.

Installing cable basket

- **Standards:** To BS 7671 and in accordance with IEE Guidance Note 1.
- **Joints:**

- **Cut:** Adjacent cross basket wires. Make smooth any burrs or edges.
- **Earth conductors:** Connect across joints.
- **Accessories:** Form on site and connect with basket manufacturer's coupling components.
- **Fire barriers:** Provide where required to maintain fire performance of fabric.
- **Support:**
 - **Fixing arrangement:** Independently fix and support from building structure using threaded rod fixed to channel cable support with shake proof washers and hex nuts;
Independently fix and support from building structure using threaded rod fixed into expanding anchors;
and Independently fix and support from building structure using threaded rod fixed into resin injection anchors.
 - **Clearance from building fabric (minimum):** 20 mm.
- **Components:** Avoid contact between dissimilar metals.
- **Routing of cable basket:** Submit working drawings showing the final routes.

Installing cable supports on roofs

Shared by: 90-55-10/330 Cable ladders; and 90-55-10/335 Cable trays.

- **Position:** Elevate above roof.
- **Mounting:** Load spreading supports.

Multiple cable runs

Shared by: 90-55-10/325 Cable baskets; 90-55-10/330 Cable ladders; and 90-55-10/335 Cable trays.

- **Requirement:**

Cable support zones

Shared by: 90-55-10/325 Cable baskets; 90-55-10/330 Cable ladders; and 90-55-10/335 Cable trays.

- **Ceiling voids:**
 - **Clear distance between underside of cable supports and brackets and topside of ceiling (minimum):** Contractor's choice.

Installing conduit, trunking and ducting

Shared by: 90-55-10/460 Conduit fittings; 90-55-10/715 Installing pliable and flexible conduit; 90-55-10/720 Installing rigid metallic conduit; 90-55-10/725 Installing rigid non metallic conduit; 90-55-10/735 Installing conduit connections to equipment; and 90-55-10/765 Conduit, trunking and ducting zones.

- **Standards:** In accordance with BS 7671 and IET Guidance Note 1.
- **Preparation:** Cut square. Remove burrs and sharp edges to make smooth.
- **Protection of metallic conduit, trunking and ducting:**
 - **Joints and ends:** Remove grease, oil, dirt and rust before applying protective paint. Paint immediately following installation.
 - **Protective paint:**

Generally: Compatible with conduit, trunking and ducting finish.

Type: Match factory finish.

- **Cross-sectional area:** Maintain throughout the conduit, trunking and ducting length.
- **Arrangement:** Position vertically and horizontally in line with equipment served, and parallel with building lines.
- **Spare containment:** Install one spare 25 mm diameter conduit from each distribution board to the nearest accessible void space, terminating in a conduit box with lid.
- **Draw wires:** Install galvanized soft iron wires within spare conduit, trunking and ducting.
- **Distance from other services running parallel (minimum):**
 - **Generally:** 150 mm.
 - **Above radiators:** 1000 mm.
 - **Steam services:** 600 mm.
- **Drainage of conduit, trunking and ducting:** Locate drainage outlets at lowest points in conduit, trunking and ducting installed externally, and where condensation may occur.
- **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, trunking and ducting from building structure.
- **Cleaning:** Clean insides of conduit, trunking and ducting before installing cables.
- **Cabling:** Install when conduit, trunking and ducting enclosure is complete.
- **Submittals:** Submit manufacturer's technical information. Submit drawings showing the proposed routes of conduit, trunking and ducting and the location of service outlets.

Installing conduit generally

Shared by: [90-55-10/715 Installing pliable and flexible conduit](#); [90-55-10/720 Installing rigid metallic conduit](#); [90-55-10/725 Installing rigid non metallic conduit](#); and [90-55-10/735 Installing conduit connections to equipment](#).

- **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:**
 - **Generally:** 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:**
 - **Generally:** Install flush with finished surfaces. Provide extension rings if required.
 - **Fixing screws:** Countersunk, or round-headed screws.

- **Number of fixings (minimum):** Two.
 - **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):** Two.
 - **Floors:** Do not install draw-in boxes in floors.
- **Conduit in walls:** Avoid concealed horizontal runs.
- **Suspended ceiling installations:** Fasten outlet boxes to structure above ceiling.

Installing rigid metallic conduit

- **General requirements:** Installing conduit generally and Installing conduit, trunking and ducting.
- **Fixings:** Distance saddle; Saddle; and Spacer bar saddle.
- **Joints:** Plain and 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.

Installing rigid non metallic conduit

- **General requirements:** Installing conduit generally and Installing conduit, trunking and ducting.
- **Fixings:** Distance saddle; Saddle; and Spacer bar saddle.
- **Joints:** Compression and Threaded.
- **Conduit connections to boxes and items of equipment:** Threaded bushed entries.

Installing conduit connections to equipment

Shared by: 90-55-10/360 Flexible conduit; and 90-55-10/380 Rigid conduit.

- **General requirements:** Installing conduit generally and Installing conduit, trunking and ducting.
- **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 of adequate length to facilitate removal of equipment for maintenance. Final termination in swivel connectors.
- **Connections to external equipment:** Flexible conduit.

Installing trunking generally

- **Supports and mounting arrangement:** Wall mounted;
Ceiling mounted;
Floor mounted;
Purpose made brackets;
and Suspension rods and steel channels.
- **Changes of direction:** Manufacturer's bends and tees.
- **Joints:**
 - **Generally:** 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.
- **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.

Conduit, trunking and ducting zones

Shared by: 90-55-10/360 Flexible conduit; 90-55-10/380 Rigid conduit; and 90-55-10/410 Cable trunking and cable ducting systems.

- **General requirements:** Installing conduit, trunking and ducting.
- **Ceiling voids:** Provide clear distance of 150 mm (minimum) between underside of any conduit, trunking or trunking and the topside of ceiling.

Installing low voltage cables

Shared by: 90-55-15/342 Fire resistant, insulated and sheathed cables; 90-55-15/345 PVC insulated cables; 90-55-15/346 PVC insulated cables for interconnecting wiring; 90-55-15/349 Single-core heat resisting insulating cables; 90-55-15/351 Thermosetting insulated cables; 90-55-15/352 Thermosetting insulated and PVC sheathed cables (XLPE/ PVC singles); 90-55-15/355 Thermosetting insulated metal screened LSZH sheathed multicore cables; 90-55-15/665 Installing flexible cords; 90-55-15/670 Installing prefabricated wiring; and 90-55-15/680 Installing low voltage armoured cables.

- **Standard:** In accordance with 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. Clear cable path of debris.
- **Installation temperature (minimum):** 5°C.
- **Cables:** Install in one length. Dress cables flat, free from twists, kinks and strain.
- **Cable pulling:** Do not overstress. Prevent kinks and twisting of the cable.
- **Cable protection:** Cables passing through walls and floors to be sleeved with conduit or pipeduct to a minimum of 300 mm. Bush at both ends. Ensure that appropriate fire stopping materials are used to maintain the original fire integrity of the wall or floor around the penetration.
- **Concealed cable runs to wall accessories:** Run vertically from the accessory.
- **Exposed cable runs:**
- **Distance from other services running parallel (minimum):** 150 mm. Position cables below heating pipes.
- **Jointing and termination:**
 - **Final circuit cables:** At electrical accessories only.
 - **Core connections:** Using compression lugs to equipment without integral clamping terminals.
 - **Terminating cables when not using glands:** Take sheathing of cables into accessory boxes and equipment and protect against abrasion with grommets.

Extra low and low voltage cable routes

Shared by: 90-55-15/342 Fire resistant, insulated and sheathed cables; 90-55-15/343 Fire resistant, insulated and sheathed armoured cables; 90-55-15/344 Mineral insulated cables type A and type B; 90-55-15/345 PVC insulated cables; 90-55-15/346 PVC insulated cables for interconnecting wiring; 90-55-15/351 Thermosetting insulated cables; 90-55-15/352 Thermosetting insulated and PVC sheathed cables (XLPE/ PVC singles); 90-55-15/353 Thermosetting insulated and PVC sheathed armoured cables; 90-55-15/354 Thermosetting insulated and LSZH sheathed armoured cables; 90-55-15/355 Thermosetting insulated metal screened LSZH sheathed multicore cables; 90-55-15/366 Balanced twisted-pair cables; 90-55-15/385 Prefabricated LSZH insulated singles in flexible conduit; and 90-55-15/386 Prefabricated LSZH insulated and sheathed multi-core.

- **Cables generally:**
 - **Concealed cable runs to wall accessories:** Run vertically from the accessory.
 - **Exposed cable runs:** Contractor's choice.
- **Distance from other services running parallel (minimum):** 150 mm. Position cables below heating pipes.

Low voltage cables concealed in walls and partitions

Shared by: 90-55-15/342 Fire resistant, insulated and sheathed cables; 90-55-15/343 Fire resistant, insulated and sheathed armoured cables; 90-55-15/344 Mineral insulated cables type A and type B; 90-55-15/345 PVC insulated cables; 90-55-15/346 PVC insulated cables for interconnecting wiring; 90-55-15/351 Thermosetting insulated cables; 90-55-15/352 Thermosetting insulated and PVC sheathed cables (XLPE/ PVC singles); 90-55-15/353 Thermosetting insulated metal screened LSZH sheathed multicore cables; 90-55-15/385 Prefabricated LSZH insulated singles in flexible conduit; and 90-55-15/386 Prefabricated LSZH insulated and sheathed multi-core.

- **Position:** In a zone within 150 mm of wall perimeter (except at the floor); and run vertically or horizontally from these zones, or from floor level, to switches,

accessories, etc and At least 50 mm from the surface. Ensure all routes are agreed with architect (working drawings) to ensure historic fabric is maintained.

- **Protection:** Rigid conduit and Cover with galvanized steel channel nailed to substrate.

Extra low and low voltage cables in accessible roof spaces

Shared by: 90-55-15/340 Flexible cords; 90-55-15/342 Fire resistant, insulated and sheathed cables; 90-55-15/343 Fire resistant, insulated and sheathed armoured cables; 90-55-15/344 Mineral insulated cables type A and type B; 90-55-15/345 PVC insulated cables; 90-55-15/346 PVC insulated cables for interconnecting wiring; 90-55-15/351 Thermosetting insulated cables; 90-55-15/352 Thermosetting insulated and PVC sheathed cables (XLPE/ PVC singles); 90-55-15/353 Thermosetting insulated and PVC sheathed armoured cables; 90-55-15/354 Thermosetting insulated and LSZH sheathed armoured cables; 90-55-15/355 Thermosetting insulated metal screened LSZH sheathed multicore cables; 90-55-15/366 Balanced twisted-pair cables; 90-55-15/385 Prefabricated LSZH insulated singles in flexible conduit; and 90-55-15/386 Prefabricated LSZH insulated and sheathed multi-core.

- **Cables running across ceiling joists:** Cable baskets;
Cable trays;
and Cable trunking and cable ducting systems.

Extra low and low voltage surface mounted cables

Shared by: 90-55-15/340 Flexible cords; 90-55-15/342 Fire resistant, insulated and sheathed cables; 90-55-15/343 Fire resistant, insulated and sheathed armoured cables; 90-55-15/344 Mineral insulated cables type A and type B; 90-55-15/345 PVC insulated cables; 90-55-15/346 PVC insulated cables for interconnecting wiring; 90-55-15/351 Thermosetting insulated cables; 90-55-15/352 Thermosetting insulated and PVC sheathed cables (XLPE/ PVC singles); 90-55-15/353 Thermosetting insulated and PVC sheathed armoured cables; 90-55-15/354 Thermosetting insulated and LSZH sheathed armoured cables; 90-55-15/355 Thermosetting insulated metal screened LSZH sheathed multicore cables; and 90-55-15/366 Balanced twisted-pair 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.

Installing low voltage cables in conduit and trunking

Shared by: 90-55-15/342 Fire resistant, insulated and sheathed cables; 90-55-15/343 Fire resistant, insulated and sheathed armoured cables; 90-55-15/344 Mineral insulated cables type A and type B; 90-55-15/345 PVC insulated cables; 90-55-15/346 PVC insulated cables for interconnecting wiring; 90-55-15/349 Single-core heat resisting insulating cables; 90-55-15/351 Thermosetting insulated cables; 90-55-15/352 Thermosetting insulated and PVC sheathed cables (XLPE/ PVC singles); 90-55-15/353 Thermosetting insulated and PVC sheathed armoured cables; 90-55-15/354 Thermosetting insulated and LSZH sheathed armoured cables; 90-55-15/355 Thermosetting insulated metal screened LSZH sheathed multicore cables; 90-55-15/366 Balanced twisted-pair cables; 90-55-15/385 Prefabricated LSZH insulated singles in flexible conduit; and 90-55-15/386 Prefabricated LSZH insulated and sheathed multi-core.

- **Cable installation:** Orderly and capable of being withdrawn.
- **Single core wiring:** Arrange using the loop-in method.

- **Cables within trunking:** Tie at 2 m intervals for cables of the same circuit reference. Label ties with circuit reference number at 10 m intervals.
- **Cables in vertical conduit:** Provide cable clamps in accessible conduit boxes at 5 m intervals.
- **Extra low voltage cables:** Install within a separate partition from low voltage cables where installed in multi compartment trunking.

Cable installation on channel cable supports, cable tray, cable ladder and cable basket

Shared by: 90-55-15/342 Fire resistant, insulated and sheathed cables; 90-55-15/343 Fire resistant, insulated and sheathed armoured cables; 90-55-15/344 Mineral insulated cables type A and type B; 90-55-15/345 PVC insulated cables; 90-55-15/346 PVC insulated cables for interconnecting wiring; 90-55-15/351 Thermosetting insulated cables; 90-55-15/353 Thermosetting insulated and PVC sheathed armoured cables; 90-55-15/354 Thermosetting insulated and LSZH sheathed armoured cables; and 90-55-15/355 Thermosetting insulated metal screened LSZH sheathed multicore cables.

- **Cabling:** Install when cable supports are complete.
- **Position:** Place single and multi-core cables side by side.
- **Fastening:**
 - **Fastenings generally:** Secure cables, do not indent sheaths. Position to enable any submain cable to be individually removed.
 - **Submain cables <95 mm²:** Cable cleats.
Spacing (maximum): 600 mm.
 - **Submain cables >95 mm²:** Cable cleats and Cable bands.
Spacing (maximum): 600 mm.
 - **Final circuit cabling:** Cable ties.
Spacing (maximum): 600 mm.
 - **Extra low voltage, communications and fibre optic cabling:** Cable ties.
Spacing (maximum): 600 mm.

Installing electrical monitoring and metering equipment

Shared by: 90-65-55/320 Digital metering equipment; and 90-65-55/360 Loop field strength meters.

- **Standard:** In accordance with BS 7671.
- **Digital metering equipment:** Connect to building management system.

System completion

Testing and commissioning induction-loop systems generally

- **Standard:** In accordance with BS 7594.
- **System commissioning agent:** System manufacturer.
- **Notice before commencing tests (minimum):** Two weeks.
- **Areas where magnetic field strength and signal-to-noise ratio falls below design parameters:** Identify on layout drawing.
- **System commissioning:**
 - **Method:** Submit proposals.

- **Meter:** Loop field strength meter.
- **Input equipment:** Commission.
- **Output controls:** Commission and adjust.
- **Equalizers and auxiliary passive elements:** Commission.
- **Measurement grid:** Contractor's choice.
- **Magnetic field strength:** Measure.
- **Coverage area:** Determine.
- **Working area:** Determine.
- **Speech transmission index value (minimum):** Measure in accordance with BS EN 60268-16.
- **Results:** Submit.
- **Cable testing:** As required
 - **Insulation resistance:** Submit results.
 - **Earth continuity:** Submit results.
 - **Loop current:** Measure.
- **Loop:** Measure resistance. Verify loop is operating within design limits.

Equipment labelling and system diagrams

- **Equipment rack:** Label with a unique identification code.
- **Final amplifiers:** Label with induction-loop identification information.
- **System diagram:**
 - **Include the following:** Show the location and identity of system equipment and routes.
 - **Position:** Next to the final amplifier.

Documentation

- **Operating and maintenance instructions:**
 - **Scope:** Submit for the system giving optimum settings for controls.
 - **Product information:** Include product description, date of purchase, performance characteristics, application (suitability for use), method of operation and control, and cleaning and maintenance requirements.
 - **Format:** Paper copy.
 - **Number of copies:** Three.
- **Record drawings:**
 - **Content:** General arrangement drawings showing the location of all air terminals, tapes, earth rods, plates and electrodes, test joints, and plates, route of protective bonding conductors from the lightning protection system to other services and to the main earthing terminal.
 - **Format:** A1 paper print drawing and Electronic drawing.
 - **Number of copies:** Three.
- **Submittal date:** At handover.

Spares

- **Spare fuses:**
 - **Quantity (minimum):** Contractor's choice.

Maintenance

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

System re-commissioning

- **Induction-loop system:** Re-commission.
- **Timing:** Contractor's choice.

Subjective testing

- **Area of test:**
- **Objective:**
- **Timing:**
- **Panellists:**
- **Results:** Submit.

Ω End of system

Access control system

System outline

Access control system

- **Description:** The Contractor shall employ a Security Specialist to design, supply, install, test and commission a door entry access system to external and internal doors as detailed within the specification and shown on the layout drawings.

The Access control system shall provide a controlled and secure building area that encompasses the philosophy of locating card readers on all entrances as shown on the layouts, specialist areas and areas containing high value equipment.

Each card reader requires a network point on the secure side of the door and will be allocated an IP address by the clients IT department. In addition each door position will require an interface to the fire alarm system, with the system configured to fail open on activation of the fire alarm. All staff will be issued with intelligent proximity cards, which will grant access to areas as appropriate.

An intercomm shall be provided at the Blue Boar Street Entrance which provides audio and video interface and information to the adjacent office area. The operator within the office area shall be able to communicate with the Blue Boar street entrance and release the door allowing access to the lobby. Release and communication from the entrance to the flats above has yet to be determined. Allowance shall be made for and release and interfaces with the above flats at tender stage.

System Performance

The access control system shall be capable of the following: -

- Networkable up to 256 doors.
- 10,000 card holder record facility.
- Up to 32 time zones with four start/stop times.
- Unlimited number of access groups.
- Three holiday schedules.
- PC system operators each with password protection
- Operate upon All Microsoft Windows platforms, inclusive of latest Windows.

The access control system shall manage the movement of personnel using the following: -

- A desktop PC for the system administration, addition and editing of personnel details, report generation and acknowledgement of system alarms.
 - Door controllers and door functions.
 - Readers, door monitoring contacts and exit switches.
- The system shall include all control equipment, all hardware and software, and all cabling and ancillary services including training.

Equipment to be Installed

Card Readers:

Door Interface Unit:

Emergency Door Release:
Green break glass unit

Exit Button:
Touch sensitive (where required)

Locking Mechanisms

Surface mounted magnetic locks of a minimum 15kN holding force.

Automatic Doors: refer to door manufacturers recommended equipment

Power: 230v Power supply via non switched fused connection unit adjacent to the DIU position

Network Connection: Standard network point (RJ45) adjacent to DIU position

Fire Alarm Interface: I/O module (volt free contact) adjacent to DIU position

The Electrical Sub-Contractor shall provide all cable containment associated with the access control system.

The Electrical Sub-Contractor shall also provide the relevant quantity of fire alarm interfaces to the door controllers to allow the doors being controlled to 'fail safe' upon activation of the fire alarm.

To each door controller, a power supply unit shall be installed above the ceiling void. The unit shall be fitted with a tamperproof switch.

The Electrical Contractor shall liaise with the Security Specialist during tender and shall allow for supplying and installing all additional containment, external containment shall be galvanised steel conduit fixed to the structure.

Locks

The internal release of these doors (on secure side) shall be controlled via a touch sensitive 'request to exit' button or via an exit card reader as indicated on the drawings. In all cases an emergency breakglass unit (green in colour) shall be provided and wired in series with the power supply to the lock. The breakglass units shall have a lift up Perspex hinged cover and mounted at 1200mm above finished floor level.

The breakglass unit shall be labelled 'DOOR RELEASE - EMERGENCY USE ONLY'.

Readers

All card readers shall be provided as part of the security specialist package. All readers shall be securely fixed using tamperproof fixings and wired via flush conduits. Close site liaison is required to ensure that the conduit is installed to a position where the reader operation will not be undermined.

The Door Interface master controller unit shall be connected to an addressable 230V

interface on the fire alarm system to ensure that the respective doors are unlocked upon activation of a fire alarm. The Electrical Contractor shall allow for cabling between the Door Interface master door controller and the fire alarm interface.

All external card readers shall have a minimum rating of IP65 and shall be vandal resistant. All card readers shall include red/green status indicator lights to indicate when access is denied or granted.

Wiring to Equipment

Cables shall generally be standard 4-pair data type where length is not subject to significant restriction. However, care shall be taken when sizing cables to magnetic locks to ensure that resulting volt drop does not undermine the effective and continual operation of the device.

The Security Contractor shall provide and install the complete cabling between readers, locks, contacts, system controllers and etc, to provide a fully operational system.

Equipment shall be wired in accordance with approved connection diagrams. Where cable connections are made into equipment, a numbered marker sleeve shall be fitted to cable-core, which shall correspond to the wiring diagram.

Ensure that all wiring connections are correctly made before any equipment is set to work. Soldered ends shall be provided for termination.

Cable tails to terminals shall be of sufficient length and be neatly dressed and arranged to prevent development of tension in the cable or on the termination. All cables shall be tethered within enclosures securely.

The security specialist shall ensure early communication with the electrical contractor to ensure all power supplies and interfaces are installed in a timely manner and allowed for as part of the tender costing package.

The Client's preferred specialist is

Gary Cheeseman of
Pyrotec Services Ltd
Avalon House,
Marcham Rd,
Abingdon,
OX14 1TZ
Phone: 01235 524469

- **System Performance:** To provide a card access system to the client's requirements to limit access to areas of the site as indicated on the drawings.

BS 7671; IEE Wiring Regulations
BS EN 50133; alarm systems and access control
Relevant British Standards
NACOSS Code of Practice;
In accordance with the requirements of the fire officer;
SDS 2002.
NSI NCAP 30 - Code of Practice for the Provision of Access Control Systems and Company

Access control points and Connection to fire detection and alarm systems.

- **System manufacturer:** A member of British Security Industry Association;
A Gold member of National Security Inspectorate;
and A member of Security Systems and Alarms Inspection Board
- **Standards:** To BS EN 50133-1 and in accordance with BS EN 50133-7.
- **Operation in the event of mains failure:** Access points open.
- **Tokens:** Passive proximity credentials.
- **Readers:** Proximity readers.
- **Standby battery supply (minimum):** 24 h.
- **Locking mechanisms:** Magnetic locks and strike plates and Shear locks and strike plates.
- **Controls:** Access control units;
Door controllers;
and Personal computers type A.
- **System accessories:** Card printers;
Emergency break glass units;
and Request to exit buttons.
- **Cable type:** Contractor's design.
- **Containment:** Rigid conduit and Cable trunking and cable ducting systems.
- **Rewireable installation:** Required.
- **Concealed installation:** Required.
- **Execution:** Installing electronic access control systems and Equipment labelling and system diagrams.
- **System completion:** Part Testing and commissioning access control systems generally;
Documentation;
Spares and consumables;
and Maintenance.

System performance

Access control points

- **Recognition classification:** To BS EN 50133-1, class 2.
- **Access classification:** To BS EN 50133-1, class lass B.
- **Environmental classification:** To BS EN 50133-1, class I and To BS EN 50133-1, class III.
- **Number of transactions (minimum):** 500 per 24 h.

Connection to fire detection and alarm systems

- **Operation in the event of a fire signal:** Access controlled doors open / de-energise

Products

Rigid conduit

Shared by: 70-70-25/660 Installing main earthing conductor; 70-70-45/110 Low voltage distribution system; 70-70-75/110 Hard wired low voltage small power system; 70-80-35/110 Hard wired general lighting system; 75-45-40/110 Audio-frequency-induction-loop system; 75-60-05/110 Access control system; 75-60-40/110 Intruder detection and alarm system; 75-65-30/110 Fire detection and alarm system; 75-70-05/110 Assistance call system; and 90-55-15/645 Low voltage cables concealed in walls and partitions.

- **Manufacturer:** Contractor's choice.
- **Standards:** To BS EN 61386-21.
- **Mechanical properties:**
 - **Resistance to compression:** Heavy.
 - **Resistance to impact:** Heavy.
- **Transport, installation and application:**
 - **Lower temperature (minimum):** Manufacturer's standard.
 - **Upper temperature (maximum):** Manufacturer's standard.
- **Resistance to bending:** Rigid.
- **Electrical characteristics:** With electrical continuity properties.
- **Resistance to external influences:**
 - **Protection against ingress of solid objects (minimum):** To BS EN 60529, IP3X.
 - **Protection against ingress of water (minimum):** To BS EN 60529, IPX0.
- **Resistance to corrosion:** To BS EN 61386-1, Class 4.
- **Tensile strength:** Heavy.
- **Resistance to flame propagation:** Manufacturer's standard.
- **Suspended load capacity:** Heavy.
- **Colour:** Submit proposals.
- **Sizes (OD):** 25 mm.
- **Execution:** Installing rigid metallic conduit;
Installing rigid non metallic conduit;
Installing conduit connections to equipment;
and Conduit, trunking and ducting zones.

Cable trunking and cable ducting systems

Shared by: 70-70-45/110 Low voltage distribution system; 70-70-75/110 Hard wired low voltage small power system; 70-80-35/110 Hard wired general lighting system; 75-60-05/110 Access control system; 75-60-40/110 Intruder detection and alarm system; 75-65-30/110 Fire detection and alarm system; 75-70-05/110 Assistance call system; 75-70-05/120 Emergency voice communication system; and 90-55-15/650 Extra low and low voltage cables in accessible roof spaces.

- **Manufacturer:** Contractor's choice.
- **Standards:** To BS EN 50085-1 and BS EN 50085-2-1.
- **Material:** Metallic;

Non-metallic;
and Steel.

- **Construction:** To include means of preventing contact between liquids and insulated conductors and live parts.
- **Temperature properties:**
 - **Storage and transport temperature (maximum):** Manufacturer's standard.
 - **Installation and application temperature (minimum):** Manufacturer's standard.
 - **Application temperature (maximum):** Manufacturer's standard.
- **Resistance to flame propagation:** Required.
- **Electrical properties:** With electrical continuity characteristics.
- **Ingress protection (minimum):** To BS EN 60529, IP x4.
- **Protection against corrosive and polluting substances:** High protection outside and inside.
- **Access method:** With tools.
- **Screening:** Required.
- **Execution:** Conduit, trunking and ducting zones and Installing trunking generally.

Personal computers

Shared by: 75-60-05/110 Access control system; and 75-60-10/110 CCTV system.

- **Manufacturer:** Contractor's choice.
- **Processor:**
 - **Clock speed (CPU):** Manufacturer's standard.
 - **Clock speed (front side bus):** Manufacturer's standard.
 - **L2 cache size:** Manufacturer's standard.
- **RAM:** Manufacturer's standard.
- **Hard disk:**
 - **Capacity:** Manufacturer's standard.
 - **Speed:** Manufacturer's standard.
- **Graphics card:**
 - **Memory:** Manufacturer's standard.
 - **Resolution:**
- **Sound card:**
- **Optical drive:**
- **Network card:**
- **I/O ports:**
- **Monitor:**
- **Keyboard:**
- **Mouse:**
- **Operating system:**

Card printers

- **Manufacturer:** Access Control Manufacturer
- **Format:** Manufacturer's standard.

- **Print:**
 - **Method:** Colour dye sublimation.
 - **Resolution:** Manufacturer's standard.
 - **Operation:** Manufacturer's standard.
 - **Speed (minimum):** 60 cards/ h.
- **Laminate:** Manufacturer's standard.
- **Card feeder capacity:** Manufacturer's standard.

Passive proximity credentials

- **Manufacturer:** Access Control Manufacturer
- **Operating frequency:** Manufacturer's standard.
- **Proximity read range:** Manufacturer's standard.
- **Contactless cards:**
 - **Standard:** Physical characteristics to BS ISO/IEC 14443-1.
 - **Material:**
 - **Colour:** White.
 - **Magnetic stripe:** Required.
- **Tokens:**
 - **Material:**
 - **Colour:**
- **Adhesive tags:**
 - **Material:** Polycarbonate.
 - **Colour:**
- **Printing capability:**
- **Programming:** Manufacturer's standard.
- **Code:** Unique, pre-programmed to BS 7227.
- **Unique, visible identification number:** Required.
- **Authentication:**
- **Format:**
- **Manufacturer's guarantee against electronic failure (minimum):** 25 years.
- **Operating temperature range:**
- **Accessories:** Manufacturer's standard.
- **Standards:**

Proximity readers

- **Manufacturer:** Access Control Manufacturer
- **Security grading:**
- **Environmental classification:**
- **Material and finish:** ABS plastic.
- **Colour:** Black.
- **Impact protection (minimum):**
- **Relative humidity (non-condensing):**
- **Type of operation:**
- **Communication interface:**

- **Number of users (minimum):**
- **Operating frequency:** Manufacturer's standard.
- **Proximity read range:** Up to 75 mm.
- **Integral keypad:**
- **Remote door opening:**
- **Mounting position:**
- **Visual indication:** Multi-coloured LED displaying red when access point status secure, green when unlocked.
- **Audio status indication:** Multiple tone sequences.
- **Accessories:**
- **Ingress protection (minimum):** To BS EN 60529, IP 54 and To BS EN 60529, IP 67.
- **Rated operational voltage (Ue):** Manufacturer's standard.
- **Rated operational current (In):** Manufacturer's standard.
- **Tamper detection:** Required.
- **Execution:** Installing keypads and readers.

Magnetic locks and strike plates

- **Manufacturer:** Access Control Manufacturer
- **Standard:** To BS EN 13637, when used on escape routes.
- **Rated operational voltage (Ue):** Manufacturer's standard.
- **Operation in the event of mains failure:** Fail unlocked.
- **Holding force (minimum):** 5 kN.
- **Monitoring:**
- **Features:** Anti-tamper.
- **Material and finish:** Brushed aluminium.
- **Colour:**
- **Instant release circuit:** Required.
- **Operating temperature range:**
- **Execution:**

Shear locks and strike plates

- **Manufacturer:**
- **Standard:** To BS EN 13637, when used on escape routes.
- **Rated operational voltage (Ue):** Manufacturer's standard.
- **Operation in the event of mains failure:** Fail unlocked.
- **Holding force (minimum):** 15kN
- **Monitoring:**
- **Features:**
- **Alarms:**
- **Material and finish:** Brushed aluminium.
- **Colour:**
- **Instant release circuit:** Required.
- **Mounting within door:** Manufacturer's standard.

- **Operating temperature range:**
- **Accessories:**
- **Execution:**

Access control units

- **Manufacturer:** Access Control Manufacturer
- **Standards:** To BS EN 60839-11-1 and BS EN 60839-11-2.
- **Security grading:**
- **Environmental classification:**
- **Enclosure:**
 - **Material and finish:** Manufacturer's standard.
 - **Colour:**
- **Rated operational voltage (Ue):** 240 V a.c.
- **Rated operational current (In):** Manufacturer's standard.
- **Battery backup:**
 - **Battery location:**
 - **Battery backup capacity:**
- **Type of operation:**
- **Number of doors per controller:**
- **Number of users (minimum):** Manufacturer's standard.
- **Communication interface:**
- **Visual indication:**
- **Interfaces:**
 - **Door lock relays:**
 - **Door status monitoring:**
 - **Readers:**
 - **Volt free relays:**
 - **Request to exit buttons:**
- **Data encryption:**
- **Random access memory (RAM) capacity (minimum):**
- **Storage memory capacity:**
- **Administration access:** Password protected.
- **Database:**
- **Information fields per user:**
- **Spare information fields per user (minimum):** Manufacturer's standard.
- **Import and export of database in ASCII format:** Required.
- **Incorporation of external data:**
- **Integral event memory capacity (minimum):**
- **Monitor and record the following transactions and events:**
- **Events and transactions:** Data and time stamp.
- **Customised event alarms:** Display.
- **Control features:**
 - **Include the following:**

- **Anti-passback:** Manufacturer's standard.
- **Time between credential presentation and door unlock (maximum):** 0.3 seconds.
- **Reports:**
 - **Transaction and event reports:** By access point.
By area.
By department.
By time and date period.
By transaction type.
By user.
 - **Other reports:** Building occupancy.
Staff time and attendance.
- **Publishing:** Export to pdf and Print.
- **Accessories:**
- **Execution:**

Door controllers

- **Manufacturer:** Access control manufacturer
- **Number of doors per controller:** Manufacturer's standard.
- **Rated operational voltage (Ue):** Manufacturer's standard.
- **Rated operational current (In):** Manufacturer's standard.
- **Door lock battery backup:** Manufacturer's standard.
- **Time between token presentation and door unlock (maximum):** 0.3 s.
- **Enclosure:**
 - **Material:** Manufacturer's standard.
 - **Finish:** Manufacturer's standard.
 - **Tamper alarm:** Required.

Request to exit buttons

- **Manufacturer:** Access control manufacturer
- **Security grading:**
- **Environmental classification:**
- **Material and finish:** Brushed aluminium.
- **Colour:**
- **Mounting arrangement:**
- **Engraving:** "PUSH TO EXIT".
- **Operation:** Momentary.
- **Switch rating:** Suitable for 12 V d.c. operation with common, normally closed and normally open contacts.
- **Illuminated button:** Not required.
- **Button characteristics:**
- **Execution:**

Emergency break glass units

- **Manufacturer:** Access control manufacturer

- **Security grading:**
- **Environmental classification:**
- **Frangible element:** Resettable.
- **Test method:** Key.
- **Protective cover:** Required.
- **Number of poles:** Double pole switch with common, normally open and closed contacts.
- **Switch rating:**
- **Monitoring:**
 - **Audible indication:**
 - **Visual indication:**
- **Colour:** Green.
- **Labelling:** "EMERGENCY DOOR RELEASE".
- **Mounting:** Fully recessed;
Semi-recessed;
and Surface.
- **Execution:**

Execution

Installing electronic access control systems

- **Standards:** To BS EN 50133-1 and in accordance with BS EN 50133-7.
- **Location of the access controller:** As per drawings
- **Installing cabling:**
 - **Standard:** In accordance with BS 7671.
 - **Routes:**
 - **Security measures:** Suitably protect all cabling from inadvertent damage or tampering to avoid compromising the security of the system.

Equipment labelling and system diagrams

- **Access points and door controllers:** Label with a unique identification code.
- **System diagram:** Provide showing the location and identity of all system equipment.
- **Position:** Next to the access system controller.

Installing conduit, trunking and ducting

Shared by: [90-55-10/460 Conduit fittings](#); [90-55-10/715 Installing pliable and flexible conduit](#); [90-55-10/720 Installing rigid metallic conduit](#); [90-55-10/725 Installing rigid non metallic conduit](#); [90-55-10/735 Installing conduit connections to equipment](#); and [90-55-10/765 Conduit, trunking and ducting zones](#).

- **Standards:** In accordance with BS 7671 and IET Guidance Note 1.
- **Preparation:** Cut square. Remove burrs and sharp edges to make smooth.
- **Protection of metallic conduit, trunking and ducting:**
 - **Joints and ends:** Remove grease, oil, dirt and rust before applying protective paint. Paint immediately following installation.

– **Protective paint:**

Generally: Compatible with conduit, trunking and ducting finish.

Type: Match factory finish.

- **Cross-sectional area:** Maintain throughout the conduit, trunking and ducting length.
- **Arrangement:** Position vertically and horizontally in line with equipment served, and parallel with building lines.
- **Spare containment:** Install one spare 25 mm diameter conduit from each distribution board to the nearest accessible void space, terminating in a conduit box with lid.
- **Draw wires:** Install galvanized soft iron wires within spare conduit, trunking and ducting.
- **Distance from other services running parallel (minimum):**
 - **Generally:** 150 mm.
 - **Above radiators:** 1000 mm.
 - **Steam services:** 600 mm.
- **Drainage of conduit, trunking and ducting:** Locate drainage outlets at lowest points in conduit, trunking and ducting installed externally, and where condensation may occur.
- **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, trunking and ducting from building structure.
- **Cleaning:** Clean insides of conduit, trunking and ducting before installing cables.
- **Cabling:** Install when conduit, trunking and ducting enclosure is complete.
- **Submittals:** Submit manufacturer's technical information. Submit drawings showing the proposed routes of conduit, trunking and ducting and the location of service outlets.

Installing conduit generally

Shared by: 90-55-10/715 Installing pliable and flexible conduit; 90-55-10/720 Installing rigid metallic conduit; 90-55-10/725 Installing rigid non metallic conduit; and 90-55-10/735 Installing conduit connections to equipment.

- **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:**
 - **Generally:** 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:**

- **Generally:** Install flush with finished surfaces. Provide extension rings if required.
- **Fixing screws:** Countersunk, or round-headed screws.
- **Number of fixings (minimum):** Two.
- **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):** Two.
 - **Floors:** Do not install draw-in boxes in floors.
- **Conduit in walls:** Avoid concealed horizontal runs.
- **Suspended ceiling installations:** Fasten outlet boxes to structure above ceiling.

Installing rigid metallic conduit

- **General requirements:** Installing conduit generally and Installing conduit, trunking and ducting.
- **Fixings:** Distance saddle;
Saddle;
and Spacer bar saddle.
- **Joints:** Plain and 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.

Installing rigid non metallic conduit

- **General requirements:** Installing conduit generally and Installing conduit, trunking and ducting.
- **Fixings:** Distance saddle;
Saddle;
and Spacer bar saddle.
- **Joints:** Compression and Threaded.
- **Conduit connections to boxes and items of equipment:** Threaded bushed entries.

Installing conduit connections to equipment

Shared by: 90-55-10/360 Flexible conduit; and 90-55-10/380 Rigid conduit.

- **General requirements:** Installing conduit generally and Installing conduit, trunking and ducting.
- **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 of adequate length to

facilitate removal of equipment for maintenance. Final termination in swivel connectors.

- **Connections to external equipment:** Flexible conduit.

Installing trunking generally

- **Supports and mounting arrangement:** Wall mounted;
Ceiling mounted;
Floor mounted;
Purpose made brackets;
and Suspension rods and steel channels.
- **Changes of direction:** Manufacturer's bends and tees.
- **Joints:**
 - **Generally:** 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.
- **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.

Conduit, trunking and ducting zones

Shared by: 90-55-10/360 Flexible conduit; 90-55-10/380 Rigid conduit; and 90-55-10/410 Cable trunking and cable ducting systems.

- **General requirements:** Installing conduit, trunking and ducting.
- **Ceiling voids:** Provide clear distance of 150 mm (minimum) between underside of any conduit, trunking or trunking and the top side of ceiling.

Installing keypads and readers

- **Mounting:**
 - **Mounting position:** Install the reader on the wall within 200 mm of the latch edge of the door.
 - **Mounting arrangement:**
 - **Height (finished floor level to underside of equipment):** Part M
- **Administration reader:** Install adjacent to the access controller or PC administering the software to allow registration of users.

System completion

Part Testing and commissioning access control systems generally

- **Standards:** To BS EN 50133-7.
- **System commissioning agent:** System manufacturer.
- **Notice before commencing tests (minimum):** 14 d.
- **System programming:** Configure access permissions and Configure time grids, zones and slots.
- **Cable testing:**
 - **Insulation resistance:** Submit results.
 - **Earth continuity:** Submit results.
- **Access points:** Verify the correct operation of reader, across each access level. Check alignment of lock mechanism. Configure unlock times.
- **Standby supply:** Verify operation in the event of a mains failure. Check capacity and submit results. Verify operation of battery charger.
- **Equipment tamper detection:** Verify operation.

Documentation

- **Operating and maintenance instructions:**
 - **Scope:** Refer to General Condition Section 00-80-70 - Work Contract Completion
- **Standards:** To BS EN 60839-11-1 and BS EN 60839-11-2.
- **System communications:** Submit details of the communication network and any relevant protocols used.
- **Record drawings:**
 - **Content:** For all access control cabling, the cable origin, circuit designation, route from controller to access control point, conductor material and c.s.a, insulation type and colour, number of cores per cable, number of cables in ducts, on tray or ladder;
General arrangement drawings;
and Location of each access point, its associated controller and power supply.
Refer to General Condition Section 00-80-70 - Work Contract Completion
- **Submittal date:** Refer to General Condition Section 00-80-70 - Work Contract Completion

Spares and consumables

- **Credentials to be supplied:** Submit proposals.
- **Spares to be supplied:**
 - **Fuses:**
 - **Frangible elements:**
 - **Printer ink cartridges:**

Maintenance

- **Servicing and maintenance:** Undertake.

- **Duration:** Until 12 months after Practical Completion.

Ω End of system

CCTV system

System outline

CCTV system

- **Description:** The Electrical Contractor shall employ the Security Specialists detailed within the Material Schedule to supply and install a complete CCTV system interfaced onto the Town Hall's existing security networks to comply with NACP 20 and National Security Inspectorate's Code of Practice as detailed in the Specification and as indicated on the drawings.

Town Hall has 2 CCTV systems, one of which is being phased out. The Museum CCTV system shall be interfaced with the recent and latest CCTV system.

All services with the exception as listed below and as noted on the drawings shall be isolated, stripped out and made safe, prior to the demolition.

The redundant equipment shall be stripped out and safely removed and disposed, and/or handed back to the Client.

All services stripped out to the area demarcation line to be made safe at this point.

The redundant services should not pose a health and safety risk. All cable containment and pipes shall be capped off at this point. The Contractor should ensure no sharp edges.

All circuits to be disconnected from the point of the origin and clearly labelled as redundant. Other areas are to be retained in use during the course of the works.

It is therefore imperative that these systems are maintained through out these works and any downtime is agreed with the Client.

The CCTV Specialist shall allow to carry out the equipment selection, installation, testing and commissioning as described further in this specification.

The CCTV Specialist shall be employed to provide all equipment, wire and connect the same, and to test and commission the installation. They shall also provide full working drawings and final test documentation/drawings. The Electrical Sub-Contractor shall establish during the tender period and provide all necessary power supplies together with containment for all cables. They shall also co-ordinate the activity of the Specialists involved to provide a fully operational system.

Cable containment shall be installed along main routes to contain the CCTV system cabling, the Electrical Contractor shall provide conduit / cable basket to all internal security items.

Cabling to external CCTV cameras / equipment shall be installed within dedicated ducts provided by the Main Contractor. All cables rising from the ducts to the building mounted CCTV cameras / equipment shall be contained within conduits and installed behind the cladding.

Where conduits are installed to the security equipment then the Electrical Contractor shall ensure that the conduit is terminated local to the equipment and sufficient cable tails have been left at the outlet for the Specialist to terminate.

The Electrical Contractor shall allow for all necessary power supplies and containment in order to provide a complete system. This shall include conduit back boxes etc, to the devices shown.

The CCTV system will run over the category 6 cabling system to its own dedicated switch hardware in the hub rooms and server rooms. In some circumstances the CCTV system or part, will need to be on a dedicated network and not connected to the IP network. This needs to be discussed further at the next stage.

The system shall provide a web interface to allow staff to use any network connected device to monitor live and recorded video capture.

There will be a degree of integration between the security systems and the iBMS to simplify the operation of the building. The exact level of integration will be discussed and agreed as part of the design development.

The CCTV digital video recorder will provide 30 days data storage. The actual amount will be agreed as part of the design development. The CCTV system will be designed for general surveillance only and not specifically to provide facial recognition (evidential quality images).

THE SYSTEM SHALL BE OPEN PROTOCOL. Refer to the definition of open protocol elsewhere in this document. The Electrical Contractor shall employ a CCTV specialist for the design, supply, installation, connection, testing, commissioning and setting to work of the complete system. The specialist shall provide a complete system to meet the requirements of this specification. The specialist shall be a NACOSS Gold Contractor and shall base the design of the system on the equipment specified or equal, approved and better.

An internal and external CCTV system shall be provided to monitor the building facades and entrances as well as providing general coverage of internal circulation spaces.

All equipment shall be of commercial quality and suitable for an expected life of 15 years in a normal commercial environment. All equipment shall be new and previously unused.

CCTV Cameras

All external cameras shall be provided with a heater which is humidistat and thermostat controlled in order to prevent condensation forming within the enclosure. All external camera enclosures shall be of the dome type.

All cameras shall operate in real colour when there is sufficient daylight and automatically switch to monochrome when the level of illumination in the field of view falls below a satisfactory level. The transition between the two modes shall take place almost instantaneously to minimise the interruption to the image. Any camera which is likely to have large variances in exposure in the same shot shall incorporate "HyperD" technology so as to provide a balanced and useable image (e.g. cameras covering doorways or partially shaded areas).

CCTV Columns and Camera Mountings

External CCTV cameras shall generally be provided to cover the external facades of the building and positioned so as to cover higher risk areas such as ground and first floor doors/windows, external staircases and any easily accessible roof areas.

Building-mounted cameras shall be positioned so as to remain safely accessible by authorised personnel using mobile elevated work platforms. External cameras mounted remote from the building shall be mounted on hinged columns, the column base being of sufficient size to accommodate a fused cut-out and signal/telemetry terminations as well as any interfaces required.

All cameras shall operate in conjunction with the intruder alarm system as well as a network of external redwall detectors. Trigger inputs from either the redwall detectors or the intruder alarm system shall cause the cameras to begin recording at a rate of not less than 25 frames per-second. Trigger inputs shall also cause any PTZ cameras to pan, tilt and zoom to a preset position corresponding to the device which has been triggered.

Cables, Wiring and Ducting and Drawpits

All external and internal cameras shall be wired using Cat 6 cable. Where cables run externally they shall be external grade. The Electrical Contractor shall also provide a weatherproof fused connection unit for each pole-mounted camera which shall be installed in the base of the column. All cables shall be enclosed within ducts which shall be colour-coded and positioned to meet the requirements of NJUG (national joint utilities group) volume one (www.njug.org.uk).

CCTV Monitors

A single monitoring station shall be provided in the FM Office on the mezzanine floor. This shall comprise of a 19-inch wall-mounted, flat screen monitor. This shall be mounted on double elbow adjustable bracket to provide lateral and vertical adjustment. A 6-inch flat-screen monitor shall be provided in the CCTV rack to facilitate setup, review and maintenance of the CCTV images. The monitoring station shall be provided with a control console which will communicate with the relevant system using the RS-485 protocol.

Samples of the proposed equipment shall be provided by the Electrical Contractor for approval/sign-off by the CA and Client Team before ordering. The Electrical Contractor shall ensure all samples are provided at an expedient time so as not to affect programme and shall be responsible for organising a meeting with the above parties for the above purposes.

Digital Video Recorder and Network Links

The design of the system shall be based around the "SD Advanced" DVR (digital video recorder) as manufactured by Dedicated Micros or equal and approved. This shall be complete with all interfaces, converters, power supply units, keyboards, wiring and licenses necessary to form a complete working system. Install the unit in one of the equipment racks described in the structured wiring section and allow space within the equipment rack for a further DVR units to be installed if the system needs to be expanded in the future to cope with additional cameras. It is a requirement that the two units can be networked together so that they operate as a single system and can be controlled without the use of multiple consoles at each monitoring station.

Access to the recording system shall be by password only, all engineering and

system configurations shall be protected from unauthorised access and users shall "log on" using individual passwords. Furthermore a complete audit trail facility logging all operations on the system will be available for review by the System Administrator. The system shall be suitable for future expansion and be upgradeable in terms of software enhancements and additional cameras.

In addition to the single monitor in the control room, the system shall be configured so that CCTV image streams are available over a TCP/IP (transmission control protocol / internet protocol) so that staff can monitor the system and adjust PTZ cameras on an ad-hoc basis from any networked PC or device.

Provision shall be made for off-site transmission of the CCTV signals and remote control of the cameras from a remote monitoring centre. The Client will be responsible for the connection to the network and for protecting the system behind their own internet firewall.

Provide demonstrations and training to The Employer's staff and allow for this to be split over two separate training sessions on two separate days to aid comprehension and information retention. The specialist shall also allow to provide a meaningful contribution to the site specific user guide.

There will be a degree of integration between the security systems to simplify the operation of the building. Trigger inputs from the access control system, fire alarm or intruder alarm shall cause the relevant camera footage to be recorded at 25 fps (frames per second) for 15 seconds before the trigger and 60 seconds thereafter.

The DVR shall provide approximately 31 days of storage at a frame rate of 2 fps per camera. It is accepted that recording at 25 fps will consume storage space at a faster rate. CCTV footage shall be stored and managed on a FIFO (first in, first out) principle. A proportion of the DVR HDD shall be set aside for footage to be stored by users. This shall be retained until manually removed. All footage shall be watermarked and security stamped with the time and date. The integral DVD drive shall be capable of burning stored footage to suitable media for archiving or use by Police. The DVR shall be of an extensible design such that further DVR units and CCTV cameras can be added to the existing system without existing equipment becoming redundant. The additional units shall become an integral part of the system.

The CCTV system will be designed for general surveillance only and not specifically to provide facial recognition (evidential quality images).

System Configuration

The CCTV Specialist shall supply and install a complete CCTV system as detailed within this specification. Positions of all CCTV cameras are as indicated on the drawings.

The CCTV system shall comprise of the following: -

- i) Fully functional dome colour / monochrome cameras covering staircases.
- ii) Fully functional dome colour / monochrome cameras covering strategic external positions.
- iii) Digital recorders
- iv) General viewing monitors.
- v) Motion detection devices.

- vi) Audio equipment.
- vii) Centralised power supplies.
- viii) UPS
- ix) Video transmission units.
- x) Control equipment.

All cameras shall be fitted with premium grade lenses of correct focal length. The Security Specialist shall give consideration to the parameters of the cameras and the range of zone being covered when selecting the correct lens to suit each camera in its installed positions. Site trials shall be carried out to ensure the optimum selection of lens in each case. Final locations of all cameras shall be agreed on site.

The CCTV specialist shall allow to configure 'privacy zones' to the new and existing cameras located near to any residential areas of the site to prevent illegal viewing.

The data cabling specialist shall liaise with the Security specialist during tender to establish the exact cabling requirements. All costs associated with the cabling shall be included within the returned tender to provided a fully operation CCTV scheme.

All internal CCTV cameras shall be suitably positioned to ensure suitable coverage is achieved throughout the facility.

The Electrical Contractor shall allow to supply and install 230V power supplies in the form of weatherproof 13A fuse connection units (IP56 MK Masterseal) to each external camera position. These are generally supplied from the dedicated external distribution boards located within the switchroom as indicated on the drawings.

The Security Specialist shall allow to undertake all wiring from the fuse connection unit and shall allow to liaise with the Electrical Contractor.

Camera Control, Monitoring and Recording System

The Security Specialist shall allow to supply and install the following digital recorder/controllers.

All cameras shall be connected to IP addressable digital video servers located as indicated on the drawings. Connectivity between the digital video servers and the IP network shall be provided.

A local monitor, keyboard and fully functional camera joystick control station shall be provided adjacent to the control room rack mounted video server.

The capacity of the hard drive shall be sized to ensure high quality recordings (including audio and images) can be stored for up to 31 days after which they shall be automatically overwritten.

The CCTV system shall be complete with 1 No. 2kVA UPS system located within the base of each CCTV equipment cabinet.

It shall be possible to print individual images to a standard desktop printer, all images however exported shall be encoded with the camera name/number, system name and time/date stamp.

Access to the recording system shall be by password only, all engineering and

system configurations shall be protected from unauthorised access and users shall "log on" using individual passwords. Furthermore a complete audit trail facility logging all operations on the system will be available for review by the System Administrator. The system shall be suitable for future expansion and be upgradeable in terms of software enhancements and additional cameras.

The 19" data cabinet shall be configured for front and side access only. The front shall be covered by an overall hinged and lockable "plexi" glass door. Ventilation slots shall be provided as necessary. All hinged doors shall be earth bonded to the main assembly enclosure where metallic construction is used.

Wiring channels shall be provided as necessary and power distribution within the racks shall be by means of vertical and horizontal socket strips to the appropriate standards. All cabling shall be professionally marshalled using harnesses, looms, tie-wraps, etc. These will be used to supply all CCTV equipment within the cabinet.

The 19" rack assembly shall also be equipped with necessary power supply units and terminal rails to facilitate the connections of all cables including field wiring for the CCTV system.

The Client's preferred specialist is
 Gary Cheeseman of
 Pyrotec Services Ltd
 Avalon House,
 Marcham Rd,
 Abingdon,
 OX14 1TZ
 Phone: 01235 524469

- **System performance:** To provide a general digital CCTV system to the clients requirements to internal areas of the building and to provide external security cover as detailed on the drawings.

To provide a complete and fully functioning digital IP system for the building.

To monitor and provide visual record of persons entering the building and moving through each zone. The primary purpose of the CCTV installation is for general monitoring of behaviour and activity.

Remote monitoring;
CCTV zone;
Digital storage;
and Integration with other alarm and security systems.

- **Standards:** The system shall be designed and installed in accordance with all relevant Standards, Regulations and best practice. The complete installation is to be carried out in accordance with the latest edition and amendments of the documents specified below, which is not exhaustive:-

In accordance with ACPO policy on police response to security systems;
 In accordance with ACPOS security systems policy;
 In accordance with BS 8418;
 In accordance with BS 8495;
 and In accordance with BS EN 50132-7.

- **Format:** Digital and Internet protocol (IP).
- **Automatic activation of cameras:** Required.
- **Video motion detection:** Required.
- **Video based detection system:** Required.
- **Remote monitoring:** Required.
- **Surveillance equipment:** Cameras.
- **Camera housings:** Internal camera housings and External camera housings.
- **Controller:** Control matrix.
- **Uninterruptible power supply:** Required.
- **Telemetry transmitters:** Telemetry transmitters.
- **Telemetry receivers:** Telemetry receivers.
- **Data storage:** Personal computers type A and Network video recorders.
- **Cable type:** Balanced twisted-pair cables.
- **Containment:** Cable baskets and Cable trays.
- **Rewireable installation:** Required.
- **Concealed installation:** Required.
- **Infrared illuminators:** Contractor's design.
- **System accessories:** Transient overvoltage surge suppression for data and telecom supplies and CCTV signage.
- **Execution:** Installing closed circuit television systems and Installing signage.
- **System Completion:** Closed circuit television system testing and commissioning;
Training;
Documentation;
Spares and consumables;
and Maintenance.

System performance

Remote monitoring

- **Standard:** In accordance with BS 8418.
- **Remote video response centre (RVRC):**
 - **Registration:** A member of British Security Industry Association;
A Gold member of National Security Inspectorate;
and A member of Security Systems and Alarms Inspection Board.
 - **Location:** To be completed by user
- **Audio challenge facility:** Required.

CCTV zone

- **Purpose:** Access control;
Property protection;
Safety;
and Surveillance.
- **Target to be observed:** Individuals.
- **Image quality:** Suitable for use as evidence.
- **Number of cameras:** As per CCTV drawings

- **Camera operating mode:** Fixed and Pan, tilt and zoom.

Digital storage

- **Rate per camera (minimum):** To be completed by user

Integration with other alarm and security systems

- **Objectives:**
- **Systems to be integrated:**

Products

Cable baskets

Shared by: 70-70-45/110 Low voltage distribution system; 70-70-75/110 Hard wired low voltage small power system; 70-80-35/110 Hard wired general lighting system; 75-45-20/110 Data distribution system; 75-60-10/110 CCTV system; 75-60-40/110 Intruder detection and alarm system; 75-65-30/110 Fire detection and alarm system; and 90-55-15/650 Extra low and low voltage cables in accessible roof spaces.

- **Manufacturer:** Contractor's choice.
- **Material:**
- **Coating material:** Hot dip galvanised, powder coated RAL colour to architectural specification
- **Features:**
 - **Segregation:** Cable dividers.
 - **Protective cover:** Required.
- **Execution:** Installing cable basket; Multiple cable runs; and Cable support zones.
- **Standard:** To BS EN 61537.

Cable trays

Shared by: 70-70-45/110 Low voltage distribution system; 70-70-75/110 Hard wired low voltage small power system; 75-60-10/110 CCTV system; and 90-55-15/650 Extra low and low voltage cables in accessible roof spaces.

- **Manufacturer:** Contractor's choice.
- **Standard:** To BS EN 61537.
- **Material:** Steel.
- **Resistance against flame propagation:** Non-Flame propagating.
- **Electrical properties:**
 - **Continuity characteristics:** Without electrical continuity.
 - **Conductivity characteristics:** Without electrical conductive system component.
- **Coating material:** Hot dip galvanised, powder coated RAL colour to architectural specification
- **Temperature properties for transport, storage, installation and application:**
 - **Minimum:** Manufacturer's standard.

- **Maximum:** Manufacturer's standard.
- **Mechanical properties:**
 - **Cable tray free base area:** Manufacturer's standard.
 - **Resistance to impact:** Manufacturer's standard.
- **Features:**
 - **Flange type:** Return.
 - **Segregation:** Cable dividers.
 - **Protective cover:** Required.
- **Execution:** Installing cable tray and cable ladder;
Installing cable supports on roofs;
Multiple cable runs;
and Cable support zones.

Cable trunking and cable ducting systems

Shared by: 70-70-45/110 Low voltage distribution system; 70-70-75/110 Hard wired low voltage small power system; 70-80-35/110 Hard wired general lighting system; 75-60-05/110 Access control system; 75-60-40/110 Intruder detection and alarm system; 75-65-30/110 Fire detection and alarm system; 75-70-05/110 Assistance call system; 75-70-05/120 Emergency voice communication system; and 90-55-15/650 Extra low and low voltage cables in accessible roof spaces.

- **Manufacturer:** Contractor's choice.
- **Standards:** To BS EN 50085-1 and BS EN 50085-2-1.
- **Material:** Metallic;
Non-metallic;
and Steel.
- **Construction:** To include means of preventing contact between liquids and insulated conductors and live parts.
- **Temperature properties:**
 - **Storage and transport temperature (maximum):** Manufacturer's standard.
 - **Installation and application temperature (minimum):** Manufacturer's standard.
 - **Application temperature (maximum):** Manufacturer's standard.
- **Resistance to flame propagation:** Required.
- **Electrical properties:** With electrical continuity characteristics.
- **Ingress protection (minimum):** To BS EN 60529, IP x4.
- **Protection against corrosive and polluting substances:** High protection outside and inside.
- **Access method:** With tools.
- **Screening:** Required.
- **Execution:** Conduit, trunking and ducting zones and Installing trunking generally.

Balanced twisted-pair cables

Shared by: 75-60-10/110 CCTV system; 90-65-05/620 Installing central controllers; 90-65-05/630 Installing combined daylight and occupancy sensors; 90-65-05/640 Installing daylight sensors; and 90-65-05/670 Installing photoelectric control units.

- **Manufacturer:** Contractor's choice.

- **Standard:** To BS EN 50288-2-1;
To BS EN 50288-3-1;
To BS EN 50288-4-1;
To BS EN 50288-5-1;
and To BS EN 50288-6-1.
- **Category:** 6.
- **Nominal impedance:** 100 ohm.
- **Screening:** Required.
- **Number of pairs:** 4.
- **Conductors:** Solid.
- **Size:** Manufacturer's standard.
- **Sheath:**
 - **Type:** Low smoke zero halogen (LSZH).
 - **Colour:** Manufacturer's standard.
- **Execution:** Extra low and low voltage cable routes;
Extra low and low voltage cables in accessible roof spaces;
Extra low and low voltage surface mounted cables;
and Installing low voltage cables in conduit and trunking.

Transient overvoltage surge suppression for data and telecom supplies

Shared by: 75-45-20/110 Data distribution system; and 75-60-10/110 CCTV system.

- **Manufacturer:** Furze
- **Standards:** To BS EN 61643-21.
- **Operating voltage (nominal):** Contractor's choice.
- **Bandwidth:** Contractor's choice.
- **Operating voltage (maximum):** Contractor's choice.
- **Surge current (minimum) per signal wire:** Contractor's choice.
- **Let-through voltage (maximum):** Contractor's choice.
- **Current rating (signal):** Contractor's choice.
- **Thermal overload protection:** Contractor's choice.
- **Mode of protection:** Lines to earth, lines to lines.
- **Enclosure:** Manufacturer's standard.
- **Execution:** Installing transient overvoltage surge suppression devices for mains power supplies and data and telecom supplies.

Personal computers

Shared by: 75-60-05/110 Access control system; and 75-60-10/110 CCTV system.

- **Manufacturer:** Contractor's choice.
- **Processor:**
 - **Clock speed (CPU):** Manufacturer's standard.
 - **Clock speed (front side bus):** Manufacturer's standard.
 - **L2 cache size:** Manufacturer's standard.
- **RAM:** Manufacturer's standard.
- **Hard disk:**
 - **Capacity:** Manufacturer's standard.

- **Speed:** Manufacturer's standard.
- **Graphics card:**
 - **Memory:** Manufacturer's standard.
 - **Resolution:**
- **Sound card:**
- **Optical drive:**
- **Network card:**
- **I/O ports:**
- **Monitor:**
- **Keyboard:**
- **Mouse:**
- **Operating system:**

Cameras

- **Manufacturer:** To be completed by user
- **Connectivity:** Internet protocol.
- **Signal transmission:** Wired.
- **CCD sensor format:** 0.25 inch.
- **Spectrum:** Colour and Monochrome.
- **Resolution (minimum):** 1 megapixel.
- **Power supply:** Mains powered and Power over ethernet (PoE).
- **Camera synchronizing:** Manufacturer's standard.
- **Signal to noise ratio (minimum):** 48dB.
- **Image strength with 75 ohm terminations:** 1 V peak to peak.
- **Automatic gain control:** Required.
- **White balance control:** Manufacturer's standard.
- **Backlight compensation:** Required.
- **Present gamma settings:** 1 and 0.45.
- **Iris:** Automatic and Manual.
- **Shutter speed adjustment:** Manufacturer's standard.
- **Infrared sensitivity wavelength:** Manufacturer's standard.
- **Integrated infrared illuminator:** Manufacturer's standard.
- **Colour to monochrome switching:** Automatic at pre-determined threshold (25 lx).
- **Lens mounts:** CS type.
- **Lens:**
 - **Format:** 0.5 inch.
 - **Filter:** Manufacturer's standard.
- **Integral motion detection facility:** Required.
- **Integral two way audio facility:** Not required.
- **Mounting points:** Manufacturer's standard.
- **Environment:** Indoor and Outdoor.
- **Accessories:** Manufacturer's standard.
- **Execution:** Installing CCTV cameras.

Control matrix

- **Video inputs:** Contractor's choice.
- **Adjustable dwell time per camera image:** Contractor's choice.
- **Switching speed:** < 20 ms.
- **Response to video inputs:**
 - **Unused:** Automatic skip.
 - **Lost:** Alarm displayed on monitor.
- **Spot monitor output:** Required.
- **Control keyboard:** Tactile push buttons with individual LED indication and 3-axis joystick.
- **Manual selection of camera images:** Required.
- **Screen mode:** Sequential switching and split screen.
- **Titling:** Time, date, and camera identification.
- **Video motion detection:** Required.
- **Alarm outputs:** Contractor's choice.
- **Execution:** Installing controllers.

Telemetry transmitters

- **Manufacturer:** To be completed by user
- **Control functions:** Contractor's choice.
- **Alarm inputs:** Contractor's choice.
- **Control keyboard:** Tactile push buttons with individual LED indication.
- **Control via coaxial cabling:** Synchronized frequency shift keyed (FSK) signalling.
- **Control over twisted pair cabling:** 4-20 mA current loop.
- **Multiple camera control:** Required.
- **Guard tour set up:** Contractor's choice.
- **Mounting:** 19 inch rack.
- **System configuration:** Password protection.
- **Execution:** Installing telemetry transmitters and receivers.

Telemetry receivers

- **Format:** Contractor's choice.
- **Control signal type:** Contractor's choice.
- **Inputs:** Contractor's choice.
- **Pre-set pan, tilt, zoom and focus positions:** Contractor's choice.
- **Movement control modes:** Contractor's choice.
- **Enclosure with integral power supply unit:**
 - **Material:** Manufacturer's standard.
 - **Ingress protection (minimum):** To BS EN 60529, IP65.
 - **Colour:** Manufacturer's standard.
- **Execution:** Installing telemetry transmitters and receivers.

Network video recorders

- **Rack mounting:** Required.
- **Storage media:**
 - **Type:** Hard disk.
 - **Capacity:** To be completed by user
- **Video recording format:** Manufacturer's standard.
- **Inputs:** 10/100 base T ethernet;
Audio;
and Video.
- **Recording speed:** 0.1–250 frames/s.
- **Event recording mode:** Required.
- **Pre-event buffer:** Manufacturer's standard.
- **Camera channels:** Manufacturer's standard.
- **Video backup:** Integral DVD writer.
- **Recording initiation:** Contractor's choice.
- **Execution:** Installing network video recorders.

External camera housings

- **Manufacturer:**
- **Shape:**
- **Material:**
- **Finish:**
- **Vandal resistant fasteners:**
- **Ingress protection (minimum):** To BS EN 60529, IP65.
- **Integral heater:**
- **Sun shield:**
- **Mechanical ventilation:**
- **Wiper and washer assembly:**
- **Anti-tamper devices:**

Internal camera housings

- **Manufacturer:**
- **Shape:**
- **Material:**
- **Finish:**
- **Vandal resistant fasteners:**
- **Ingress protection (minimum):** To BS EN 60529, IP65.
- **Anti-tamper devices:**

CCTV signage

- **Material:** Manufacturer's standard.
- **Format:** Yellow background with black text and images.
- **Size:** Manufacturer's standard.

- **Content:** Warn individuals that they are entering premises or an area with CCTV surveillance.
CCTV camera symbol.
Describe the purpose of the CCTV system.
Identify the organization responsible for operating the system.

Execution

Installing closed circuit television systems

- **Standard:**
- **Site survey:** Assess the site conditions and available artificial light.
- **Access:** Locate system to provide safe access for maintenance and testing.

Installing signage

- **Position:** At main entrance. As per CCTV drawings.

Installing cable tray and cable ladder

Shared by: 90-55-10/330 Cable ladders; and 90-55-10/335 Cable trays.

- **Standards:** To BS 7671 and in accordance with IET guidance note 1.
- **Preparation:**
 - **Burrs and sharp edges:** Make smooth.
 - **Cutting:** Minimize and make good edges. Cuts to cable tray to be square along an unperforated line.
 - **Treatment of cut surface:** Extend 25 mm beyond the cut. Match finish of cable supports.
- **Access:** Provide space around cable ladder and tray 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 ladder and tray:** Maximize.
 - **Ends:** Blank with end plates.
- **Changes of size and direction:** Manufacturer's accessories of the same material type, pattern, finish and thickness as cable supports.
- **Fire barriers:** Provide where required to maintain fire performance of fabric.
- **Protective covers:** Provide to cables requiring mechanical protection.
- **Support:**
 - **Fixing arrangement:** Independently fix and support from building structure using threaded rod fixed to channel cable support with shake proof washers and hex nuts;
Independently fix and support from building structure using threaded rod fixed into expanding anchors;
and Independently fix and support from building structure using threaded rod fixed into resin injection anchors.
 - **Clearance from building fabric (minimum):** 20 mm.
- **Components:** Avoid contact between dissimilar metals.

- **Routing of cable ladder and tray:** Submit working drawings showing the final routes.

Installing cable basket

- **Standards:** To BS 7671 and in accordance with IEE Guidance Note 1.
- **Joints:**
 - **Cut:** Adjacent cross basket wires. Make smooth any burrs or edges.
 - **Earth conductors:** Connect across joints.
- **Accessories:** Form on site and connect with basket manufacturer's coupling components.
- **Fire barriers:** Provide where required to maintain fire performance of fabric.
- **Support:**
 - **Fixing arrangement:** Independently fix and support from building structure using threaded rod fixed to channel cable support with shake proof washers and hex nuts;
Independently fix and support from building structure using threaded rod fixed into expanding anchors;
and Independently fix and support from building structure using threaded rod fixed into resin injection anchors.
 - **Clearance from building fabric (minimum):** 20 mm.
- **Components:** Avoid contact between dissimilar metals.
- **Routing of cable basket:** Submit working drawings showing the final routes.

Installing cable supports on roofs

Shared by: 90-55-10/330 Cable ladders; and 90-55-10/335 Cable trays.

- **Position:** Elevate above roof.
- **Mounting:** Load spreading supports.

Multiple cable runs

Shared by: 90-55-10/325 Cable baskets; 90-55-10/330 Cable ladders; and 90-55-10/335 Cable trays.

- **Requirement:**

Cable support zones

Shared by: 90-55-10/325 Cable baskets; 90-55-10/330 Cable ladders; and 90-55-10/335 Cable trays.

- **Ceiling voids:**
 - **Clear distance between underside of cable supports and brackets and topside of ceiling (minimum):** Contractor's choice.

Installing conduit, trunking and ducting

Shared by: 90-55-10/460 Conduit fittings; 90-55-10/715 Installing pliable and flexible conduit; 90-55-10/720 Installing rigid metallic conduit; 90-55-10/725 Installing rigid non metallic conduit; 90-55-10/735 Installing conduit connections to equipment; and 90-55-10/765 Conduit, trunking and ducting zones.

- **Standards:** In accordance with BS 7671 and IET Guidance Note 1.
- **Preparation:** Cut square. Remove burrs and sharp edges to make smooth.

- **Protection of metallic conduit, trunking and ducting:**
 - **Joints and ends:** Remove grease, oil, dirt and rust before applying protective paint. Paint immediately following installation.
 - **Protective paint:**
 - Generally:** Compatible with conduit, trunking and ducting finish.
 - Type:** Match factory finish.
- **Cross-sectional area:** Maintain throughout the conduit, trunking and ducting length.
- **Arrangement:** Position vertically and horizontally in line with equipment served, and parallel with building lines.
- **Spare containment:** Install one spare 25 mm diameter conduit from each distribution board to the nearest accessible void space, terminating in a conduit box with lid.
- **Draw wires:** Install galvanized soft iron wires within spare conduit, trunking and ducting.
- **Distance from other services running parallel (minimum):**
 - **Generally:** 150 mm.
 - **Above radiators:** 1000 mm.
 - **Steam services:** 600 mm.
- **Drainage of conduit, trunking and ducting:** Locate drainage outlets at lowest points in conduit, trunking and ducting installed externally, and where condensation may occur.
- **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, trunking and ducting from building structure.
- **Cleaning:** Clean insides of conduit, trunking and ducting before installing cables.
- **Cabling:** Install when conduit, trunking and ducting enclosure is complete.
- **Submittals:** Submit manufacturer's technical information. Submit drawings showing the proposed routes of conduit, trunking and ducting and the location of service outlets.

Installing trunking generally

- **Supports and mounting arrangement:** Wall mounted;
Ceiling mounted;
Floor mounted;
Purpose made brackets;
and Suspension rods and steel channels.
- **Changes of direction:** Manufacturer's bends and tees.
- **Joints:**
 - **Generally:** 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.
- **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.

Conduit, trunking and ducting zones

Shared by: 90-55-10/360 Flexible conduit; 90-55-10/380 Rigid conduit; and 90-55-10/410 Cable trunking and cable ducting systems.

- **General requirements:** Installing conduit, trunking and ducting.
- **Ceiling voids:** Provide clear distance of 150 mm (minimum) between underside of any conduit, trunking or trunking and the topside of ceiling.

Extra low and low voltage cable routes

Shared by: 90-55-15/342 Fire resistant, insulated and sheathed cables; 90-55-15/343 Fire resistant, insulated and sheathed armoured cables; 90-55-15/344 Mineral insulated cables type A and type B; 90-55-15/345 PVC insulated cables; 90-55-15/346 PVC insulated cables for interconnecting wiring; 90-55-15/351 Thermosetting insulated cables; 90-55-15/352 Thermosetting insulated and PVC sheathed cables (XLPE/ PVC singles); 90-55-15/353 Thermosetting insulated and PVC sheathed armoured cables; 90-55-15/354 Thermosetting insulated and LSZH sheathed armoured cables; 90-55-15/355 Thermosetting insulated metal screened LSZH sheathed multicore cables; 90-55-15/366 Balanced twisted-pair cables; 90-55-15/385 Prefabricated LSZH insulated singles in flexible conduit; and 90-55-15/386 Prefabricated LSZH insulated and sheathed multi-core.

- **Cables generally:**
 - **Concealed cable runs to wall accessories:** Run vertically from the accessory.
 - **Exposed cable runs:** Contractor's choice.
- **Distance from other services running parallel (minimum):** 150 mm. Position cables below heating pipes.

Extra low and low voltage cables in accessible roof spaces

Shared by: 90-55-15/340 Flexible cords; 90-55-15/342 Fire resistant, insulated and sheathed cables; 90-55-15/343 Fire resistant, insulated and sheathed armoured cables; 90-55-15/344 Mineral insulated cables type A and type B; 90-55-15/345 PVC insulated cables; 90-55-15/346 PVC insulated cables for interconnecting wiring; 90-55-15/351 Thermosetting insulated cables; 90-55-15/352 Thermosetting insulated and PVC sheathed cables (XLPE/ PVC singles); 90-55-15/353 Thermosetting insulated and PVC sheathed armoured cables; 90-55-15/354 Thermosetting insulated and LSZH sheathed armoured cables; 90-55-15/355 Thermosetting insulated metal screened LSZH sheathed multicore cables; 90-55-15/366

Balanced twisted-pair cables; 90-55-15/385 Prefabricated LSZH insulated singles in flexible conduit; and 90-55-15/386 Prefabricated LSZH insulated and sheathed multi-core.

- **Cables running across ceiling joists:** Cable baskets; Cable trays; and Cable trunking and cable ducting systems.

Extra low and low voltage surface mounted cables

Shared by: 90-55-15/340 Flexible cords; 90-55-15/342 Fire resistant, insulated and sheathed cables; 90-55-15/343 Fire resistant, insulated and sheathed armoured cables; 90-55-15/344 Mineral insulated cables type A and type B; 90-55-15/345 PVC insulated cables; 90-55-15/346 PVC insulated cables for interconnecting wiring; 90-55-15/351 Thermosetting insulated cables; 90-55-15/352 Thermosetting insulated and PVC sheathed cables (XLPE/ PVC singles); 90-55-15/353 Thermosetting insulated and PVC sheathed armoured cables; 90-55-15/354 Thermosetting insulated and LSZH sheathed armoured cables; 90-55-15/355 Thermosetting insulated metal screened LSZH sheathed multicore cables; and 90-55-15/366 Balanced twisted-pair 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.

Installing low voltage cables in conduit and trunking

Shared by: 90-55-15/342 Fire resistant, insulated and sheathed cables; 90-55-15/343 Fire resistant, insulated and sheathed armoured cables; 90-55-15/344 Mineral insulated cables type A and type B; 90-55-15/345 PVC insulated cables; 90-55-15/346 PVC insulated cables for interconnecting wiring; 90-55-15/349 Single-core heat resisting insulating cables; 90-55-15/351 Thermosetting insulated cables; 90-55-15/352 Thermosetting insulated and PVC sheathed cables (XLPE/ PVC singles); 90-55-15/353 Thermosetting insulated and PVC sheathed armoured cables; 90-55-15/354 Thermosetting insulated and LSZH sheathed armoured cables; 90-55-15/355 Thermosetting insulated metal screened LSZH sheathed multicore cables; 90-55-15/366 Balanced twisted-pair cables; 90-55-15/385 Prefabricated LSZH insulated singles in flexible conduit; and 90-55-15/386 Prefabricated LSZH insulated and sheathed multi-core.

- **Cable installation:** Orderly and capable of being withdrawn.
- **Single core wiring:** Arrange using the loop-in method.
- **Cables within trunking:** Tie at 2 m intervals for cables of the same circuit reference. Label ties with circuit reference number at 10 m intervals.
- **Cables in vertical conduit:** Provide cable clamps in accessible conduit boxes at 5 m intervals.
- **Extra low voltage cables:** Install within a separate partition from low voltage cables where installed in multi compartment trunking.

Installation of surge suppression devices generally type B

- **Standards:** To BS 7671; To DD CLC/TS 61643-12; and To DD CLC/TS 61643-22.
- **Equipment:** Provide electrical supplies to equipment requiring power.
- **Fixings:** Non-corroding and compatible with the environment where they are installed.

Installing transient overvoltage surge suppression devices for mains power supplies and data and telecom supplies

- **General requirements:** Installation of surge suppression devices generally type B.
- **Point of installation:** At main low voltage switchboard and At main telephone distribution panel.
- **Transient overvoltage suppression devices:** Interconnect.
- **Control cables between transient overvoltage suppression devices and BMS:** Interconnect.
- **Interconnecting cable:**
 - **Cable type:** Device manufacturer's standard.
 - **Cable size:** Device manufacturer's standard.
 - **Cable length (maximum):** 250 mm.
 - **Cable installation:** Tightly bind connecting leads together.
- **Fuse protection:** Provide fuse protection to transient overvoltage surge suppression devices.
- **Isolation:** Required.

Installing CCTV cameras

- **Siting:** Suitable for access control and Suitable for site perimeter surveillance.
- **Power supplies:** Not required.
- **Fixing equipment:**
 - **Generally:** Fix independently of wiring installation with zinc electroplated fasteners.
 - **Orientation:** Accurate and square to vertical and horizontal axes.
- **Final connection:** Complete.

Installing controllers

- **Position:** In control room.
- **Security:** Protect from interference by unauthorized individuals.
- **Power supplies:** From UPS and Unswitched fused connection units.
- **Final connection:** Complete.

Installing telemetry transmitters and receivers

Shared by: 90-75-10/350 Telemetry transmitters; and 90-75-10/360 Telemetry receivers.

- **Security:** Protect from interference by unauthorized individuals.
- **Power supplies:** Unswitched fused connection units.
- **Telemetry data controls connections:** Complete.

Installing network video recorders

- **Security:** Protect from interference by unauthorized individuals.
- **Power supplies:** UPS and Unswitched fused connection units.
- **Network video recorder data connections:** Complete.

System completion

Closed circuit television system testing and commissioning

- **Standard:** To BS EN 50132-7.
- **System commissioning agent:** System supplier.
- **Notice before commencing tests (minimum):** Two weeks.
- **Cable testing:**
 - **Insulation resistance:** Submit results.
 - **Earth continuity:** Submit results.
- **Evaluation of system performance:** Rotakin test.
- **Camera coverage:** Adjust to obtain optimal performance with normal and infrared illumination.
- **Infrared illuminators:** Accurately adjust to suit angle of associated cameras.
- **Pan and tilt units:** Check accuracy of pre-set positions and demonstrate movement covers whole of relevant surveillance area.
- **Alarm and motion detection devices:** Verify the operation, and adjust to provide maximum coverage.
- **Image storage time:** Confirm.
- **Sample video:** Record and exported from each camera. Submit sample video recordings.

Documentation

- **Test and commissioning schedules:** Submit a minimum of two weeks prior to commencing tests.
- **Operating and maintenance instructions:**
 - **Scope:** Submit for the system giving optimum settings for controls.
 - **Product information:** Include product description, date of purchase, performance characteristics, application (suitability for use), method of operation and control, and cleaning and maintenance requirements.
 - **Format:** Paper copy.
 - **Number of copies:** Three.
- **Secure recording area logbook:** Hard back cover embossed "CCTV LOG BOOK" with A4 lined paper, minimum 100 pages.
- **Number of copies:** Three.
- **Record drawings:**
 - **Content:** General arrangement drawings showing the location of all control equipment, including receivers, transmitters, recorders, cameras, monitors, and associated power supply and For all control cabling, the cable origin, circuit designation, route from control equipment to receivers, transmitters, recorders, cameras, and monitors. Include conductor material and c.s.a, insulation type and colour, number of cores per cable, number of cables in ducts, on tray or ladder.
 - **Format:** A1 paper print drawing and Electronic drawing.
 - **Number of copies:** Three.

- **Submittal date:** At handover.

Spares and consumables

- **Blank video tapes:**
 - **Type:**
 - **Time period:**
 - **Quantity:** Determine.
- **Compatible blank recordable digital medium:**
 - **Type:** DVD.
 - **Quantity:** Determine.

Maintenance

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

Training

- **Operator training:**
 - **Training provider:** System supplier.
 - **Training period:** Before Practical Completion
 - **Training content:** Submit proposals.

Ω End of system

Intruder detection and alarm system

System outline

Intruder detection and alarm system

- **Description:**

The security shall provide:-

- " An Intruder detection system arranged to permit specific areas of the building to be used outside of opening hours;
- " A discrete code based panel within a protected area;
- " Door contacts, dual PIR and microwave detectors and panic switches;
- " Sensors/detectors located to protect perimeter of the building and detect movement should an intrusion occur;
- " Confirmation of intrusion by sequential activation of detectors and communication of this to an ARC (Alarm Receiving Centre). Confirm cause of alarm, raise alarm with sirens and strobe lights and auto-dial;
- " Access-controlled doors with smart readers, electromagnetic locks and cards to control staff, student and visitor access;

The Intruder Alarm System (IAS) shall be typically based on the Stage 4 drawings and designed to provide comprehensive protection to all ground floor perimeter rooms, all circulation spaces, all access routes into the building and high-risk areas such as ICT-rich rooms. The system shall be engineered to grade 3 of EN 50131 and shall be configured so as to provide sequential confirmation of alarm activation to a BS 5979 Alarm Receiving Centre (ARC) via dual, independent communication routes. The system shall provide the facility for manual activation of the alarm in the event of a threatening incident during occupied hours.

The Museum area shall be designed to Grade 3 level of security detection, whilst recognising the fact the the remainder of the Town Hall does not yet comply with Grade 3 Level. This upgrade to the Town Hall systems may occur in the future, but not under this Contract. The Museum system shall be completely interfaced with the Town Hall system (when updated) to form one overall system.

THE SYSTEM SHALL BE OPEN PROTOCOL. Refer to the definition of open protocol elsewhere in this document.

The Electrical Contractor shall employ a specialist for the design, supply, installation, connection, testing, commissioning and setting to work of the complete system. The specialist shall provide a complete system to meet the requirements of this specification. The specialist shall be a NACOSS Gold Contractor and shall base the design of the system on the equipment specified or equal and approved.

The detection devices shall include the following technologies as appropriate to the risk and the building fabric.

- Dual-technology detectors
- Magnetic contacts
- Deliberately operated devices (hold-up alarm)
- Panic alarm button at reception

This list does not preclude the inclusion of other technologies but these shall be by prior agreement with the CA.

The specialist shall provide a Zoning proposal drawing. This zoning shall permit partial setting and unsetting of the system so as to allow flexible use of the building.

All detection devices shall be wired using unarmoured 8-core cable to a number of RIOs (remote input/output units). These shall in turn be wired to the proposed main security panel which shall be located in a protected area. It shall not be possible to access the main panel without generating a confirmed alarm.

User interfaces shall be provided in the form of keypads with illuminated alpha-numeric displays. These shall be located at key staff entrance points as indicated on the drawings.

Panic Alarms:

Panic alarms shall be provided in the main reception

The Client's preferred specialist is

Gary Cheeseman of
Pyrotec Services Ltd
Avalon House,
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Abingdon,
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Phone: 01235 524469

- **System Performance:** To provide an intruder alarm detection system and panic alarm in accordance with the clients requirements.

The contractor shall appoint a specialist NACOSS approved subcontractor to supply and install a security system to the building.

The system shall be designed and installed in accordance with all relevant Standards, Regulations and best practice. The complete installation is to be carried out in accordance with the latest edition and amendments of the documents specified below, which is not exhaustive:-

To provide an intruder alarm detection system and panic alarm in accordance with the clients requirements.

NSI - Codes of practice for intruder alarm systems
ACPO - Association of chief police officers latest policies
BS EN-50131 - European intruder alarm code of practices
PD6662:2004 - Intruder and Hold up Alarm systems
DD243:2004 - 'Confirmed Alarm' system
Secure by Design (or other recognised design approval) - Liaison with Police Liaison Officer.

System setting and unsetting;

Protected area, zoning and device identification;

Spare capacity;

Connection to fire detection and alarm systems;
Continuous monitoring;
Police response;
Integration with other alarm and security systems;
Integration with CCTV systems;
Grade 3 and grade 4 standby period;
Digital communicators;
Direct line signalling;
Prevention of setting for grade 1 systems;
Prevention of setting for grade 2 systems;
Prevention of setting for grade 3 systems;
Supplementary processing of signals for grade 1 systems;
Supplementary processing of signals for grade 2 systems;
Supplementary processing of signals for grade 3 or 4 systems;
Supplementary indications for grade 1 and 2 systems;
Supplementary indications for grade 3 systems;
Supplementary indications for grade 4 systems;
Notification requirements for grade 1 systems;
Notification requirements for grade 2 systems;
Notification requirements for grade 3 systems;
Notification requirements for grade 4 systems;
Supplementary tamper detection for grade 1 systems;
Supplementary tamper detection for grade 2 systems;
Supplementary tamper detection for grade 3 systems;
Communication between system components for grade 1 systems;
Monitoring substitution of grade 1, 2 and 3 system components;
Event recording for grade 1 systems;
Event recording for grade 2 systems;
Event recording for grade 3 systems;
 and Event recording for grade 4 systems.

- **System manufacturer:** A member of British Security Industry Association;
A Gold member of National Security Inspectorate;
and A member of Security Systems and Alarms Inspection Board.
- **Power supply:** To BS EN 50131-1, type A.
- **Detectors:** Beam interruption detectors;
Capacitive proximity detectors;
Combined passive infrared and microwave detectors;
Combined passive infrared and ultrasonic detectors;
Deliberately operated devices;
Acoustic detectors;
Microwave detectors;
Passive infrared detectors;
Ultrasonic detectors;
Vibration detectors;
Volumetric capacitive detectors;
and Protective switches.
- **Cabling and containment:**
 - **Cable type:** PVC insulated cables for interconnecting wiring.
 - **Containment:** Cable baskets;
Rigid conduit;
and Cable trunking and cable ducting systems.
 - **Rewireable installation:** Required.

- **Concealed installation:** Required.
- **Warning devices:**
 - **Internal:** Internal warning devices;
LED clusters;
Vibrating pagers;
and Xenon beacons.
 - **External:** External warning devices and To alarm receiving centre (ARC).
 - **Signalling method:** Digital communicators and Direct line signalling.
- **Control and indicating equipment (CIE):** Intrusion and hold-up alarm panels and Remote keypads.
- **Execution:** Removing intruder detection and alarm systems and Installing intrusion and hold-up alarm systems.
- **System completion:** Testing and commissioning intruder detection and hold-up alarms systems generally;
Documentation;
Spares and consumables;
Maintenance;
Device identification and testing;
System soak testing;
Standby battery testing;
Testing actuation, integration and interfacing with other alarm and security systems;
and Modifications to existing intrusion and hold-up alarm systems.

System performance

System setting and unsetting

Protected area, zoning and device identification

- **Perimeter protection:** All external doors and windows.
- **Zoning:** Divide the installation into separately controlled and identifiable zones.
- **Device identification:** Individual address.

Spare capacity

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

Connection to fire detection and alarm systems

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

Integration with CCTV systems

- **Integration:** In accordance with BS 8418.

Continuous monitoring

- **Objective:** As per security drawings

Police response

- **Response:** In accordance with ACPO policy on police response to security systems and In accordance with ACPOS security systems policy.

Integration with other alarm and security systems

- **Objectives:** Interface to be provided with existing Town Hall system
- **Systems to be integrated:**

Prevention of setting for grade 3 systems

- **Conditions preventing system setting:** Mandatory requirements

Supplementary processing of signals for grade 3 or 4 systems

- **System status, set:**
 - **Response to hold-up signal or message:** Internal audible alarm.
 - **Response to tamper signal or message:** Submit proposals.
 - **Response to fault signal or message:** Submit proposals.
- **System status, unset:**
 - **Response to hold-up signal or message:** Submit proposals.
 - **Response to tamper signal or message:** Submit proposals.

Supplementary indications for grade 3 systems

- **System set:** Mandatory
- **During unsetting:** Mandatory

Notification requirements for grade 3 systems

- **Means of notification:** Refer to 10 of BS EN 50131-1

Supplementary tamper detection for grade 3 systems

- **Additional forms of tamper detection:** Mandatory

Monitoring substitution of grade 1, 2 and 3 system components

- **Substitution of system components:** Not required.
- **Substitution of signals or messages:** Not required.
- **Timing:**
 - **Substitution of system components:** Mandatory
 - **Substitution of signals or messages:** Mandatory

Event recording for grade 2 systems

- **Memory capacity (minimum):** 250 events.
- **Endurance of memory after system power failure (minimum):** 30 days.
- **Event recording functions:** Submit proposals.

Event recording for grade 3 systems

- **Memory capacity (minimum):** 500 events.

- **Endurance of memory after system power failure (minimum):** 30 days.
- **Event recording functions:** Submit proposals.

Products

Cable cleats

Shared by: 70-70-45/110 Low voltage distribution system; 70-70-75/110 Hard wired low voltage small power system; and 90-55-15/735 Cable installation on channel cable supports, cable tray, cable ladder and cable basket.

- **Manufacturer:** Contractor's choice.
- **Standard:** To BS EN 61914.
- **Format:** Contractor's choice.
- **Material:** Metallic.
- **Temperatures for permanent installation:**
 - **Maximum:** 105°C.
 - **Minimum:** -25°C.
- **Resistance to impact:** Heavy.
- **Type of retention or resistance to electromechanical forces:** Resistant to electromechanical forces, withstanding one short circuit.
- **Environmental influences:**
 - **Non-metallic and composite components:** Resistant to ultraviolet light.
 - **Metallic and composite components:** High resistance to corrosion.

Cable ties

Shared by: 70-70-45/110 Low voltage distribution system; 70-70-75/110 Hard wired low voltage small power system; and 90-55-15/735 Cable installation on channel cable supports, cable tray, cable ladder and cable basket.

- **Manufacturer:** Contractor's choice.
- **Standard:** To BS EN 62275.
- **Format:** Wrap around self-locking releasable.
- **Material:** Nylon and Metal.
- **Loop tensile strength (minimum):** Manufacturer's standard.
- **Temperatures for permanent installation:**
 - **Maximum:** 60°C.
 - **Minimum:** -15°C.
- **Contribution to fire:** Non-flame propagating.
- **Environmental influences:**
 - **Non-metallic and composite components:** Resistant to ultraviolet light.
 - **Metallic and composite components:** Resistant to corrosion.

Cable bands

Shared by: 70-70-45/110 Low voltage distribution system; and 90-55-15/735 Cable installation on channel cable supports, cable tray, cable ladder and cable basket.

- **Manufacturer:** Contractor's choice.

- **Material:** Manufacturer's standard.
- **Protective covering:** Manufacturer's standard.

Cable baskets

Shared by: 70-70-45/110 Low voltage distribution system; 70-70-75/110 Hard wired low voltage small power system; 70-80-35/110 Hard wired general lighting system; 75-45-20/110 Data distribution system; 75-60-10/110 CCTV system; 75-60-40/110 Intruder detection and alarm system; 75-65-30/110 Fire detection and alarm system; and 90-55-15/650 Extra low and low voltage cables in accessible roof spaces.

- **Manufacturer:** Contractor's choice.
- **Material:**
- **Coating material:** Hot dip galvanised, powder coated RAL colour to architectural specification
- **Features:**
 - **Segregation:** Cable dividers.
 - **Protective cover:** Required.
- **Execution:** Installing cable basket;
Multiple cable runs;
and Cable support zones.
- **Standard:** To BS EN 61537.

Cable trays

Shared by: 70-70-45/110 Low voltage distribution system; 70-70-75/110 Hard wired low voltage small power system; 75-60-10/110 CCTV system; and 90-55-15/650 Extra low and low voltage cables in accessible roof spaces.

- **Manufacturer:** Contractor's choice.
- **Standard:** To BS EN 61537.
- **Material:** Steel.
- **Resistance against flame propagation:** Non-Flame propagating.
- **Electrical properties:**
 - **Continuity characteristics:** Without electrical continuity.
 - **Conductivity characteristics:** Without electrical conductive system component.
- **Coating material:** Hot dip galvanised, powder coated RAL colour to architectural specification
- **Temperature properties for transport, storage, installation and application:**
 - **Minimum:** Manufacturer's standard.
 - **Maximum:** Manufacturer's standard.
- **Mechanical properties:**
 - **Cable tray free base area:** Manufacturer's standard.
 - **Resistance to impact:** Manufacturer's standard.
- **Features:**
 - **Flange type:** Return.
 - **Segregation:** Cable dividers.
 - **Protective cover:** Required.

- **Execution:** Installing cable tray and cable ladder;
Installing cable supports on roofs;
Multiple cable runs;
and Cable support zones.

Rigid conduit

Shared by: 70-70-25/660 Installing main earthing conductor; 70-70-45/110 Low voltage distribution system; 70-70-75/110 Hard wired low voltage small power system; 70-80-35/110 Hard wired general lighting system; 75-45-40/110 Audio-frequency-induction-loop system; 75-60-05/110 Access control system; 75-60-40/110 Intruder detection and alarm system; 75-65-30/110 Fire detection and alarm system; 75-70-05/110 Assistance call system; and 90-55-15/645 Low voltage cables concealed in walls and partitions.

- **Manufacturer:** Contractor's choice.
- **Standards:** To BS EN 61386-21.
- **Mechanical properties:**
 - **Resistance to compression:** Heavy.
 - **Resistance to impact:** Heavy.
- **Transport, installation and application:**
 - **Lower temperature (minimum):** Manufacturer's standard.
 - **Upper temperature (maximum):** Manufacturer's standard.
- **Resistance to bending:** Rigid.
- **Electrical characteristics:** With electrical continuity properties.
- **Resistance to external influences:**
 - **Protection against ingress of solid objects (minimum):** To BS EN 60529, IP3X.
 - **Protection against ingress of water (minimum):** To BS EN 60529, IPX0.
- **Resistance to corrosion:** To BS EN 61386-1, Class 4.
- **Tensile strength:** Heavy.
- **Resistance to flame propagation:** Manufacturer's standard.
- **Suspended load capacity:** Heavy.
- **Colour:** Submit proposals.
- **Sizes (OD):** 25 mm.
- **Execution:** Installing rigid metallic conduit;
Installing rigid non metallic conduit;
Installing conduit connections to equipment;
and Conduit, trunking and ducting zones.

Cable trunking and cable ducting systems

Shared by: 70-70-45/110 Low voltage distribution system; 70-70-75/110 Hard wired low voltage small power system; 70-80-35/110 Hard wired general lighting system; 75-60-05/110 Access control system; 75-60-40/110 Intruder detection and alarm system; 75-65-30/110 Fire detection and alarm system; 75-70-05/110 Assistance call system; 75-70-05/120 Emergency voice communication system; and 90-55-15/650 Extra low and low voltage cables in accessible roof spaces.

- **Manufacturer:** Contractor's choice.
- **Standards:** To BS EN 50085-1 and BS EN 50085-2-1.

- **Material:** Metallic;
Non-metallic;
and Steel.
- **Construction:** To include means of preventing contact between liquids and insulated conductors and live parts.
- **Temperature properties:**
 - **Storage and transport temperature (maximum):** Manufacturer's standard.
 - **Installation and application temperature (minimum):** Manufacturer's standard.
 - **Application temperature (maximum):** Manufacturer's standard.
- **Resistance to flame propagation:** Required.
- **Electrical properties:** With electrical continuity characteristics.
- **Ingress protection (minimum):** To BS EN 60529, IP x4.
- **Protection against corrosive and polluting substances:** High protection outside and inside.
- **Access method:** With tools.
- **Screening:** Required.
- **Execution:** Conduit, trunking and ducting zones and Installing trunking generally.

PVC insulated cables for interconnecting wiring

Shared by: 75-60-40/110 Intruder detection and alarm system; and 75-70-05/110 Assistance call system.

- **Manufacturer:** Contractor's choice.
- **Standard:** To BS 4737-3-30.
- **Conductor:**
 - **Nominal diameter:** 0.22 mm².
 - **Stranding:** 7 x 0.2 mm.
 - **Sheath:** PVC.
 - **Colour:** Manufacturer's standard.
 - **Number of cores:** As required
- **Execution:** Installing low voltage cables;
Extra low and low voltage cable routes;
Low voltage cables concealed in walls and partitions;
Extra low and low voltage cables in accessible roof spaces;
Extra low and low voltage surface mounted cables;
Installing low voltage cables in conduit and trunking;
and Cable installation on channel cable supports, cable tray, cable ladder and cable basket.

Intrusion and hold-up alarm panels

- **Manufacturer:** Refer to electrical equipment schedules.
- **Standard:** To BS EN 50131-3 and BS EN 50131-6.
- **Security grading:** Refer to the specification system description.
- **Environmental classification:** To suit the locations environmental conditions and in accordance with BS EN 50131-1.
- **Control features:**

- **Integral keypad:** 32 (2x16) alphanumeric backlit LCD, digital keypad and LED indicating power 'On'.
- **Event log capacity (minimum):** 1000 events.
- **Communication interfaces:** Manufacturer's standard.
- **Access door control:** Manufacturer's standard.
- **Number of zones (minimum):** Manufacturer's standard.
- **Number of groups (minimum):** Manufacturer's standard.
- **Number of users (minimum):** Manufacturer's standard.
- **Execution:** Installing intruder alarm control and indicating equipment.

Remote keypads

- **Standard:** To BS EN 50131-3.
- **Security grading:** To BS EN 50131-1, Grade 3.
- **Environmental classification:** Submit proposals.
- **Control features:**
 - **Display type:** Manufacturer's standard.
 - **Setting and unsetting:** Via PIN and Via proximity card.
 - **Operation:** Full system control.
- **Enclosure:** Suitable for flush mounting.
- **Execution:** Installing remote keypads.

Capacitive proximity detectors

- **Standard:** To BS 4737-3-13.
- **Security grading:** To BS EN 50131-1, Grade 3.
- **Environmental classification:** Submit proposals.
- **Mounting:** Ceiling and Wall.
- **Features:** Manufacturer's standard.
- **Execution:** Installing capacitive proximity devices.

Combined passive infrared and microwave detectors

- **Manufacturer:** Refer to the electrical equipment schedules.
- **Standard:** To BS EN 50131-2-4.
- **Security grading:** To BS EN 50131-1, Grade 3.
- **Environmental classification:** Submit proposals.
- **Mounting:** Ceiling and Wall.
- **Range:** 360° - 15 m;
11 m;
15 m;
and 18 m.
- **Features:** Manufacturer's standard.
- **Execution:** Installing combined passive infrared and microwave detectors.

Combined passive infrared and ultrasonic detectors

- **Standard:** To BS EN 50131-2-5.
- **Security grading:** To BS EN 50131-1, Grade 3.

- **Environmental classification:** Submit proposals.
- **Mounting:** Ceiling and Wall.
- **Features:** Manufacturer's standard.
- **Execution:** Installing combined passive infrared and ultrasonic detectors.

Microwave detectors

- **Manufacturer:** Refer to the electrical equipment schedules.
- **Standard:** To BS EN 50131-2-3.
- **Security grading:** Refer to the specification system description.
- **Environmental classification:** To suit the locations environmental conditions and in accordance with BS EN 50131-1.
- **Mounting:** Ceiling and Wall.
- **Features:** Manufacturer's standard.
- **Execution:** Installing microwave detectors.

Passive infrared detectors

- **Manufacturer:** Refer to the electrical equipment schedules.
- **Standard:** To BS EN 50131-2-2.
- **Security grading:** Refer to the specification system description.
- **Environmental classification:** To suit the locations environmental conditions and in accordance with BS EN 50131-1.
- **Mounting:** Ceiling and Wall.
- **Range:** Manufacturer's standard.
- **Features:** Manufacturer's standard.
- **Execution:** Installing passive infrared detectors.

Vibration detectors

- **Manufacturer:** Refer to the electrical equipment schedules.
- **Standard:** To BS 4737-3-10.
- **Security grading:** Refer to the specification system description.
- **Environmental classification:** To suit the locations environmental conditions and in accordance with BS EN 50131-1.
- **Mounting:** Ceiling and Wall.
- **Detection range (minimum):** Manufacturer's standard.
- **Execution:** Installing vibration detectors.

Deliberately operated devices

- **Manufacturer:** Refer to the electrical equipment schedules.
- **Standard:** To BS 4737-3-14.
- **Security grading:** Refer to the specification system description.
- **Environmental classification:** To suit the locations environmental conditions and in accordance with BS EN 50131-1.
- **Device type:** Manufacturer's standard.
- **Operating mechanism:** Non-latching.
- **Key reset:** Not required.

- **Operating method:** Hand operated.
- **Sound level during operation:** Quiet.
- **Execution:** Installing deliberately operated devices.

Protective switches

- **Manufacturer:** Refer to the electrical equipment schedules.
- **Standard:** To BS 4737-3-3.
- **Security grading:** Refer to the specification system description.
- **Environmental classification:** To suit the locations environmental conditions and in accordance with BS EN 50131-1.
- **Device type:** Magnetic reed switch.
- **Circuit configuration:** Manufacturer's standard.
- **Material:** Plastics.
- **Mounting:** Recessed and Surface.
- **Execution:** Installing protective switches.

External warning devices

- **Manufacturer:** Refer to electrical equipment schedules.
- **Standard:** To BS EN 50131-4.
- **Security grading:** Refer to the specification system description.
- **Environmental classification:** To suit the locations environmental conditions and in accordance with BS EN 50131-1.
- **Category:** Manufacturer's standard.
- **Storage device type:** Manufacturer's standard.
- **Enclosure:**
 - **Material:** Polycarbonate.
 - **Body colour:** Manufacturer's standard.
 - **Lens colour:** Manufacturer's standard.
- **Stroke:** Integral xenon beacon.
- **Status indicators:** Integral status LED.
- **Sound pressure level (minimum):** 95 dB(A) @1m with automatic cut off after 15 minutes.
- **Execution:** Installing electronic sounders.

Internal warning devices

- **Manufacturer:** Refer to electrical equipment schedules.
- **Security grading:** Refer to the specification system description.
- **Environmental classification:** To suit the locations environmental conditions and in accordance with BS EN 50131-1.
- **Category:** Manufacturer's standard.
- **Storage device type:** Manufacturer's standard.
- **Enclosure:**
 - **Material:** Polycarbonate.
 - **Colour:** Manufacturer's standard.

- **Sound pressure level (minimum):** 75 dB(A) @1m, with automatic cut off after 15 minutes and selectable alternating or continuous tone.
- **Strobe:** Integral xenon strobe.
- **Status indicators:** Integral status LED.
- **Execution:** Installing electronic sounders.
- **Standard:** To BS EN 50131-4.

LED clusters

- **Manufacturer:** Refer to electrical equipment schedules.
- **Colour:** Manufacturer's standard.
- **Execution:** Installing LED clusters.

Xenon beacons

- **Manufacturer:** Refer to electrical equipment schedules.
- **Colour:** Manufacturer's standard.
- **Execution:** Installing xenon beacons.

Execution

Removing intruder detection and alarm systems

- **Scope:**

Installing intrusion and hold-up alarm systems

- **Standards:** To DD CLC/TS 50131-7.

Installing cable tray and cable ladder

Shared by: 90-55-10/330 Cable ladders; and 90-55-10/335 Cable trays.

- **Standards:** To BS 7671 and in accordance with IET guidance note 1.
- **Preparation:**
 - **Burrs and sharp edges:** Make smooth.
 - **Cutting:** Minimize and make good edges. Cuts to cable tray to be square along an unperforated line.
 - **Treatment of cut surface:** Extend 25 mm beyond the cut. Match finish of cable supports.
- **Access:** Provide space around cable ladder and tray 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 ladder and tray:** Maximize.
 - **Ends:** Blank with end plates.
- **Changes of size and direction:** Manufacturer's accessories of the same material type, pattern, finish and thickness as cable supports.
- **Fire barriers:** Provide where required to maintain fire performance of fabric.
- **Protective covers:** Provide to cables requiring mechanical protection.

- **Support:**
 - **Fixing arrangement:** Independently fix and support from building structure using threaded rod fixed to channel cable support with shake proof washers and hex nuts;
Independently fix and support from building structure using threaded rod fixed into expanding anchors;
and Independently fix and support from building structure using threaded rod fixed into resin injection anchors.
 - **Clearance from building fabric (minimum):** 20 mm.
- **Components:** Avoid contact between dissimilar metals.
- **Routing of cable ladder and tray:** Submit working drawings showing the final routes.

Installing cable basket

- **Standards:** To BS 7671 and in accordance with IEE Guidance Note 1.
- **Joints:**
 - **Cut:** Adjacent cross basket wires. Make smooth any burrs or edges.
 - **Earth conductors:** Connect across joints.
- **Accessories:** Form on site and connect with basket manufacturer's coupling components.
- **Fire barriers:** Provide where required to maintain fire performance of fabric.
- **Support:**
 - **Fixing arrangement:** Independently fix and support from building structure using threaded rod fixed to channel cable support with shake proof washers and hex nuts;
Independently fix and support from building structure using threaded rod fixed into expanding anchors;
and Independently fix and support from building structure using threaded rod fixed into resin injection anchors.
 - **Clearance from building fabric (minimum):** 20 mm.
- **Components:** Avoid contact between dissimilar metals.
- **Routing of cable basket:** Submit working drawings showing the final routes.

Installing cable supports on roofs

Shared by: 90-55-10/330 Cable ladders; and 90-55-10/335 Cable trays.

- **Position:** Elevate above roof.
- **Mounting:** Load spreading supports.

Multiple cable runs

Shared by: 90-55-10/325 Cable baskets; 90-55-10/330 Cable ladders; and 90-55-10/335 Cable trays.

- **Requirement:**

Cable support zones

Shared by: 90-55-10/325 Cable baskets; 90-55-10/330 Cable ladders; and 90-55-10/335 Cable trays.

- **Ceiling voids:**

- **Clear distance between underside of cable supports and brackets and topside of ceiling (minimum):** Contractor's choice.

Installing conduit, trunking and ducting

Shared by: [90-55-10/460 Conduit fittings](#); [90-55-10/715 Installing pliable and flexible conduit](#); [90-55-10/720 Installing rigid metallic conduit](#); [90-55-10/725 Installing rigid non metallic conduit](#); [90-55-10/735 Installing conduit connections to equipment](#); and [90-55-10/765 Conduit, trunking and ducting zones](#).

- **Standards:** In accordance with BS 7671 and IET Guidance Note 1.
- **Preparation:** Cut square. Remove burrs and sharp edges to make smooth.
- **Protection of metallic conduit, trunking and ducting:**
 - **Joints and ends:** Remove grease, oil, dirt and rust before applying protective paint. Paint immediately following installation.
 - **Protective paint:**
 - Generally:** Compatible with conduit, trunking and ducting finish.
 - Type:** Match factory finish.
- **Cross-sectional area:** Maintain throughout the conduit, trunking and ducting length.
- **Arrangement:** Position vertically and horizontally in line with equipment served, and parallel with building lines.
- **Spare containment:** Install one spare 25 mm diameter conduit from each distribution board to the nearest accessible void space, terminating in a conduit box with lid.
- **Draw wires:** Install galvanized soft iron wires within spare conduit, trunking and ducting.
- **Distance from other services running parallel (minimum):**
 - **Generally:** 150 mm.
 - **Above radiators:** 1000 mm.
 - **Steam services:** 600 mm.
- **Drainage of conduit, trunking and ducting:** Locate drainage outlets at lowest points in conduit, trunking and ducting installed externally, and where condensation may occur.
- **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, trunking and ducting from building structure.
- **Cleaning:** Clean insides of conduit, trunking and ducting before installing cables.
- **Cabling:** Install when conduit, trunking and ducting enclosure is complete.
- **Submittals:** Submit manufacturer's technical information. Submit drawings showing the proposed routes of conduit, trunking and ducting and the location of service outlets.

Installing conduit generally

Shared by: [90-55-10/715 Installing pliable and flexible conduit](#); [90-55-10/720 Installing rigid metallic conduit](#); [90-55-10/725 Installing rigid non metallic conduit](#); and [90-55-10/735 Installing conduit connections to equipment](#).

- **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:**
 - **Generally:** 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:**
 - **Generally:** Install flush with finished surfaces. Provide extension rings if required.
 - **Fixing screws:** Countersunk, or round-headed screws.
 - **Number of fixings (minimum):** Two.
 - **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):** Two.
 - **Floors:** Do not install draw-in boxes in floors.
- **Conduit in walls:** Avoid concealed horizontal runs.
- **Suspended ceiling installations:** Fasten outlet boxes to structure above ceiling.

Installing rigid metallic conduit

- **General requirements:** Installing conduit generally and Installing conduit, trunking and ducting.
- **Fixings:** Distance saddle;
Saddle;
and Spacer bar saddle.
- **Joints:** Plain and 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.

Installing rigid non metallic conduit

- **General requirements:** Installing conduit generally and Installing conduit, trunking and ducting.
- **Fixings:** Distance saddle;
Saddle;
and Spacer bar saddle.

- **Joints:** Compression and Threaded.
- **Conduit connections to boxes and items of equipment:** Threaded bushed entries.

Installing conduit connections to equipment

Shared by: 90-55-10/360 Flexible conduit; and 90-55-10/380 Rigid conduit.

- **General requirements:** Installing conduit generally and Installing conduit, trunking and ducting.
- **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 of adequate length to facilitate removal of equipment for maintenance. Final termination in swivel connectors.
- **Connections to external equipment:** Flexible conduit.

Installing trunking generally

- **Supports and mounting arrangement:** Wall mounted;
Ceiling mounted;
Floor mounted;
Purpose made brackets;
and Suspension rods and steel channels.
- **Changes of direction:** Manufacturer's bends and tees.
- **Joints:**
 - **Generally:** 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.
- **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.

Conduit, trunking and ducting zones

Shared by: 90-55-10/360 Flexible conduit; 90-55-10/380 Rigid conduit; and 90-55-10/410 Cable trunking and cable ducting systems.

- **General requirements:** Installing conduit, trunking and ducting.
- **Ceiling voids:** Provide clear distance of 150 mm (minimum) between underside of any conduit, trunking or trunking and the topside of ceiling.

Installing low voltage cables

Shared by: 90-55-15/342 Fire resistant, insulated and sheathed cables; 90-55-15/345 PVC insulated cables; 90-55-15/346 PVC insulated cables for interconnecting wiring; 90-55-15/349 Single-core heat resisting insulating cables; 90-55-15/351 Thermosetting insulated cables; 90-55-15/352 Thermosetting insulated and PVC sheathed cables (XLPE/ PVC singles); 90-55-15/355 Thermosetting insulated metal screened LSZH sheathed multicore cables; 90-55-15/665 Installing flexible cords; 90-55-15/670 Installing prefabricated wiring; and 90-55-15/680 Installing low voltage armoured cables.

- **Standard:** In accordance with 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. Clear cable path of debris.
- **Installation temperature (minimum):** 5°C.
- **Cables:** Install in one length. Dress cables flat, free from twists, kinks and strain.
- **Cable pulling:** Do not overstress. Prevent kinks and twisting of the cable.
- **Cable protection:** Cables passing through walls and floors to be sleeved with conduit or pipeduct to a minimum of 300 mm. Bush at both ends. Ensure that appropriate fire stopping materials are used to maintain the original fire integrity of the wall or floor around the penetration.
- **Concealed cable runs to wall accessories:** Run vertically from the accessory.
- **Exposed cable runs:**
- **Distance from other services running parallel (minimum):** 150 mm. Position cables below heating pipes.
- **Jointing and termination:**
 - **Final circuit cables:** At electrical accessories only.
 - **Core connections:** Using compression lugs to equipment without integral clamping terminals.
 - **Terminating cables when not using glands:** Take sheathing of cables into accessory boxes and equipment and protect against abrasion with grommets.

Extra low and low voltage cable routes

Shared by: 90-55-15/342 Fire resistant, insulated and sheathed cables; 90-55-15/343 Fire resistant, insulated and sheathed armoured cables; 90-55-15/344 Mineral insulated cables type A and type B; 90-55-15/345 PVC insulated cables; 90-55-15/346 PVC insulated cables for interconnecting wiring; 90-55-15/351 Thermosetting insulated cables; 90-55-15/352 Thermosetting insulated and PVC sheathed cables (XLPE/ PVC singles); 90-55-15/353 Thermosetting insulated and PVC sheathed armoured cables; 90-55-15/354 Thermosetting insulated and LSZH sheathed armoured cables; 90-55-15/355 Thermosetting insulated metal screened LSZH sheathed multicore cables; 90-55-15/366 Balanced twisted-pair

cables; 90-55-15/385 Prefabricated LSZH insulated singles in flexible conduit; and 90-55-15/386 Prefabricated LSZH insulated and sheathed multi-core.

- **Cables generally:**
 - **Concealed cable runs to wall accessories:** Run vertically from the accessory.
 - **Exposed cable runs:** Contractor's choice.
- **Distance from other services running parallel (minimum):** 150 mm. Position cables below heating pipes.

Low voltage cables concealed in walls and partitions

Shared by: 90-55-15/342 Fire resistant, insulated and sheathed cables; 90-55-15/343 Fire resistant, insulated and sheathed armoured cables; 90-55-15/344 Mineral insulated cables type A and type B; 90-55-15/345 PVC insulated cables; 90-55-15/346 PVC insulated cables for interconnecting wiring; 90-55-15/351 Thermosetting insulated cables; 90-55-15/352 Thermosetting insulated and PVC sheathed cables (XLPE/ PVC singles); 90-55-15/355 Thermosetting insulated metal screened LSZH sheathed multicore cables; 90-55-15/385 Prefabricated LSZH insulated singles in flexible conduit; and 90-55-15/386 Prefabricated LSZH insulated and sheathed multi-core.

- **Position:** In a zone within 150 mm of wall perimeter (except at the floor); and run vertically or horizontally from these zones, or from floor level, to switches, accessories, etc and At least 50 mm from the surface. Ensure all routes are agreed with architect (working drawings) to ensure historic fabric is maintained.
- **Protection:** Rigid conduit and Cover with galvanized steel channel nailed to substrate.

Extra low and low voltage cables in accessible roof spaces

Shared by: 90-55-15/340 Flexible cords; 90-55-15/342 Fire resistant, insulated and sheathed cables; 90-55-15/343 Fire resistant, insulated and sheathed armoured cables; 90-55-15/344 Mineral insulated cables type A and type B; 90-55-15/345 PVC insulated cables; 90-55-15/346 PVC insulated cables for interconnecting wiring; 90-55-15/351 Thermosetting insulated cables; 90-55-15/352 Thermosetting insulated and PVC sheathed cables (XLPE/ PVC singles); 90-55-15/353 Thermosetting insulated and PVC sheathed armoured cables; 90-55-15/354 Thermosetting insulated and LSZH sheathed armoured cables; 90-55-15/355 Thermosetting insulated metal screened LSZH sheathed multicore cables; 90-55-15/366 Balanced twisted-pair cables; 90-55-15/385 Prefabricated LSZH insulated singles in flexible conduit; and 90-55-15/386 Prefabricated LSZH insulated and sheathed multi-core.

- **Cables running across ceiling joists:** Cable baskets; Cable trays; and Cable trunking and cable ducting systems.

Extra low and low voltage surface mounted cables

Shared by: 90-55-15/340 Flexible cords; 90-55-15/342 Fire resistant, insulated and sheathed cables; 90-55-15/343 Fire resistant, insulated and sheathed armoured cables; 90-55-15/344 Mineral insulated cables type A and type B; 90-55-15/345 PVC insulated cables; 90-55-15/346 PVC insulated cables for interconnecting wiring; 90-55-15/351 Thermosetting insulated cables; 90-55-15/352 Thermosetting insulated and PVC sheathed cables (XLPE/ PVC singles); 90-55-15/353 Thermosetting insulated and PVC sheathed armoured cables; 90-55-15/354 Thermosetting insulated and LSZH sheathed armoured cables; 90-55-15/355 Thermosetting insulated metal screened LSZH sheathed multicore cables; and 90-55-15/366 Balanced twisted-pair 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.

Installing low voltage cables in conduit and trunking

Shared by: 90-55-15/342 Fire resistant, insulated and sheathed cables; 90-55-15/343 Fire resistant, insulated and sheathed armoured cables; 90-55-15/344 Mineral insulated cables type A and type B; 90-55-15/345 PVC insulated cables; 90-55-15/346 PVC insulated cables for interconnecting wiring; 90-55-15/349 Single-core heat resisting insulating cables; 90-55-15/351 Thermosetting insulated cables; 90-55-15/352 Thermosetting insulated and PVC sheathed cables (XLPE/ PVC singles); 90-55-15/353 Thermosetting insulated and PVC sheathed armoured cables; 90-55-15/354 Thermosetting insulated and LSZH sheathed armoured cables; 90-55-15/355 Thermosetting insulated metal screened LSZH sheathed multicore cables; 90-55-15/366 Balanced twisted-pair cables; 90-55-15/385 Prefabricated LSZH insulated singles in flexible conduit; and 90-55-15/386 Prefabricated LSZH insulated and sheathed multi-core.

- **Cable installation:** Orderly and capable of being withdrawn.
- **Single core wiring:** Arrange using the loop-in method.
- **Cables within trunking:** Tie at 2 m intervals for cables of the same circuit reference. Label ties with circuit reference number at 10 m intervals.
- **Cables in vertical conduit:** Provide cable clamps in accessible conduit boxes at 5 m intervals.
- **Extra low voltage cables:** Install within a separate partition from low voltage cables where installed in multi compartment trunking.

Cable installation on channel cable supports, cable tray, cable ladder and cable basket

Shared by: 90-55-15/342 Fire resistant, insulated and sheathed cables; 90-55-15/343 Fire resistant, insulated and sheathed armoured cables; 90-55-15/344 Mineral insulated cables type A and type B; 90-55-15/345 PVC insulated cables; 90-55-15/346 PVC insulated cables for interconnecting wiring; 90-55-15/351 Thermosetting insulated cables; 90-55-15/353 Thermosetting insulated and PVC sheathed armoured cables; 90-55-15/354 Thermosetting insulated and LSZH sheathed armoured cables; and 90-55-15/355 Thermosetting insulated metal screened LSZH sheathed multicore cables.

- **Cabling:** Install when cable supports are complete.
- **Position:** Place single and multi-core cables side by side.
- **Fastening:**
 - **Fastenings generally:** Secure cables, do not indent sheaths. Position to enable any submain cable to be individually removed.
 - **Submain cables <95 mm²:** Cable cleats.
Spacing (maximum): 600 mm.
 - **Submain cables >95 mm²:** Cable cleats and Cable bands.
Spacing (maximum): 600 mm.
 - **Final circuit cabling:** Cable ties.
Spacing (maximum): 600 mm.
 - **Extra low voltage, communications and fibre optic cabling:** Cable ties.
Spacing (maximum): 600 mm.

Installing intruder alarm control and indicating equipment

- **Standard:** In accordance with DD CLC/TS 50131-7.
- **Position:** As per contractors installation drawings.
- **Fixing equipment:** Fix independently of wiring installation with zinc electroplated fasteners.
- **Orientation:** Accurate and square to vertical and horizontal axes. Align control panels with adjacent items of switchgear and accessories on the same horizontal axis.
- **Main power supply:** Via an unswitched fused connection unit.

Installing remote keypads

- **Mounting:** Refer to security drawings
- **Height (finished floor level to underside of equipment):** 1300 mm.

Installing acoustic detectors

- **Mounting:** Recessed;
Semi recessed;
and Surface mounted.
- **Height (finished floor level to underside of equipment):** Refer to security drawings

Installing beam interruption devices

- **Mounting:** Recessed;
Semi recessed;
and Surface mounted.
- **Height (finished floor level to underside of equipment):** Refer to security drawings

Installing capacitive proximity devices

- **Mounting:** Recessed;
Semi recessed;
and Surface mounted.
- **Height (finished floor level to underside of equipment):** Refer to security drawings

Installing combined passive infrared and microwave detectors

- **Mounting:** Surface mounted.
- **Height (finished floor level to underside of equipment):** As per contractors installation drawings.

Installing combined passive infrared and ultrasonic detectors

- **Mounting:** Recessed;
Semi recessed;
and Surface mounted.
- **Height (finished floor level to underside of equipment):** Refer to security drawings

Installing microwave detectors

- **Mounting:** Surface mounted.
- **Height (finished floor level to underside of equipment):** As per contractors installation drawings.

Installing passive infrared detectors

- **Mounting:** Surface mounted.
- **Height (finished floor level to underside of equipment):** As per contractors installation drawings.

Installing ultrasonic detectors

- **Mounting:** Recessed;
Semi recessed;
and Surface mounted.
- **Height (finished floor level to underside of equipment):** Refer to security drawings

Installing vibration detectors

- **Mounting:** Surface mounted.
- **Height (finished floor level to underside of equipment):** As per contractors installation drawings.

Installing volumetric capacitive detectors

- **Mounting:** Recessed;
Semi recessed;
and Surface mounted.
- **Height (finished floor level to underside of equipment):** Refer to security drawings

Installing electronic sounders

Shared by: 90-75-40/375 External warning devices; and 90-75-40/380 Internal warning devices.

- **Mounting:** Surface mounted.
- **Height (finished floor level to underside of equipment):** As per contractors installation drawings.

Installing deliberately operated devices

- **Mounting:** Surface mounted.
- **Height (finished floor level to underside of equipment):** As per contractors installation drawings.

Installing protective switches

- **Mounting:** Surface mounted.
- **Height (finished floor level to underside of equipment):** As per contractors installation drawings.

Installing LED clusters

- **Mounting:** Surface mounted.
- **Height (finished floor level to underside of equipment):** As per contractors installation drawings.

Installing xenon beacons

- **Mounting:** Surface mounted.
- **Height (finished floor level to underside of equipment):** As per contractors installation drawings.

System completion

Testing and commissioning intruder detection and hold-up alarms systems generally

- **Standard:** To DD CLC/TS 50131-7.
- **System commissioning agent:** System manufacturer.
- **Notice before commencing tests (minimum):** Two weeks.
- **Cable testing:**
 - **Insulation resistance:** The contractor shall test and commission the complete system and include the results within the operation and maintenance manuals.
 - **Earth continuity:** The contractor shall test and commission the complete system and include the results within the operation and maintenance manuals.
- **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.

Documentation

- **Standard:** To DD CLC/TS 50131-7.
- **Operating and maintenance instructions:**
 - **Scope:** Submit for the system giving optimum settings for controls.
 - **Product information:** Include product description, date of purchase, performance characteristics, application (suitability for use), method of operation and control, and cleaning and maintenance requirements.
 - **Format:** Paper copy.
 - **Number of copies:** Three.

- **Logbook:** Hardback cover embossed 'INTRUDER AND HOLD-UP ALARM SYSTEM LOGBOOK' with A4 lined paper, minimum 100 pages.
- **Number of copies:** Two.
- **Record drawings:**
 - **Content:** General arrangement drawings showing the location of all control and indicating equipment, remote key pads, detectors,; Sounders, visual indicators, beacon, and protective switches and any associated power supply; and For all control cabling, the cable origin, circuit designation, route from control and indicating equipment to detectors, sounders, visual indicators, beacons, keypads, and protective switches. Include conductor material and c.s.a, insulation type and colour, number of cores per cable, number of cables in ducts, on tray or ladder.
 - **Format:** A1 paper print drawing and Electronic drawing.
 - **Number of copies:** Three.
- **Submittal date:** At handover.

Spares and consumables

- **Supply the following spares:**
 - **Deliberately operated devices:** Not required
 - **Detectors:** Two of each type.
 - **Protective switches.:** Two of each type.

Maintenance

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

Device identification and testing

- **Device list:** Before commissioning Submit proposals, including proposed device, zone and group names.
- **Zone diagram:** Before commissioning Submit proposals.
- **Timing of submittals:** Prior to commissioning.
- **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.

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:** Required.

Standby battery testing

- **Mains power supply:** Isolate.
- **Quiescent mode:** Measure current supplied by standby source when intrusion and hold-up alarm system is operating in the quiescent mode. Submit results.

- **Alarm mode:** Measure current supplied by standby source when intrusion and hold-up alarm system is operating in the alarm mode. Submit results.

Testing actuation, integration and interfacing with other 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.

Modifications to existing intrusion and hold-up alarm systems

- **Modification certificate:** Submit.
- **Existing operation and maintenance manuals and record drawings:** Update.

Ω End of system

Fire detection and alarm system

System outline

Fire detection and alarm system

- **Description:** The Electrical Contractor shall design, supply, install and commission a complete system of fire detection and alarm to comply with all design requirements. The installation shall comply fully with the requirements of BS5839:2017, Fire Detection and Alarm Systems for Buildings.

All services with the exception as listed below and as noted on the drawings shall be isolated, stripped out and made safe, prior to the demolition.

The redundant equipment shall be stripped out and safely removed and disposed, and/or handed back to the Client.

All services stripped out to the area demarcation line to be made safe at this point.

The redundant services should not pose a health and safety risk. All cable containment and pipes shall be capped off at this point. The Contractor should ensure no sharp edges.

All circuits to be disconnected from the point of the origin and clearly labelled as redundant. Other areas are to be retained in use during the course of the works.

It is therefore imperative that these systems are maintained through out these works and any downtime is agreed with the Client.

The system shall be provided to comply with the requirements of an L1 classification system as defined within BS5839.

An automatic fire alarm and detection system shall be installed to provide an early warning of fire to all occupants within the refurbished area. The fire detection system within the refurbished area shall interface completely with the existing fire alarm system in the building and form part of the building overall strategy

A fully analogue addressable automatic fire detection and alarm system shall be installed throughout the building in accordance with BS 5839:2017 (Code of practice for fire alarm system) minimum category L1

The system shall comprise automatic smoke/heat detectors as required throughout, with heat detectors located within areas where a quick response is required without the risk of a false alarm, i.e. within plantrooms. In addition all final exits shall be covered by manual call points and also interface units linking all equipment required to be shut down or switched on upon a fire evacuation.

The main fire alarm panel is located within the Ground Floor entrance area. Extender and repeater panels shall be installed to facility the new radio/wirless alarm system in the GF and basement area.

The system shall consist of the following equipment:

- Manual break glass units, heat detectors, smoke detectors, sounders, VADs
- Automatic and manual interlocks with mechanical plant systems including gas valve, Automatic - opening vents, ventilation systems.
- Interfacing including disabled refuge system, BEMS, lifts and magnetic door holders, and auto closers

The system shall incorporate integral battery back-up for a minimum 24 hours in the event of mains failure. The fire alarm system shall be of 'open protocol' type and shall be BACNET compatible.

To meet the requirements of DDA (Disabled Disability Act) and BS5839:2017, the fire alarm system shall also be supplemented with visual alarm devices within circulation areas, toilets and plantrooms.

GENERAL

The Electrical Contractor shall appoint a fire alarm specialist to design, supply and install a wireless/radio digital addressable fire alarm system.

This Specification covers the design, construction, inspection and testing of fire alarm equipment, which when read in conjunction with the design drawings form a fire alarm installation.

The Electrical Contractor shall employ the specialist manufacturer to undertake the following duties: -

1. Carry out a full radio/wireless survey of the refurbished areas to determine exact locations and quantities of wireless repeaters and signal equipment.
2. Supply of all fire alarm equipment including control panels, detectors, breakglasses, sounder bases, addressable interface units, power supply units etc.
3. Provision of a detailed wiring diagram showing each device, together with indicative wiring routes and address references.
4. Provision of detailed 'cause and effect' schedule with a proposal for device addresses etc at an early stage for submission to building control. NB: The fire alarm system shall be based on an 'all out' evacuation, i.e. should an alarm condition occur within any area of the building then the fire alarm will sound, Although the system shall perform differently when manual testing is undertaken i.e. the upper ground sleep lab (UG17) shall be delayed by a maximum of 30 Seconds, this shall enable experiments to continue whilst the fire alarm system is tested.

The cause and effect schedule shall be fully agreed with the Architect, Engineer and Building Control prior to the final programming of the panels.

5. Full testing and commissioning of the system upon completion.
6. A separate visit to site over the course of a full day to instruct the Client on the operation of the system and demonstrate the same.
7. Provision of full maintenance information, including operation and maintenance manuals for the equipment, and as fitted drawings showing locations and addresses

of all devices. A complete listing showing address numbers shall be provided.

COMPLIANCE WITH STANDARDS

All equipment and materials must comply with the most recent issues and revisions of all relevant British Standards current at the time of tender.

The following British Standards are applicable:-

BS 800 Specification for radio interference limits and measurements for household appliances, portable tools and other electrical equipment causing similar types of interference.

BS 3116 Automatic fire alarm systems in buildings.

BS 5445 Specification for components of automatic fire detection systems.

BS 5588 Fire precautions in the design and construction of buildings.

BS 5839 Fire detection and alarm systems in buildings.

ELECTRICAL SUPPLY

All wireless/radio devices to be supplied with appropriate batteries

All fire alarm control detection and alarm equipment shall be suitable for use at 24 Volts DC.

System power supplies shall be suitable for use on 230 Volts AC systems.

FIRE ALARM CIRCUITS

Circuit Design

Detection circuits shall be capable of providing as a minimum requirement, monitoring of open and short circuits, together with monitoring of the removal of detector heads.

The system and repeaters etc shall be arranged such that the removal of any detector does not impair the correct operation of any other detector or call point.

Circuits shall be monitored for open and short circuit faults.

Short circuit isolators shall be installed at the end of each fire alarm zone.

Circuit Wiring

Since a wireless/radio system is proposed cabling and the like will be minimal however in instances where cabling is required the following applies;

Any circuitry shall be carried out using LSOH sheathed fire resistant cable typically as Delta Firetuff Standard where laid on containment. Where cabling is installed on historic building fabric MICC cabling with suitable fire resisting properties shall be utilised. Runs of cabling shall not contain mixed cable types.

Fire alarm cabling shall have a red sheath except where specified to the contrary.

Fire alarm cable shall generally be run on cable baskets located in corridors or ceiling voids and clipped utilising metallic tie raps.

All cable routes & drops shall be agreed with the architect via working drawings prior to commencement of works.

Manual Call Points

Manual call points shall be of the steady-pressure breakglass type manufactured to BS 5839 Part 2, EN 54 and installed to BS 5839 Part 1.
The Contractor shall allow for the supply and installation of clear hinged polycarbonate covers to be fitted to each call point to prevent accidental activations.

Heat Detectors

All heat detectors shall be of the analogue addressable type compatible with the control equipment and conform to BS 5445 Part 5 or 8 as indicated on the drawings. The detectors shall have an LED to indicate that it has operated and shall be supplied with a Universal surface patress or flush mounting box.

Smoke Detectors

Smoke detectors shall be optical type and of the analogue addressable type compatible with the control and indicating equipment and shall conform to BS 5446 Part 1.

In addition the detector shall have an LED to indicate that it has operated and shall fit a common base.

The common base shall be either of the patress or flush fixing type as appropriate.

Note:- tags are to be removed from all detector heads to prevent unauthorised removal of the heads.

Detectors, to EN54 Part 5 and 7 as applicable shall be photoelectric smoke, fixed temperature heat and multi-sensor combining optical smoke and heat elements. Provide and install smoke detectors in ceiling voids, where the height is greater than 800mm or the ceiling void contains an fire risk, that shall be fixed so that they can be easily serviced and removed without obstruction by wire cable basket, pipework etc. A remote indicator shall be provided, for each detector above the false ceiling, inside a lift shaft or inside a plant room. The indicator shall be installed in a logical position that shall not impede access to the detector or other plant/equipment. All detectors and addressable devices shall operate using an open communications protocol.

LED Beacons

The Fire Alarm specialist shall supply and install low profile red LED VADs as indicated on design drawings.

Within plant areas LED VADs shall be wall mounted onto a BESA box at 2200mm AFFL..

Within all other areas the LED beacons shall be mounted over a recessed conduit accessory box where possible, mounted at 2200mm AFFL.

The final locations of the external VADs shall be agreed with the Fire Officer, Building Control, Engineer and Architect prior to undertaking the installation.

Sounders

Fire Alarm specialist shall supply and install red fire alarm sounders with 100dBA sound pressure output at 1m as indicated on design drawings.

The Electrical Contractor/Fire Alarm Specialist shall allow to supply and install all an IP65 rated sounder located adjacent to each VAD or provide an integral version as indicated on the drawings detailed.

The final locations of the external sounders shall be agreed with the Fire Officer, Building Control, Engineer and Architect prior to undertaking the installation.

CONTROL AND INDICATING EQUIPMENT

The fire alarm installation shall utilise where possible the existing main fire alarm panel and control equipment. If new control or repeater equipment is required during the final design the following would apply.

All control and indicating equipment shall comply with BS 3116 Part 4, be compatible with the specified fire alarm system and shall provide all fault and alarm conditions detailed in BS 5839 Part 1.

The control panels shall not employ fan cooling, shall be provided with means of clearly indicating the origin of fire calls and shall identify power supply, system and zone circuit faults as minimum requirements.

Controls for silence alarm, re-setting, lamp testing and zone evacuate shall be provided via a key enable switch or alternative means of protection.

Controls shall also be provided preventing signals being sent to equipment connected to loop interfaces during standard testing procedures.

The system shall be capable of controlling ancillary devices and shall be provided with at least one spare changeover auxiliary relay.

The main control panel (master panel) shall be located at the main entrance.

POWER SUPPLIES

All power supplies shall comply with BS 5839 Part 1 generally and be provided with 'mains available' indication.

Batteries

Batteries for the panel shall be of the sealed lead acid type, comprising sufficient cells to provide a nominal 24V DC supply to the alarm system under all operating conditions. The batteries shall be sized to provide up to 72 hours of autonomous operation in quiescent mode followed by 30 minutes in alarm mode.

The batteries shall be combined within each individual panel.

Battery lifetime of the detection devices and VADs etc shall be minimum of 5 years.

Charger

The power supply shall be complete with a static type charger/rectifier compatible with the batteries. The charger shall be capable of fully re-charging the battery within 48 hours whilst maintaining the system standing load.
A battery volts low alarm shall be provided and indicated on the control panel.

Enclosure

The power supply enclosure shall be naturally ventilated with an anti-corrosive paint finish.

ANCILLARY SERVICES

Other Systems

Provide loop driven addressable interface units for connection to other system as generically shown on the schematic on drawings. Make final connection to these other systems and commission links as part of overall testing.

In particular, allow for signalling the following systems.

Addressable interface units shall be supplied for connection to the below systems:-

- i) Passenger & Goods lift.
- ii) MCC panels.
- iii) Door Hold open devices.
- iv) Access controlled doors.
- v) Disabled Refuge system

NB: All connections and cabling shall be supplied by the Electrical Contractor. All interfaces shall be situated as close as practically possible to the device they are to operate.

Door Hold Open Units

Door retaining units for corridor doors shall be supplied by one power supply unit. A fire alarm interface shall close all doors grouped to that power supply unit during alarm status.

The door retaining unit shall be of the wall mounted electromagnetic type c/w remote release.

The power supply units for the above shall be located close to the start of each circuit and mounted to a solid surface.

The interface units are loop powered and require no additional power supply.

All door retaining units require a 24V DC supply. Each unit shall be supplied from a power supply unit, the Electrical Contractor shall supply 230V AC switched fused

connection units to each door retaining power supply unit.

PROTECTION OF LIFT SHAFTS AND SERVICE RISERS

All lift shafts and service risers shall be protected by aspirating smoke detection located at the top of the shaft / riser and for all electrical & IT risers one detector per floor mounted on the underneath of all floorplates.

INSPECTION AND TESTING

All equipment is to be tested and inspected to demonstrate compliance with the relevant specifications and standards.

The Fire Alarm Specialist shall be employed to carry out a full functional test on site and to further demonstrate the same to the Employer, and the employer's representative, on a separate occasion.

Note that a fully detailed schedule of all devices and operations shall be provided by the specialist to allow the client's representative to agree all system labelling with him, and all "cause and effect" scenarios.

The Fire Alarm Specialist shall issue a certificate stating that the system has been commissioned and is fully operational.

MAINTENANCE

The Electrical Contractor and specialist shall include within the returned tender for all costs associated with the first 12 months routine maintenance. The commencement of the 'first day' of this period shall coincide with the project completion date.

The Fire Alarm Specialist shall allow to attend site three additional times

SOAK TEST

The Electrical Contractor shall provide a soak test to BS 5839 Part 1 2002 Section 35.2.6.

The soak test is to be carried out once the commissioning of the building has been finished and prior to the Client taking ownership of the building.

Allow attendance as necessary by the Specialist Contractor during the soak test period. During the soak test period each manual call point should bear an indication that it is not to be used.

Allow for all necessary insurances to be in place to cover the use of the building by the Contractors, Specialist Contractors.

A false alarm monitoring test shall be performed by the Electrical Contractor for 7 days, complete with 24 hour monitoring of all detection equipment to establish the system does not produce unwanted false alarms.

Should this test fail for any reason at any period during the 7 day test, then the soak test will be repeated from the start again, until the systems function accurately and correctly.

Practical completion will not be awarded until the soak test has been completed successfully.

The preferred and incumbent fire alarm specialist is

Stewart Fisher of

Pyrotec Services Ltd
Avalon House,
Marcham Rd,
Abingdon,
OX14 1TZ
Phone: 01235 524469

stewart.fisher@pyrotec-systems.co.uk

- **System performance:** To provide a fire detection and alarm system in compliance with all relevant standards.

BS 5839. 2002 - Fire Detection & Alarm Systems for Buildings
BS 5588 and Building Control specific requirements
The regulatory reform (fire safety) order 2005

¢ BS 7671;
¢ BS EN 14604;
¢ BS 5839 Parts 1, 2, 4 and 5;
¢ Manufacturers' guidelines;
¢ BS 9999;
¢ BS 5446
¢ BS 5445
¢ BS 6266
¢ Building Regulations Part B
¢ Building Regulations Part M
¢ DDA Regulations
¢ Architectural Fire Strategy Drawings
¢ Architectural Door Schedules
¢ Fire Strategy Document
¢ Building Control Requirements
¢ Fire Officer Requirements

Performance of fire detection and alarm systems;
System category L2;
System category L5;
System category P2;
Detection zones;
Alarm zones;
Actuation of fire protection systems;
Integration with other alarm and security systems;
Interfaces to equipment;
Interface isolation for testing purposes;
Alarm filtering;
External alarm signalling;
and Remote signalling.

- **System manufacturer:** LPCB LPS 1014 certified.
- **Format:** Automatic analogue addressable.
- **Category:** L1 in refurbished area - connected to existing fire system
- **Detection devices:**
 - **Types:** Combustion gas detectors;
Manual call points;
Optical beam smoke detectors;
Point flame detectors;
Point heat detectors;
and Point smoke detectors.
- **Equipment interconnectivity:** Fire resistant, insulated and sheathed cables;
Fire resistant, insulated and sheathed armoured cables;
and Radio based equipment generally.
- **Cable containment:** Cable baskets;
Rigid conduit;
and Cable trunking and cable ducting systems.
- **Rewireable installation:** Required.
- **Concealed installation:** Required.
- **Internal alarms:**
 - **Primary:** Sounders.
 - **Secondary:** Vibrating pillow pads;
Vibrating radio pagers;
and Visual alarm signal devices type A.
- **External alarms:** To alarm receiving centre (ARC);
To fire brigade;
and Visual alarm signal devices type B.
- **Controls:** Fire detection and alarm control and indicating equipment (CIE);
Mimic panels;
and Fire detection and fire alarm power supply equipment.
- **System accessories:** Automatic door release mechanisms;
Remote indicators;
and Zone diagrams.
- **Execution:** Modifying existing fire detection and alarm systems;
Radio communications survey;
Installing cabling;
Installing interfaces to other equipment and systems;
and Installing all zone evacuation controls.
- **System completion:** System information;
Device identification and testing;
Standby battery testing;
System soak testing;
Measurement of sound pressure levels;
Testing and commissioning generally;
Testing actuation, integration and interfacing with alarm and security systems;
Documentation;
Spares and consumables;
Maintenance;
Verification certificate;
and Acceptance certificate for fire detection and alarm systems in non-domestic premises.

System performance

Performance of fire detection and alarm systems

- **Areas to be protected:** As fire alarm drawings. The extent of a fire detection and alarm system should be determined by a fire risk assessment.
- **System objectives:** To provide a fire detection and alarm system in compliance with all relevant standards.

An automatic fire alarm system, primarily for life safety to BS5839 Part 1 2002 will be provided to achieve the following objectives.

" To provide early warning of the presence of fire, by use of automatic and manual fire detection devices.

" To interface with heating and ventilation systems to ensure the achievement of appropriate plant shutdowns.

" To return the appropriate lifts to a designated safe floor level, as approved by the Relevant Authority and disable them until the fire alarm system has been reset or (where designated Fire Fighting or Patient Evacuation Lifts) if they are operated by manual override control.

" To release, to enable closure, of the appropriate magnetic hold-open door units.

" To interface with the appropriate automatic doors to open in the event of an evacuation.

- **Spare system capacity:** 10% of installed alarm devices and 10% loop loading.
- **Number of devices per zone (maximum):** Manufacturers recommendations

System category L2

- **Objectives:**
- **Coverage:**

System category L5

- **Objectives:**
- **Coverage:**

System category P2

- **Objectives:**
- **Coverage:**

Detection zones

- **Zoning:** As per fire alarm schematic

Alarm zones

- **Alarm zoning:** As per Architects fire strategy drawings
- **Mode of operation:** Evacuate All zones

- **All zone evacuate control:** Required.

Actuation of fire protection systems

- **Standard:** To BS 7273-1 and To BS 7273-3.

Integration with other alarm and security systems

- **Objectives:**
- **Systems to be integrated:**

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
 Smoke vents:
 - Operation under evacuate signal: Open
 Smoke curtains:
 - Operation under evacuate signal: Release
 Sound systems:
 - Operation under evacuate signal: Silence

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:** Via CIE.

Alarm filtering

- **Objective:**
- **Arrangement:**

External alarm signalling

- **Objective:** Should be controlled so that they silence automatically after a maximum of 30 minutes.

Remote signalling

- **Means of signal transmission:**
 - **Primary:** To be completed by user
 - **Secondary:** None.
- **Transmission path monitoring:** RedCARE

- **Signals to be transmitted to ARC:** Fire Signals
 - **Separately identifiable, include the following:** Pre-alarm.
Alarm.
Fault.
Device isolated.
Zone isolated.

Products

Cable cleats

Shared by: 70-70-45/110 Low voltage distribution system; 70-70-75/110 Hard wired low voltage small power system; and 90-55-15/735 Cable installation on channel cable supports, cable tray, cable ladder and cable basket.

- **Manufacturer:** Contractor's choice.
- **Standard:** To BS EN 61914.
- **Format:** Contractor's choice.
- **Material:** Metallic.
- **Temperatures for permanent installation:**
 - **Maximum:** 105°C.
 - **Minimum:** -25°C.
- **Resistance to impact:** Heavy.
- **Type of retention or resistance to electromechanical forces:** Resistant to electromechanical forces, withstanding one short circuit.
- **Environmental influences:**
 - **Non-metallic and composite components:** Resistant to ultraviolet light.
 - **Metallic and composite components:** High resistance to corrosion.

Cable ties

Shared by: 70-70-45/110 Low voltage distribution system; 70-70-75/110 Hard wired low voltage small power system; and 90-55-15/735 Cable installation on channel cable supports, cable tray, cable ladder and cable basket.

- **Manufacturer:** Contractor's choice.
- **Standard:** To BS EN 62275.
- **Format:** Wrap around self-locking releasable.
- **Material:** Nylon and Metal.
- **Loop tensile strength (minimum):** Manufacturer's standard.
- **Temperatures for permanent installation:**
 - **Maximum:** 60°C.
 - **Minimum:** -15°C.
- **Contribution to fire:** Non-flame propagating.
- **Environmental influences:**
 - **Non-metallic and composite components:** Resistant to ultraviolet light.
 - **Metallic and composite components:** Resistant to corrosion.

Cable bands

Shared by: 70-70-45/110 Low voltage distribution system; and 90-55-15/735 Cable installation on channel cable supports, cable tray, cable ladder and cable basket.

- **Manufacturer:** Contractor's choice.
- **Material:** Manufacturer's standard.
- **Protective covering:** Manufacturer's standard.

Cable baskets

Shared by: 70-70-45/110 Low voltage distribution system; 70-70-75/110 Hard wired low voltage small power system; 70-80-35/110 Hard wired general lighting system; 75-45-20/110 Data distribution system; 75-60-10/110 CCTV system; 75-60-40/110 Intruder detection and alarm system; 75-65-30/110 Fire detection and alarm system; and 90-55-15/650 Extra low and low voltage cables in accessible roof spaces.

- **Manufacturer:** Contractor's choice.
- **Material:**
- **Coating material:** Hot dip galvanised, powder coated RAL colour to architectural specification
- **Features:**
 - **Segregation:** Cable dividers.
 - **Protective cover:** Required.
- **Execution:** Installing cable basket;
Multiple cable runs;
and Cable support zones.
- **Standard:** To BS EN 61537.

Cable trays

Shared by: 70-70-45/110 Low voltage distribution system; 70-70-75/110 Hard wired low voltage small power system; 75-60-10/110 CCTV system; and 90-55-15/650 Extra low and low voltage cables in accessible roof spaces.

- **Manufacturer:** Contractor's choice.
- **Standard:** To BS EN 61537.
- **Material:** Steel.
- **Resistance against flame propagation:** Non-Flame propagating.
- **Electrical properties:**
 - **Continuity characteristics:** Without electrical continuity.
 - **Conductivity characteristics:** Without electrical conductive system component.
- **Coating material:** Hot dip galvanised, powder coated RAL colour to architectural specification
- **Temperature properties for transport, storage, installation and application:**
 - **Minimum:** Manufacturer's standard.
 - **Maximum:** Manufacturer's standard.
- **Mechanical properties:**
 - **Cable tray free base area:** Manufacturer's standard.
 - **Resistance to impact:** Manufacturer's standard.

- **Features:**
 - **Flange type:** Return.
 - **Segregation:** Cable dividers.
 - **Protective cover:** Required.
- **Execution:** Installing cable tray and cable ladder;
Installing cable supports on roofs;
Multiple cable runs;
and Cable support zones.

Rigid conduit

Shared by: 70-70-25/660 Installing main earthing conductor; 70-70-45/110 Low voltage distribution system; 70-70-75/110 Hard wired low voltage small power system; 70-80-35/110 Hard wired general lighting system; 75-45-40/110 Audio-frequency-induction-loop system; 75-60-05/110 Access control system; 75-60-40/110 Intruder detection and alarm system; 75-65-30/110 Fire detection and alarm system; 75-70-05/110 Assistance call system; and 90-55-15/645 Low voltage cables concealed in walls and partitions.

- **Manufacturer:** Contractor's choice.
- **Standards:** To BS EN 61386-21.
- **Mechanical properties:**
 - **Resistance to compression:** Heavy.
 - **Resistance to impact:** Heavy.
- **Transport, installation and application:**
 - **Lower temperature (minimum):** Manufacturer's standard.
 - **Upper temperature (maximum):** Manufacturer's standard.
- **Resistance to bending:** Rigid.
- **Electrical characteristics:** With electrical continuity properties.
- **Resistance to external influences:**
 - **Protection against ingress of solid objects (minimum):** To BS EN 60529, IP3X.
 - **Protection against ingress of water (minimum):** To BS EN 60529, IPX0.
- **Resistance to corrosion:** To BS EN 61386-1, Class 4.
- **Tensile strength:** Heavy.
- **Resistance to flame propagation:** Manufacturer's standard.
- **Suspended load capacity:** Heavy.
- **Colour:** Submit proposals.
- **Sizes (OD):** 25 mm.
- **Execution:** Installing rigid metallic conduit;
Installing rigid non metallic conduit;
Installing conduit connections to equipment;
and Conduit, trunking and ducting zones.

Cable trunking and cable ducting systems

Shared by: 70-70-45/110 Low voltage distribution system; 70-70-75/110 Hard wired low voltage small power system; 70-80-35/110 Hard wired general lighting system; 75-60-05/110 Access control system; 75-60-40/110 Intruder detection and alarm system; 75-65-30/110 Fire detection and alarm system; 75-70-05/110 Assistance call system; 75-70-

05/120 Emergency voice communication system; and 90-55-15/650 Extra low and low voltage cables in accessible roof spaces.

- **Manufacturer:** Contractor's choice.
- **Standards:** To BS EN 50085-1 and BS EN 50085-2-1.
- **Material:** Metallic;
Non-metallic;
and Steel.
- **Construction:** To include means of preventing contact between liquids and insulated conductors and live parts.
- **Temperature properties:**
 - **Storage and transport temperature (maximum):** Manufacturer's standard.
 - **Installation and application temperature (minimum):** Manufacturer's standard.
 - **Application temperature (maximum):** Manufacturer's standard.
- **Resistance to flame propagation:** Required.
- **Electrical properties:** With electrical continuity characteristics.
- **Ingress protection (minimum):** To BS EN 60529, IP x4.
- **Protection against corrosive and polluting substances:** High protection outside and inside.
- **Access method:** With tools.
- **Screening:** Required.
- **Execution:** Conduit, trunking and ducting zones and Installing trunking generally.

Fire resistant, insulated and sheathed cables

Shared by: 70-70-45/110 Low voltage distribution system; 70-70-75/110 Hard wired low voltage small power system; 70-80-35/110 Hard wired general lighting system; and 75-65-30/110 Fire detection and alarm system.

- **Manufacturer:** Batt cables or equal and approved
- **Standard:** To BS 7629-1.
- **Third party certification:** British Approvals Service for Cables (BASEC) certified and LPCB.
- **Size:** Refer to cable schedule
- **Screen:** Copper tape.
- **Execution:** Installing low voltage cables;
Extra low and low voltage cable routes;
Low voltage cables concealed in walls and partitions;
Extra low and low voltage cables in accessible roof spaces;
Extra low and low voltage surface mounted cables;
Installing low voltage cables in conduit and trunking;
and Cable installation on channel cable supports, cable tray, cable ladder and cable basket.

Fire resistant, insulated and sheathed armoured cables

Shared by: 70-70-45/110 Low voltage distribution system; and 75-65-30/110 Fire detection and alarm system.

- **Manufacturer:** Batt cables or equal and approved
- **Standard:** To BS 7846.

- **Third party certification:** British Approvals Service for Cables (BASEC) certified and LPCB.
- **Size:** Refer to cable schedule
- **Insulation:** Cross-linked polyethylene.
- **Execution:** Extra low and low voltage cable routes;
Low voltage cables concealed in walls and partitions;
Extra low and low voltage cables in accessible roof spaces;
Extra low and low voltage surface mounted cables;
Installing low voltage cables in conduit and trunking;
Cable installation on channel cable supports, cable tray, cable ladder and cable basket;
Installing low voltage armoured cables;
Joining and terminating low voltage armoured cables;
Excavations;
Cables in ducts;
Cables in trenches;
Installing underground cable marker tape;
and Cables in vertical trunking and ducts.

Fire detection devices generally

Shared by: 90-75-30/325 Combustion gas detectors; 90-75-30/330 Manual call points; 90-75-30/335 Optical beam smoke detectors; 90-75-30/340 Point flame detectors; 90-75-30/345 Point heat detectors; 90-75-30/350 Point smoke detectors; 90-75-30/360 Sounders ; and 90-75-30/415 Visual alarm signal devices type A and type B.

- **Device address setup:** Automatic via CIE.
- **Removal of devices:** Must require a special tool. Must not affect the operation of alarm equipment.
- **Device bases:** Maintain circuit continuity when device is removed.
- **Short circuit isolators:** Integral to control equipment.

Combustion gas detectors

- **General requirements:** Fire detection devices generally.
- **Manufacturer:** As per CIE manufacturer
- **Execution:** Installing point detectors.

Manual call points

- **General requirements:** Fire detection devices generally.
- **Manufacturer:** As per CIE manufacturer
- **Standard:** To BS EN 54-11.
- **Operation:** Type A.
- **Frangible element:** Non-resettable.
- **Integral red visual indicator:** Required.
- **Environmental category:** Weatherproof.
- **Mounting:** Fully recessed;
Semi-recessed;
and Surface.
- **Time delay between activation of manual call point and the alarm signal (maximum):** 3 s.

- **Protective covers:** Required.
- **Execution:** Installing manual call points.
- **Time delay:** 3 s maximum between activation of manual call point and the evacuate signal being generated.

Optical beam smoke detectors

- **General requirements:** Fire detection devices generally.
- **Manufacturer:** As per CIE manufacturer
- **Standard:** To BS EN 54-12
- **Thermal turbulence detection:** Manufacturer's standard.
- **Contamination compensation:** Manufacturer's standard.
- **Power supply:** Manufacturer's standard.
- **Execution:**
- **Controller:**
 - **Functions:**
 - **Display type:** LCD accessible via pass code.
 - **Display the following information:**
- **Detector type:**
- **Operating range (minimum):**
- **Ingress protection (minimum):**
- **Power source:**

Point flame detectors

- **General requirements:** Fire detection devices generally.
- **Manufacturer:** As per CIE manufacturer
- **Standard:** To BS EN 54-10
- **Classification:** Manufacturer's standard.
- **Detector type:** Infra-red.
- **Execution:** Installing point detectors.
- **Accessories:**
- **Ingress protection (minimum):**
- **Power source:**
- **Mounting:**
- **Operating range (minimum):**

Point heat detectors

- **General requirements:** Fire detection devices generally.
- **Manufacturer:** As per CIE manufacturer
- **Standard:** To BS EN 54-5.
- **Classification:** A1 and A2.
- **Suffix:** S and R.
- **Detector type:** Line and Point.
- **Execution:** Installing point detectors.

Point smoke detectors

- **General requirements:** Fire detection devices generally.
- **Manufacturer:** As per CIE manufacturer
- **Standard:** To BS EN 54-7.
- **Detector type:** Optical.
- **Execution:** Installing point detectors.

Radio based equipment generally

- **Standard:** To BS EN 54-25.
- **Power supply:** Mains supply and reserve battery.
- **Battery life (minimum):** 3 years in the temperature range 15°C-35°C.
- **Monitoring of communication between equipment and devices:**
 - **Response to loss of communication with radio communication components:** Report at CIE within 400 s of fault developing.
 - **Monitor cables of antennae that are external to components of a radio-linked system for open and short circuit conditions.:** Report at CIE within 100 s of fault developing.
- **Monitoring of device power supplies:**
 - **Low battery indication:** 30 days warning at CIE.
 - **Imminent battery failure:** Generate fault condition where remaining power is unable to maintain normal operation for > 7 days and > 30 m in alarm condition.

Sounders

Shared by: 75-65-30/110 Fire detection and alarm system; and 75-70-05/120 Emergency voice communication system.

- **General requirements:** Fire detection devices generally.
- **Manufacturer:** As per CIE manufacturer
- **Standard:** To BS EN 54-3.
- **Sounder type:** Electronic sounder.
- **Sounder cut off time (maximum):** 30 minutes.
- **Ingress protection standard:** Type A and Type B.
- **Colour:** White.
- **Directional output at 1 m (minimum):** 100 dBA.
- **Integral beacon:** Required.
- **Mounting:** Recessed;
Semi-recessed;
and Surface.
- **Power supply:** From loop;
From sounder circuit;
and From sound driver module.
- **Execution:** Installing sounders.

Vibrating pillow pads

- **Manufacturer:** Deaf Alerter

Vibrating radio pagers

- **Manufacturer:** Deaf Alerter
- **Type of licence:** Manufacturer's standard.
- **Response time following alarm condition (maximum):** 5 s.
- **Response to fire alarm condition:** Unique vibrating and audible output on alarm condition, continuous for 60 s or until acknowledged at the vibrating radio pager. Fire alarm condition to have priority over all other signals.
- **Response to loss of transmission:** Identified at the pager within 5 m by a visual and tactile signal.
- **Power source:** Battery.
- **Low battery warning:** Indicated by visual and tactile signal.
- **Display:** 80 character (minimum) LCD with backlight and password protection

Fire detection and alarm control and indicating equipment (CIE)

- **Manufacturer:** To be completed by user
- **Standard:** To BS EN 54-2.
- **Main display:** 32 character alphanumeric colour display.
- **Zone indication:** Individual LED status indicators and Separate LED mimic diagram.
- **Monitored sounder circuits (minimum):** Manufacturer's standard.
- **Printer:** Manufacturer's standard.
- **Indications:** Manufacturer's standard.
- **Controls:** Manufacturer's standard.
- **Outputs:** Manufacturer's standard.
- **Input device:** Alphanumeric keypad and Qwerty keyboard.
- **Enclosure:**
 - **Type:** Manufacturer's standard.
 - **Ingress protection (minimum):** To BS EN 60529, IP 30.
 - **Material:** Steel.
 - **Mounting:** Recessed;
Semi-recessed;
and Surface.
- **Execution:** Installing main control and indicating equipment (CIE).

Fire detection and fire alarm power supply equipment

- **Manufacturer:** As per CIE manufacturer
- **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:** Manufacturer's standard.
- **Housing:** Within the CIE.
- **Monitoring of power supplies:** By the CIE.
- **Execution:** Installing main control and indicating equipment (CIE).

Mimic panels

- **Manufacturer:** Contractor's choice.
- **Standard:** BS EN 54-2.
- **Format:** Illuminated site layout panel.
- **Enclosure:**
 - **Ingress protection (minimum):** Manufacturer's standard.
 - **Material:** Stainless steel.
 - **Mounting:** Recessed and Surface.
- **Functional requirements:**
 - **Display:** Manufacturer's standard.
 - **Controls:** Manufacturer's standard.
- **Printer:** Not required.
- **Execution:** Installing main control and indicating equipment (CIE).

Automatic door release mechanisms

- **Manufacturer:** As per CIE manufacturer
- **Standard:** To BS 5839-3.
- **Control type:** Electromagnetic.
- **Mounting type:** Floor mounted; Overhead; and Wall mounted.
- **Operation:** Automatic via CIE.
- **Power:** Separate power supply unit.
- **Integral manual release button:** Required.

Remote indicators

- **Manufacturer:** As per CIE manufacturer
- **Lamp:** High intensity LED.
 - **Colour:** Manufacturer's standard.
- **Lens:**
 - **Material:** Polycarbonate.
 - **Colour:** Clear.
- **Ingress protection (minimum):** Manufacturer's standard.
- **Execution:** Installing remote indicators.

Visual alarm signal devices type A

Shared by: 75-65-30/110 Fire detection and alarm system; and 75-70-05/120 Emergency voice communication system.

- **General requirements:** Fire detection devices generally.
- **Manufacturer:** As per CIE manufacturer
- **Standard:** To BS EN 54-23.
- **Device type:** LED.
- **Environment type:** A.

- **Category:** Manufacturer's standard.
- **Lens colour:** Red.
- **Execution:** Installing visual alarm signal devices.

Visual alarm signal devices type B

Shared by: 75-65-30/110 Fire detection and alarm system; and 75-70-05/120 Emergency voice communication system.

- **General requirements:** Fire detection devices generally.
- **Manufacturer:** As per CIE manufacturer
- **Standard:** To BS EN 54-23.
- **Device type:** LED beacon.
- **Environment type:** A.
- **Category:** Manufacturer's standard.
- **Lens colour:** Red.
- **Execution:** Installing visual alarm signal devices.

Execution

Installing fire alarm systems generally

Shared by: 75-65-30/615 Modifying existing fire detection and alarm systems; 75-65-30/630 Installing cabling; 75-65-30/640 Installing interfaces to other equipment and systems; and 75-65-30/645 Installing all zone evacuation controls.

- **Standard:** To BS 5839-1.

Modifying existing fire detection and alarm systems

- **General requirements:** Installing fire alarm systems generally.
- **Existing fire detection and alarm system:**
 - **Short circuit isolators:** Identify and label.
 - **End of line devices:** Identify and label.
 - **Sounders:** Identify cabling route and label.
 - **Detection devices:** Identify cabling route and label.
 - **Interfaces with other equipment:** Identify and label.
- **Connections to external and remote signalling devices:** Isolate.
- **Circuits and cabling that are to remain:** Make good and update record drawings.
- **Method:** Submit proposals.

Installing cabling

- **General requirements:** Installing fire alarm systems generally.
- **Standard:** To BS 7671.
- **Cable route:** Segregate from other cabling. Where installed in trunking, locate in a dedicated fire cabling compartment.
- **Cable topology:** Loop circuits without spurs or tees and Radial circuits without spurs or tees.

- **Mechanical protection:** Cables should be mechanically protected in areas where physical damage or rodent attack could occur. BS 5839-1 recognizes that mechanical protection might not be necessary in relatively benign environments such as offices and shops where the cables are fixed directly to robust construction, e.g. structural columns. Insert, e.g. To cabling mounted below 2 m.
- **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.

Installing interfaces to other equipment and systems

- **General requirements:** Installing fire alarm systems generally.
- **Connection to equipment:** Install interconnecting wiring between interface unit and equipment controlled.
- **Interface units:** Label, describing their function.

Installing all zone evacuation controls

- **General requirements:** Installing fire alarm systems generally.
- **Position:** Integral within CIE.

Radio communications survey

- **Survey method:** Submit proposals.
- **Reliability and integrity of proposed communications paths:** Determine.
- **Results:** Submit.

Installing cable tray and cable ladder

Shared by: 90-55-10/330 Cable ladders; and 90-55-10/335 Cable trays.

- **Standards:** To BS 7671 and in accordance with IET guidance note 1.
- **Preparation:**
 - **Burrs and sharp edges:** Make smooth.
 - **Cutting:** Minimize and make good edges. Cuts to cable tray to be square along an unperforated line.
 - **Treatment of cut surface:** Extend 25 mm beyond the cut. Match finish of cable supports.
- **Access:** Provide space around cable ladder and tray 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 ladder and tray:** Maximize.
 - **Ends:** Blank with end plates.
- **Changes of size and direction:** Manufacturer's accessories of the same material type, pattern, finish and thickness as cable supports.

- **Fire barriers:** Provide where required to maintain fire performance of fabric.
- **Protective covers:** Provide to cables requiring mechanical protection.
- **Support:**
 - **Fixing arrangement:** Independently fix and support from building structure using threaded rod fixed to channel cable support with shake proof washers and hex nuts;
Independently fix and support from building structure using threaded rod fixed into expanding anchors;
and Independently fix and support from building structure using threaded rod fixed into resin injection anchors.
 - **Clearance from building fabric (minimum):** 20 mm.
- **Components:** Avoid contact between dissimilar metals.
- **Routing of cable ladder and tray:** Submit working drawings showing the final routes.

Installing cable basket

- **Standards:** To BS 7671 and in accordance with IEE Guidance Note 1.
- **Joints:**
 - **Cut:** Adjacent cross basket wires. Make smooth any burrs or edges.
 - **Earth conductors:** Connect across joints.
- **Accessories:** Form on site and connect with basket manufacturer's coupling components.
- **Fire barriers:** Provide where required to maintain fire performance of fabric.
- **Support:**
 - **Fixing arrangement:** Independently fix and support from building structure using threaded rod fixed to channel cable support with shake proof washers and hex nuts;
Independently fix and support from building structure using threaded rod fixed into expanding anchors;
and Independently fix and support from building structure using threaded rod fixed into resin injection anchors.
 - **Clearance from building fabric (minimum):** 20 mm.
- **Components:** Avoid contact between dissimilar metals.
- **Routing of cable basket:** Submit working drawings showing the final routes.

Installing cable supports on roofs

Shared by: [90-55-10/330 Cable ladders](#); and [90-55-10/335 Cable trays](#).

- **Position:** Elevate above roof.
- **Mounting:** Load spreading supports.

Multiple cable runs

Shared by: [90-55-10/325 Cable baskets](#); [90-55-10/330 Cable ladders](#); and [90-55-10/335 Cable trays](#).

- **Requirement:**

Cable support zones

Shared by: 90-55-10/325 Cable baskets; 90-55-10/330 Cable ladders; and 90-55-10/335 Cable trays.

- **Ceiling voids:**
 - **Clear distance between underside of cable supports and brackets and topside of ceiling (minimum):** Contractor's choice.

Installing conduit, trunking and ducting

Shared by: 90-55-10/460 Conduit fittings; 90-55-10/715 Installing pliable and flexible conduit; 90-55-10/720 Installing rigid metallic conduit; 90-55-10/725 Installing rigid non metallic conduit; 90-55-10/735 Installing conduit connections to equipment; and 90-55-10/765 Conduit, trunking and ducting zones.

- **Standards:** In accordance with BS 7671 and IET Guidance Note 1.
- **Preparation:** Cut square. Remove burrs and sharp edges to make smooth.
- **Protection of metallic conduit, trunking and ducting:**
 - **Joints and ends:** Remove grease, oil, dirt and rust before applying protective paint. Paint immediately following installation.
 - **Protective paint:**
 - Generally:** Compatible with conduit, trunking and ducting finish.
 - Type:** Match factory finish.
- **Cross-sectional area:** Maintain throughout the conduit, trunking and ducting length.
- **Arrangement:** Position vertically and horizontally in line with equipment served, and parallel with building lines.
- **Spare containment:** Install one spare 25 mm diameter conduit from each distribution board to the nearest accessible void space, terminating in a conduit box with lid.
- **Draw wires:** Install galvanized soft iron wires within spare conduit, trunking and ducting.
- **Distance from other services running parallel (minimum):**
 - **Generally:** 150 mm.
 - **Above radiators:** 1000 mm.
 - **Steam services:** 600 mm.
- **Drainage of conduit, trunking and ducting:** Locate drainage outlets at lowest points in conduit, trunking and ducting installed externally, and where condensation may occur.
- **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, trunking and ducting from building structure.
- **Cleaning:** Clean insides of conduit, trunking and ducting before installing cables.
- **Cabling:** Install when conduit, trunking and ducting enclosure is complete.
- **Submittals:** Submit manufacturer's technical information. Submit drawings showing the proposed routes of conduit, trunking and ducting and the location of service outlets.

Installing conduit generally

Shared by: [90-55-10/715 Installing pliable and flexible conduit](#); [90-55-10/720 Installing rigid metallic conduit](#); [90-55-10/725 Installing rigid non metallic conduit](#); and [90-55-10/735 Installing conduit connections to equipment](#).

- **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:**
 - **Generally:** 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:**
 - **Generally:** Install flush with finished surfaces. Provide extension rings if required.
 - **Fixing screws:** Countersunk, or round-headed screws.
 - **Number of fixings (minimum):** Two.
 - **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):** Two.
 - **Floors:** Do not install draw-in boxes in floors.
- **Conduit in walls:** Avoid concealed horizontal runs.
- **Suspended ceiling installations:** Fasten outlet boxes to structure above ceiling.

Installing rigid metallic conduit

- **General requirements:** [Installing conduit generally](#) and [Installing conduit, trunking and ducting](#).
- **Fixings:** Distance saddle; Saddle; and Spacer bar saddle.
- **Joints:** Plain and 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.

Installing rigid non metallic conduit

- **General requirements:** Installing conduit generally and Installing conduit, trunking and ducting.
- **Fixings:** Distance saddle; Saddle; and Spacer bar saddle.
- **Joints:** Compression and Threaded.
- **Conduit connections to boxes and items of equipment:** Threaded bushed entries.

Installing conduit connections to equipment

Shared by: 90-55-10/360 Flexible conduit; and 90-55-10/380 Rigid conduit.

- **General requirements:** Installing conduit generally and Installing conduit, trunking and ducting.
- **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 of adequate length to facilitate removal of equipment for maintenance. Final termination in swivel connectors.
- **Connections to external equipment:** Flexible conduit.

Installing trunking generally

- **Supports and mounting arrangement:** Wall mounted; Ceiling mounted; Floor mounted; Purpose made brackets; and Suspension rods and steel channels.
- **Changes of direction:** Manufacturer's bends and tees.
- **Joints:**
 - **Generally:** 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.
- **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.

Conduit, trunking and ducting zones

Shared by: 90-55-10/360 Flexible conduit; 90-55-10/380 Rigid conduit; and 90-55-10/410 Cable trunking and cable ducting systems.

- **General requirements:** Installing conduit, trunking and ducting.
- **Ceiling voids:** Provide clear distance of 150 mm (minimum) between underside of any conduit, trunking or trunking and the topside of ceiling.

Installing low voltage cables

Shared by: 90-55-15/342 Fire resistant, insulated and sheathed cables; 90-55-15/345 PVC insulated cables; 90-55-15/346 PVC insulated cables for interconnecting wiring; 90-55-15/349 Single-core heat resisting insulating cables; 90-55-15/351 Thermosetting insulated cables; 90-55-15/352 Thermosetting insulated and PVC sheathed cables (XLPE/ PVC singles); 90-55-15/355 Thermosetting insulated metal screened LSZH sheathed multicore cables; 90-55-15/665 Installing flexible cords; 90-55-15/670 Installing prefabricated wiring; and 90-55-15/680 Installing low voltage armoured cables.

- **Standard:** In accordance with 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. Clear cable path of debris.
- **Installation temperature (minimum):** 5°C.
- **Cables:** Install in one length. Dress cables flat, free from twists, kinks and strain.
- **Cable pulling:** Do not overstress. Prevent kinks and twisting of the cable.
- **Cable protection:** Cables passing through walls and floors to be sleeved with conduit or pipeduct to a minimum of 300 mm. Bush at both ends. Ensure that appropriate fire stopping materials are used to maintain the original fire integrity of the wall or floor around the penetration.
- **Concealed cable runs to wall accessories:** Run vertically from the accessory.
- **Exposed cable runs:**
- **Distance from other services running parallel (minimum):** 150 mm. Position cables below heating pipes.
- **Jointing and termination:**
 - **Final circuit cables:** At electrical accessories only.
 - **Core connections:** Using compression lugs to equipment without integral clamping terminals.
 - **Terminating cables when not using glands:** Take sheathing of cables into accessory boxes and equipment and protect against abrasion with grommets.

Extra low and low voltage cable routes

Shared by: 90-55-15/342 Fire resistant, insulated and sheathed cables; 90-55-15/343 Fire resistant, insulated and sheathed armoured cables; 90-55-15/344 Mineral insulated cables type A and type B; 90-55-15/345 PVC insulated cables; 90-55-15/346 PVC insulated cables

for interconnecting wiring; 90-55-15/351 Thermosetting insulated cables; 90-55-15/352 Thermosetting insulated and PVC sheathed cables (XLPE/ PVC singles); 90-55-15/353 Thermosetting insulated and PVC sheathed armoured cables; 90-55-15/354 Thermosetting insulated and LSZH sheathed armoured cables; 90-55-15/355 Thermosetting insulated metal screened LSZH sheathed multicore cables; 90-55-15/366 Balanced twisted-pair cables; 90-55-15/385 Prefabricated LSZH insulated singles in flexible conduit; and 90-55-15/386 Prefabricated LSZH insulated and sheathed multi-core.

- **Cables generally:**
 - **Concealed cable runs to wall accessories:** Run vertically from the accessory.
 - **Exposed cable runs:** Contractor's choice.
- **Distance from other services running parallel (minimum):** 150 mm. Position cables below heating pipes.

Low voltage cables concealed in walls and partitions

Shared by: 90-55-15/342 Fire resistant, insulated and sheathed cables; 90-55-15/343 Fire resistant, insulated and sheathed armoured cables; 90-55-15/344 Mineral insulated cables type A and type B; 90-55-15/345 PVC insulated cables; 90-55-15/346 PVC insulated cables for interconnecting wiring; 90-55-15/351 Thermosetting insulated cables; 90-55-15/352 Thermosetting insulated and PVC sheathed cables (XLPE/ PVC singles); 90-55-15/353 Thermosetting insulated and PVC sheathed armoured cables; 90-55-15/355 Thermosetting insulated metal screened LSZH sheathed multicore cables; 90-55-15/385 Prefabricated LSZH insulated singles in flexible conduit; and 90-55-15/386 Prefabricated LSZH insulated and sheathed multi-core.

- **Position:** In a zone within 150 mm of wall perimeter (except at the floor); and run vertically or horizontally from these zones, or from floor level, to switches, accessories, etc and At least 50 mm from the surface. Ensure all routes are agreed with architect (working drawings) to ensure historic fabric is maintained.
- **Protection:** Rigid conduit and Cover with galvanized steel channel nailed to substrate.

Extra low and low voltage cables in accessible roof spaces

Shared by: 90-55-15/340 Flexible cords; 90-55-15/342 Fire resistant, insulated and sheathed cables; 90-55-15/343 Fire resistant, insulated and sheathed armoured cables; 90-55-15/344 Mineral insulated cables type A and type B; 90-55-15/345 PVC insulated cables; 90-55-15/346 PVC insulated cables for interconnecting wiring; 90-55-15/351 Thermosetting insulated cables; 90-55-15/352 Thermosetting insulated and PVC sheathed cables (XLPE/ PVC singles); 90-55-15/353 Thermosetting insulated and PVC sheathed armoured cables; 90-55-15/354 Thermosetting insulated and LSZH sheathed armoured cables; 90-55-15/355 Thermosetting insulated metal screened LSZH sheathed multicore cables; 90-55-15/366 Balanced twisted-pair cables; 90-55-15/385 Prefabricated LSZH insulated singles in flexible conduit; and 90-55-15/386 Prefabricated LSZH insulated and sheathed multi-core.

- **Cables running across ceiling joists:** Cable baskets; Cable trays; and Cable trunking and cable ducting systems.

Extra low and low voltage surface mounted cables

Shared by: 90-55-15/340 Flexible cords; 90-55-15/342 Fire resistant, insulated and sheathed cables; 90-55-15/343 Fire resistant, insulated and sheathed armoured cables; 90-55-15/344 Mineral insulated cables type A and type B; 90-55-15/345 PVC insulated cables; 90-55-15/346 PVC insulated cables for interconnecting wiring; 90-55-15/351 Thermosetting insulated cables; 90-55-15/352 Thermosetting insulated and PVC sheathed cables (XLPE/

PVC singles); 90-55-15/353 Thermosetting insulated and PVC sheathed armoured cables; 90-55-15/354 Thermosetting insulated and LSZH sheathed armoured cables; 90-55-15/355 Thermosetting insulated metal screened LSZH sheathed multicore cables; and 90-55-15/366 Balanced twisted-pair 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.

Installing low voltage cables in conduit and trunking

Shared by: 90-55-15/342 Fire resistant, insulated and sheathed cables; 90-55-15/343 Fire resistant, insulated and sheathed armoured cables; 90-55-15/344 Mineral insulated cables type A and type B; 90-55-15/345 PVC insulated cables; 90-55-15/346 PVC insulated cables for interconnecting wiring; 90-55-15/349 Single-core heat resisting insulating cables; 90-55-15/351 Thermosetting insulated cables; 90-55-15/352 Thermosetting insulated and PVC sheathed cables (XLPE/ PVC singles); 90-55-15/353 Thermosetting insulated and PVC sheathed armoured cables; 90-55-15/354 Thermosetting insulated and LSZH sheathed armoured cables; 90-55-15/355 Thermosetting insulated metal screened LSZH sheathed multicore cables; 90-55-15/366 Balanced twisted-pair cables; 90-55-15/385 Prefabricated LSZH insulated singles in flexible conduit; and 90-55-15/386 Prefabricated LSZH insulated and sheathed multi-core.

- **Cable installation:** Orderly and capable of being withdrawn.
- **Single core wiring:** Arrange using the loop-in method.
- **Cables within trunking:** Tie at 2 m intervals for cables of the same circuit reference. Label ties with circuit reference number at 10 m intervals.
- **Cables in vertical conduit:** Provide cable clamps in accessible conduit boxes at 5 m intervals.
- **Extra low voltage cables:** Install within a separate partition from low voltage cables where installed in multi compartment trunking.

Installing low voltage armoured cables

Shared by: 90-55-15/343 Fire resistant, insulated and sheathed armoured cables; 90-55-15/353 Thermosetting insulated and PVC sheathed armoured cables; and 90-55-15/354 Thermosetting insulated and LSZH sheathed armoured cables.

- **General requirements:** Installing low voltage cables.
- **Earthing:** Bond armour to equipment and main earthing system.
- **Connections to apparatus:** Moisture proof, sealed glands and shrouds.

Jointing and terminating low voltage armoured cables

Shared by: 90-55-15/343 Fire resistant, insulated and sheathed armoured cables; 90-55-15/353 Thermosetting insulated and PVC sheathed armoured cables; and 90-55-15/354 Thermosetting insulated and LSZH sheathed armoured cables.

- **Preparation:**
 - **Cable ends:** Cut 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:** To BS EN 62444 and fitted with shroud.
- **Cold pour resin and heat shrink joints:** To BS EN 50393.
- **Insulating tape:** To BS EN 60454-1.
- **Plastics sheathed cables:** Seal with proprietary shrink-on end caps.
- **Bolted terminal connections to equipment and switchgear without integral cable clamping terminals:** Compression 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.

Excavations

Shared by: 90-55-15/343 Fire resistant, insulated and sheathed armoured cables; 90-55-15/353 Thermosetting insulated and PVC sheathed armoured cables; and 90-55-15/354 Thermosetting insulated and LSZH sheathed armoured cables.

- **Excavations next to existing underground services:** In accordance with HSG 47.
- **Existing underground services:** Expose and identify.

Cables in ducts

Shared by: 90-55-15/343 Fire resistant, insulated and sheathed armoured cables; 90-55-15/353 Thermosetting insulated and PVC sheathed armoured cables; and 90-55-15/354 Thermosetting insulated and LSZH sheathed armoured cables.

- **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.

Cables in trenches

Shared by: 90-55-15/343 Fire resistant, insulated and sheathed armoured cables; 90-55-15/353 Thermosetting insulated and PVC sheathed armoured cables; and 90-55-15/354 Thermosetting insulated and LSZH sheathed armoured cables.

- **Base:** All cables and ducts to be surrounded by 75 mm sand, free of any sharp stones or flints.
- **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:** Install within duct and derate cable if longer than 10 m. Extend ducts 1 m each side of hardstanding.

- **Cable identification and protection:** Underground plastics cable protection covers and Underground cable marker tape.

Installing underground cable marker tape

Shared by: 90-55-15/343 Fire resistant, insulated and sheathed armoured cables; 90-55-15/353 Thermosetting insulated and PVC sheathed armoured cables; and 90-55-15/354 Thermosetting insulated and LSZH sheathed armoured cables.

- **Installation:** In accordance with ENA 12-23.

Cable installation on channel cable supports, cable tray, cable ladder and cable basket

Shared by: 90-55-15/342 Fire resistant, insulated and sheathed cables; 90-55-15/343 Fire resistant, insulated and sheathed armoured cables; 90-55-15/344 Mineral insulated cables type A and type B; 90-55-15/345 PVC insulated cables; 90-55-15/346 PVC insulated cables for interconnecting wiring; 90-55-15/351 Thermosetting insulated cables; 90-55-15/353 Thermosetting insulated and PVC sheathed armoured cables; 90-55-15/354 Thermosetting insulated and LSZH sheathed armoured cables; and 90-55-15/355 Thermosetting insulated metal screened LSZH sheathed multicore cables.

- **Cabling:** Install when cable supports are complete.
- **Position:** Place single and multi-core cables side by side.
- **Fastening:**
 - **Fastenings generally:** Secure cables, do not indent sheaths. Position to enable any submain cable to be individually removed.
 - **Submain cables <95 mm²:** Cable cleats.
Spacing (maximum): 600 mm.
 - **Submain cables >95 mm²:** Cable cleats and Cable bands.
Spacing (maximum): 600 mm.
 - **Final circuit cabling:** Cable ties.
Spacing (maximum): 600 mm.
 - **Extra low voltage, communications and fibre optic cabling:** Cable ties.
Spacing (maximum): 600 mm.

Cables in vertical trunking and ducts

Shared by: 90-55-15/343 Fire resistant, insulated and sheathed armoured cables; 90-55-15/353 Thermosetting insulated and PVC sheathed armoured cables; and 90-55-15/354 Thermosetting insulated and LSZH sheathed armoured cables.

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

Installing main control and indicating equipment (CIE)

Shared by: 90-75-30/380 Fire detection and alarm control and indicating equipment (CIE); 90-75-30/385 Fire detection and fire alarm power supply equipment; and 90-75-30/390 Mimic panels.

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

Installing point detectors

Shared by: 90-75-30/325 Combustion gas detectors; 90-75-30/340 Point flame detectors; 90-75-30/345 Point heat detectors; and 90-75-30/350 Point smoke detectors.

- **Protective cage:** Not required.

Installing manual call points

- **Position:** As per fire alarm drawings
- **Mounting height generally (above finished floor level):** 1.4 m.
- **Test key:** Locate to allow easy test operation.
- **Labelling:**
 - **Type:** Face engraved rigid plastic laminate.
 - **Background:** White.
 - **Lettering:** Red, identifying the manual call point address.
- **Mounting height:**

Installing sounders

- **Circuit wiring:** Install one sounder above the main control panel served by a circuit separate to those installed throughout the building and Distribute and interleave multiple sounder circuits around the building.
- **Protective cage:** Required. Sports hall etc

Installing visual alarm signal devices

Shared by: 90-75-30/415 Visual alarm signal devices type A and type B.

- **Position:** As per fire alarm drawings
- **Mounting height generally (above finished floor level):** 2.1 m.
- **Protective cage:** Required. Sports hall etc
- **Mounting height:** 2.1 m above finished floor level.

Installing remote indicators

- **Concealed detection devices:** Install individual LED indicators.

System completion

System information

- **Device list:** Before commissioning, Submit proposals, including proposed device, zone and group names.
- **Zone diagram:** Before commissioning Submit proposals.

Device identification and testing

- **Device identification:** Label devices with a unique address corresponding to that used by the CIE. Label non-addressable devices with a unique reference corresponding to that shown on the record drawings.
- **Device testing:** Verify the operation of each device. Submit a schedule of devices, including the device test methods and results.

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.

System soak testing

- **Soak test:** Undertake when construction works are complete, but before handover.
- **Period:** 14 days.
- **Re-test after remedial works:** Required.

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 electronic layout drawing showing location of measurements with results.

Testing and commissioning generally

- **Standard:** In accordance with BS 5839-1.
- **System commissioning agent:** System manufacturer.
- **Notice before commencing tests (minimum):** Two weeks.

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.

Documentation

- **Standard:** Submit proposals.
- **Operating and maintenance instructions:**
 - **Scope:** Submit for the system giving optimum settings for controls.
 - **Product information:** Include product description, date of purchase, performance characteristics, application (suitability for use), method of operation and control, and cleaning and maintenance requirements.
 - **Format:** Paper copy.
 - **Number of copies:** Three.
- **Log book:** Submit one copy in accordance with BS 5839-1 Annex F.
- **Record drawings:**
 - **Content:** General arrangement drawings showing the location of all control and indicating equipment, manual call points, detectors, radio transmitters and aerials, sounders, visual alarm signal devices, short circuit isolators, end of line devices, remote indicators, interface units connecting to other equipment, and

automatic door hold open devices and Schematic diagram showing all control cabling, the cable origin, device addresses, route from control and indicating equipment to manual call points, detectors, radio transmitters and aerials, sounders, visual alarm signal devices, short circuit isolators, end of line devices, remote indicators, interface units connecting to other equipment, and automatic door hold open devices. Include conductor material and c.s.a, insulation type and colour, number of cores per cable, number of cables in ducts, on tray or ladder.

- **Drawing format:** A1 paper print drawing and Electronic drawing.
- **Number of copies:** Three.
- **Submittal date:** At handover.
- **Fire evacuation plan:** Submit electronic colour CAD layout.
- **Certification:**
 - **Design certificate:** Submit two copies in accordance with BS 5839-1 Annex G.1.
 - **Installation certificate:** Submit two copies in accordance with BS 5839-1 Annex G.2.
 - **Commissioning certificate:** Submit two copies in accordance with BS 5839-1 Annex G.3.

Spares and consumables

- **Supply the following spares:**
 - **Frangible elements for manual call points:** Six.
 - **Detectors:** Two of each type.
- **Printer ink and paper roll:** Replace immediately before handover.

Maintenance

- **Servicing and maintenance:**
 - **Standard:** To BS 5839-1.
- **Duration:** Until 12 months after Practical Completion.

Verification certificate

- **System verification agent:** Contractor's choice.
- **Verification certificate:** Submit two copies in accordance with BS 5839-1 Annex G.5.

Acceptance certificate for fire detection and alarm systems in non-domestic premises

- **Acceptance certificate:** Submit two copies in accordance with BS 5839-1, Annex G.4.

Ω End of system

Assistance call system

System outline

Assistance call system

- **Description:** The contractor shall design, supply, install, test and commission a complete disabled toilet alarm system, to the areas indicated on the drawing.

The toilets shall be individually zoned.

The alarms shall be wired back to the central monitored control point located, adjacent the fire panel, at the main reception. A secondary indication panel or screen shall be provided at the shop sales desk.

The accessible WCs & baby change rooms shall be provided with a surface ceiling mounted pullcord unit with integral reassurance lamp and amber lens. The pullcord shall be red/orange in colour, 3 metres in length and terminate 450mm from the floor level with two number 50mm red bangles. The ceiling pullcord shall be positioned so that the cord is to the right hand side of the wc bowl and within easy reach.

The closing of this switch shall activate the alarm.

An overdoor lamp/tone generator shall be provided over the head of the door leading into the WC/change room from the corridor. The unit shall be centred above the doorway.

The unit shall be recessed and incorporate an illuminated amber lens and audible tone generator and shall be activated once the pullcord switch has been operated. The unit shall be engraved "WC ALARM".

A duplicate overdoor lamp/tone generator shall be provided to the ground floor reception area which shall provide remote indication, mirroring the operation of the unit above the disabled wc door.

A recessed reset push with integral reassurance lamp with amber lens shall also be provided to the inside of the disabled wc room, located adjacent the door leading into the room. The unit shall be engraved "RESET".

The activation of this unit shall reset the system, extinguish and silence all visual and audible alarms.

Activated calls are to be acknowledged at the reception desk. The call is to be reset at activated station.

- **System Performance:** To provide a system to cover the disabled toilets with alerts relayed to reception and/or remote monitoring station.

The alarm system shall be design, supplied, installed and commissioned in accordance with the following:

BS 8300-2:2018 Design of an accessible and inclusive built environment. Buildings - code of practice
Part M of the Building Regulations
BS 5839-9:2011

Design of assistance call systems and Integration with other alarm and security systems.

- **System manufacturer:** Protec, equivalent or approved
- **Operating voltage:** 12 V d.c.
- **Zones:** Contractor's design.
- **Equipment interconnectivity:** Wired and Radio based equipment for emergency voice communication.
- **Call actuator:** Press button units and Pull cord units.
- **Alarm indication:** Overdoor indicators and Remote indicators.
- **Reset unit:** Reset units.
- **Power supply unit:** Power supply units.
- **Circuit monitoring:** Open circuit and Short circuit.
- **Cabling:**
 - **Types:** PVC insulated cables for interconnecting wiring. MICC
- **Containment:** Rigid conduit and Cable trunking and cable ducting systems.
- **Rewireable installation:** Required.
- **Execution:** Installing assistance call systems.
- **System completion:** Testing and commissioning assistance call systems generally;
Calibration certificates;
Documentation for assistance call systems;
and Maintenance.

System performance

Design of assistance call systems

- **Design:** Complete the design of the assistance call system.
- **Requirement:** Submit proposals including detailed design drawings, technical information, calculations and manufacturers' literature.

Integration with other alarm and security systems

Shared by: 75-70-05/110 Assistance call system; and 75-70-05/120 Emergency voice communication system.

- **Objectives:** Contractor's choice.
- **Systems to be integrated:** Assistance call and emergency voice communication systems

Products

Cable cleats

Shared by: 70-70-45/110 Low voltage distribution system; 70-70-75/110 Hard wired low voltage small power system; and 90-55-15/735 Cable installation on channel cable supports, cable tray, cable ladder and cable basket.

- **Manufacturer:** Contractor's choice.
- **Standard:** To BS EN 61914.
- **Format:** Contractor's choice.
- **Material:** Metallic.
- **Temperatures for permanent installation:**
 - **Maximum:** 105°C.
 - **Minimum:** -25°C.
- **Resistance to impact:** Heavy.
- **Type of retention or resistance to electromechanical forces:** Resistant to electromechanical forces, withstanding one short circuit.
- **Environmental influences:**
 - **Non-metallic and composite components:** Resistant to ultraviolet light.
 - **Metallic and composite components:** High resistance to corrosion.

Cable ties

Shared by: 70-70-45/110 Low voltage distribution system; 70-70-75/110 Hard wired low voltage small power system; and 90-55-15/735 Cable installation on channel cable supports, cable tray, cable ladder and cable basket.

- **Manufacturer:** Contractor's choice.
- **Standard:** To BS EN 62275.
- **Format:** Wrap around self-locking releasable.
- **Material:** Nylon and Metal.
- **Loop tensile strength (minimum):** Manufacturer's standard.
- **Temperatures for permanent installation:**
 - **Maximum:** 60°C.
 - **Minimum:** -15°C.
- **Contribution to fire:** Non-flame propagating.
- **Environmental influences:**
 - **Non-metallic and composite components:** Resistant to ultraviolet light.
 - **Metallic and composite components:** Resistant to corrosion.

Cable bands

Shared by: 70-70-45/110 Low voltage distribution system; and 90-55-15/735 Cable installation on channel cable supports, cable tray, cable ladder and cable basket.

- **Manufacturer:** Contractor's choice.
- **Material:** Manufacturer's standard.
- **Protective covering:** Manufacturer's standard.

Cable baskets

Shared by: 70-70-45/110 Low voltage distribution system; 70-70-75/110 Hard wired low voltage small power system; 70-80-35/110 Hard wired general lighting system; 75-45-20/110 Data distribution system; 75-60-10/110 CCTV system; 75-60-40/110 Intruder detection and alarm system; 75-65-30/110 Fire detection and alarm system; and 90-55-15/650 Extra low and low voltage cables in accessible roof spaces.

- **Manufacturer:** Contractor's choice.
- **Material:**
- **Coating material:** Hot dip galvanised, powder coated RAL colour to architectural specification
- **Features:**
 - **Segregation:** Cable dividers.
 - **Protective cover:** Required.
- **Execution:** Installing cable basket; Multiple cable runs; and Cable support zones.
- **Standard:** To BS EN 61537.

Cable trays

Shared by: 70-70-45/110 Low voltage distribution system; 70-70-75/110 Hard wired low voltage small power system; 75-60-10/110 CCTV system; and 90-55-15/650 Extra low and low voltage cables in accessible roof spaces.

- **Manufacturer:** Contractor's choice.
- **Standard:** To BS EN 61537.
- **Material:** Steel.
- **Resistance against flame propagation:** Non-Flame propagating.
- **Electrical properties:**
 - **Continuity characteristics:** Without electrical continuity.
 - **Conductivity characteristics:** Without electrical conductive system component.
- **Coating material:** Hot dip galvanised, powder coated RAL colour to architectural specification
- **Temperature properties for transport, storage, installation and application:**
 - **Minimum:** Manufacturer's standard.
 - **Maximum:** Manufacturer's standard.
- **Mechanical properties:**
 - **Cable tray free base area:** Manufacturer's standard.
 - **Resistance to impact:** Manufacturer's standard.
- **Features:**
 - **Flange type:** Return.
 - **Segregation:** Cable dividers.
 - **Protective cover:** Required.
- **Execution:** Installing cable tray and cable ladder; Installing cable supports on roofs;

Multiple cable runs;
and Cable support zones.

Rigid conduit

Shared by: 70-70-25/660 Installing main earthing conductor; 70-70-45/110 Low voltage distribution system; 70-70-75/110 Hard wired low voltage small power system; 70-80-35/110 Hard wired general lighting system; 75-45-40/110 Audio-frequency-induction-loop system; 75-60-05/110 Access control system; 75-60-40/110 Intruder detection and alarm system; 75-65-30/110 Fire detection and alarm system; 75-70-05/110 Assistance call system; and 90-55-15/645 Low voltage cables concealed in walls and partitions.

- **Manufacturer:** Contractor's choice.
- **Standards:** To BS EN 61386-21.
- **Mechanical properties:**
 - **Resistance to compression:** Heavy.
 - **Resistance to impact:** Heavy.
- **Transport, installation and application:**
 - **Lower temperature (minimum):** Manufacturer's standard.
 - **Upper temperature (maximum):** Manufacturer's standard.
- **Resistance to bending:** Rigid.
- **Electrical characteristics:** With electrical continuity properties.
- **Resistance to external influences:**
 - **Protection against ingress of solid objects (minimum):** To BS EN 60529, IP3X.
 - **Protection against ingress of water (minimum):** To BS EN 60529, IPX0.
- **Resistance to corrosion:** To BS EN 61386-1, Class 4.
- **Tensile strength:** Heavy.
- **Resistance to flame propagation:** Manufacturer's standard.
- **Suspended load capacity:** Heavy.
- **Colour:** Submit proposals.
- **Sizes (OD):** 25 mm.
- **Execution:** Installing rigid metallic conduit;
Installing rigid non metallic conduit;
Installing conduit connections to equipment;
and Conduit, trunking and ducting zones.

Cable trunking and cable ducting systems

Shared by: 70-70-45/110 Low voltage distribution system; 70-70-75/110 Hard wired low voltage small power system; 70-80-35/110 Hard wired general lighting system; 75-60-05/110 Access control system; 75-60-40/110 Intruder detection and alarm system; 75-65-30/110 Fire detection and alarm system; 75-70-05/110 Assistance call system; 75-70-05/120 Emergency voice communication system; and 90-55-15/650 Extra low and low voltage cables in accessible roof spaces.

- **Manufacturer:** Contractor's choice.
- **Standards:** To BS EN 50085-1 and BS EN 50085-2-1.
- **Material:** Metallic;
Non-metallic;
and Steel.

- **Construction:** To include means of preventing contact between liquids and insulated conductors and live parts.
- **Temperature properties:**
 - **Storage and transport temperature (maximum):** Manufacturer's standard.
 - **Installation and application temperature (minimum):** Manufacturer's standard.
 - **Application temperature (maximum):** Manufacturer's standard.
- **Resistance to flame propagation:** Required.
- **Electrical properties:** With electrical continuity characteristics.
- **Ingress protection (minimum):** To BS EN 60529, IP x4.
- **Protection against corrosive and polluting substances:** High protection outside and inside.
- **Access method:** With tools.
- **Screening:** Required.
- **Execution:** Conduit, trunking and ducting zones and Installing trunking generally.

PVC insulated cables for interconnecting wiring

Shared by: 75-60-40/110 Intruder detection and alarm system; and 75-70-05/110 Assistance call system.

- **Manufacturer:** Contractor's choice.
- **Standard:** To BS 4737-3-30.
- **Conductor:**
 - **Nominal diameter:** 0.22 mm².
 - **Stranding:** 7 x 0.2 mm.
 - **Sheath:** PVC.
 - **Colour:** Manufacturer's standard.
 - **Number of cores:** As required
- **Execution:** Installing low voltage cables;
Extra low and low voltage cable routes;
Low voltage cables concealed in walls and partitions;
Extra low and low voltage cables in accessible roof spaces;
Extra low and low voltage surface mounted cables;
Installing low voltage cables in conduit and trunking;
and Cable installation on channel cable supports, cable tray, cable ladder and cable basket.

Radio based equipment for emergency voice communication

- **Manufacturer:** To be completed by user
- **Standards:** In accordance with BS 5839-9.
- **Power supply:** Manufacturer's standard.

Pull cord units

- **Manufacturer:** As assistance call manufacturer
- **Mounting:** Ceiling.
- **Cord:**
 - **Material:** Nylon.

- **Colour:** Orange.
- **Pull handles:** Two triangular pull handles.
- **Length:** Sufficient so that maximum height above floor to the lowest pull handle is 200 mm and the maximum height to the highest pull handle is 1200 mm.
- **Accessories:** Integral orange illuminated reassurance indicator and Integral red illuminated alarm indicator.
- **Execution:** Installing pull cords.

Press button units

- **Manufacturer:** As assistance call manufacturer
- **Mounting:** Wall, flush;
Wall, semi recessed;
and Wall, surface mounted.
- **Material:** White plastics.
- **Accessories:** Integral orange illuminated reassurance indicator and Integral red illuminated alarm indicator.
- **Execution:** Installing press button units.

Overdoor indicators

- **Manufacturer:** As assistance call manufacturer
- **Wall mounting:** Semi recessed and Surface mounted.
- **Material:** White plastics.
- **Visual indicator:** Red.
- **Integral buzzer:** Required.
- **Execution:** Installing overdoor indicators.

Remote indicators

- **Manufacturer:** As assistance manufacturer
- **Mounting:** Desk mounted and Wall mounted.
- **Zone indication:** Engrave with zone description.
- **Visual indication:** Individual zone red illuminated indicators.
- **Audible indication:**
 - **Tone:** Distinguishable from the fire alarm system.
 - **Alarm mute facility:** Required.
- **Execution:** Installing remote indicators.

Reset units

- **Manufacturer:** As assistance call manufacturer
- **Mounting:** Wall mounted.
- **Integral visual and audible alarm:** Not required.
- **Execution:** Installing reset units.

Power supply units

Shared by: 75-70-05/110 Assistance call system; and 75-70-05/120 Emergency voice communication system.

- **Manufacturer:** As assistance call manufacturer
- **Standard:** In accordance with BS EN 54-4.
- **Standby source:** Rechargeable battery.
- **Standby capacity:** Manufacturer's standard.
- **Integral replaceable fuse:** Required.
- **Power-on indicator:** Required.
- **Execution:** Installing power supply units.

Execution

Installing assistance call systems

- **Standard:** In accordance with BS 7671.

Installing cable tray and cable ladder

Shared by: 90-55-10/330 Cable ladders; and 90-55-10/335 Cable trays.

- **Standards:** To BS 7671 and in accordance with IET guidance note 1.
- **Preparation:**
 - **Burrs and sharp edges:** Make smooth.
 - **Cutting:** Minimize and make good edges. Cuts to cable tray to be square along an unperforated line.
 - **Treatment of cut surface:** Extend 25 mm beyond the cut. Match finish of cable supports.
- **Access:** Provide space around cable ladder and tray 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 ladder and tray:** Maximize.
 - **Ends:** Blank with end plates.
- **Changes of size and direction:** Manufacturer's accessories of the same material type, pattern, finish and thickness as cable supports.
- **Fire barriers:** Provide where required to maintain fire performance of fabric.
- **Protective covers:** Provide to cables requiring mechanical protection.
- **Support:**
 - **Fixing arrangement:** Independently fix and support from building structure using threaded rod fixed to channel cable support with shake proof washers and hex nuts;
Independently fix and support from building structure using threaded rod fixed into expanding anchors;
and Independently fix and support from building structure using threaded rod fixed into resin injection anchors.
 - **Clearance from building fabric (minimum):** 20 mm.
- **Components:** Avoid contact between dissimilar metals.
- **Routing of cable ladder and tray:** Submit working drawings showing the final routes.

Installing cable basket

- **Standards:** To BS 7671 and in accordance with IEE Guidance Note 1.
- **Joints:**
 - **Cut:** Adjacent cross basket wires. Make smooth any burrs or edges.
 - **Earth conductors:** Connect across joints.
- **Accessories:** Form on site and connect with basket manufacturer's coupling components.
- **Fire barriers:** Provide where required to maintain fire performance of fabric.
- **Support:**
 - **Fixing arrangement:** Independently fix and support from building structure using threaded rod fixed to channel cable support with shake proof washers and hex nuts;
Independently fix and support from building structure using threaded rod fixed into expanding anchors;
and Independently fix and support from building structure using threaded rod fixed into resin injection anchors.
 - **Clearance from building fabric (minimum):** 20 mm.
- **Components:** Avoid contact between dissimilar metals.
- **Routing of cable basket:** Submit working drawings showing the final routes.

Installing cable supports on roofs

Shared by: [90-55-10/330 Cable ladders](#); and [90-55-10/335 Cable trays](#).

- **Position:** Elevate above roof.
- **Mounting:** Load spreading supports.

Multiple cable runs

Shared by: [90-55-10/325 Cable baskets](#); [90-55-10/330 Cable ladders](#); and [90-55-10/335 Cable trays](#).

- **Requirement:**

Cable support zones

Shared by: [90-55-10/325 Cable baskets](#); [90-55-10/330 Cable ladders](#); and [90-55-10/335 Cable trays](#).

- **Ceiling voids:**
 - **Clear distance between underside of cable supports and brackets and topside of ceiling (minimum):** Contractor's choice.

Installing conduit, trunking and ducting

Shared by: [90-55-10/460 Conduit fittings](#); [90-55-10/715 Installing pliable and flexible conduit](#); [90-55-10/720 Installing rigid metallic conduit](#); [90-55-10/725 Installing rigid non metallic conduit](#); [90-55-10/735 Installing conduit connections to equipment](#); and [90-55-10/765 Conduit, trunking and ducting zones](#).

- **Standards:** In accordance with BS 7671 and IET Guidance Note 1.
- **Preparation:** Cut square. Remove burrs and sharp edges to make smooth.
- **Protection of metallic conduit, trunking and ducting:**

- **Joints and ends:** Remove grease, oil, dirt and rust before applying protective paint. Paint immediately following installation.
- **Protective paint:**
 - Generally:** Compatible with conduit, trunking and ducting finish.
 - Type:** Match factory finish.
- **Cross-sectional area:** Maintain throughout the conduit, trunking and ducting length.
- **Arrangement:** Position vertically and horizontally in line with equipment served, and parallel with building lines.
- **Spare containment:** Install one spare 25 mm diameter conduit from each distribution board to the nearest accessible void space, terminating in a conduit box with lid.
- **Draw wires:** Install galvanized soft iron wires within spare conduit, trunking and ducting.
- **Distance from other services running parallel (minimum):**
 - **Generally:** 150 mm.
 - **Above radiators:** 1000 mm.
 - **Steam services:** 600 mm.
- **Drainage of conduit, trunking and ducting:** Locate drainage outlets at lowest points in conduit, trunking and ducting installed externally, and where condensation may occur.
- **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, trunking and ducting from building structure.
- **Cleaning:** Clean insides of conduit, trunking and ducting before installing cables.
- **Cabling:** Install when conduit, trunking and ducting enclosure is complete.
- **Submittals:** Submit manufacturer's technical information. Submit drawings showing the proposed routes of conduit, trunking and ducting and the location of service outlets.

Installing conduit generally

Shared by: [90-55-10/715 Installing pliable and flexible conduit](#); [90-55-10/720 Installing rigid metallic conduit](#); [90-55-10/725 Installing rigid non metallic conduit](#); and [90-55-10/735 Installing conduit connections to equipment](#).

- **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:**
 - **Generally:** 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:**
 - **Generally:** Install flush with finished surfaces. Provide extension rings if required.
 - **Fixing screws:** Countersunk, or round-headed screws.
 - **Number of fixings (minimum):** Two.
 - **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):** Two.
 - **Floors:** Do not install draw-in boxes in floors.
- **Conduit in walls:** Avoid concealed horizontal runs.
- **Suspended ceiling installations:** Fasten outlet boxes to structure above ceiling.

Installing rigid metallic conduit

- **General requirements:** Installing conduit generally and Installing conduit, trunking and ducting.
- **Fixings:** Distance saddle; Saddle; and Spacer bar saddle.
- **Joints:** Plain and 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.

Installing rigid non metallic conduit

- **General requirements:** Installing conduit generally and Installing conduit, trunking and ducting.
- **Fixings:** Distance saddle; Saddle; and Spacer bar saddle.
- **Joints:** Compression and Threaded.
- **Conduit connections to boxes and items of equipment:** Threaded bushed entries.

Installing conduit connections to equipment

Shared by: 90-55-10/360 Flexible conduit; and 90-55-10/380 Rigid conduit.

- **General requirements:** Installing conduit generally and Installing conduit, trunking and ducting.
- **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 of adequate length to facilitate removal of equipment for maintenance. Final termination in swivel connectors.
- **Connections to external equipment:** Flexible conduit.

Installing trunking generally

- **Supports and mounting arrangement:** Wall mounted;
Ceiling mounted;
Floor mounted;
Purpose made brackets;
and Suspension rods and steel channels.
- **Changes of direction:** Manufacturer's bends and tees.
- **Joints:**
 - **Generally:** 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.
- **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.

Conduit, trunking and ducting zones

Shared by: [90-55-10/360 Flexible conduit](#); [90-55-10/380 Rigid conduit](#); and [90-55-10/410 Cable trunking and cable ducting systems](#).

- **General requirements:** [Installing conduit, trunking and ducting](#).
- **Ceiling voids:** Provide clear distance of 150 mm (minimum) between underside of any conduit, trunking or trunking and the topside of ceiling.

Installing low voltage cables

Shared by: [90-55-15/342 Fire resistant, insulated and sheathed cables](#); [90-55-15/345 PVC insulated cables](#); [90-55-15/346 PVC insulated cables for interconnecting wiring](#); [90-55-15/349 Single-core heat resisting insulating cables](#); [90-55-15/351 Thermosetting insulated cables](#); [90-55-15/352 Thermosetting insulated and PVC sheathed cables \(XLPE/ PVC singles\)](#); [90-55-15/355 Thermosetting insulated metal screened LSZH sheathed multicore](#)

cables; [90-55-15/665 Installing flexible cords](#); [90-55-15/670 Installing prefabricated wiring](#); and [90-55-15/680 Installing low voltage armoured cables](#).

- **Standard:** In accordance with 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. Clear cable path of debris.
- **Installation temperature (minimum):** 5°C.
- **Cables:** Install in one length. Dress cables flat, free from twists, kinks and strain.
- **Cable pulling:** Do not overstress. Prevent kinks and twisting of the cable.
- **Cable protection:** Cables passing through walls and floors to be sleeved with conduit or pipeduct to a minimum of 300 mm. Bush at both ends. Ensure that appropriate fire stopping materials are used to maintain the original fire integrity of the wall or floor around the penetration.
- **Concealed cable runs to wall accessories:** Run vertically from the accessory.
- **Exposed cable runs:**
- **Distance from other services running parallel (minimum):** 150 mm. Position cables below heating pipes.
- **Jointing and termination:**
 - **Final circuit cables:** At electrical accessories only.
 - **Core connections:** Using compression lugs to equipment without integral clamping terminals.
 - **Terminating cables when not using glands:** Take sheathing of cables into accessory boxes and equipment and protect against abrasion with grommets.

Extra low and low voltage cable routes

Shared by: [90-55-15/342 Fire resistant, insulated and sheathed cables](#); [90-55-15/343 Fire resistant, insulated and sheathed armoured cables](#); [90-55-15/344 Mineral insulated cables type A and type B](#); [90-55-15/345 PVC insulated cables](#); [90-55-15/346 PVC insulated cables for interconnecting wiring](#); [90-55-15/351 Thermosetting insulated cables](#); [90-55-15/352 Thermosetting insulated and PVC sheathed cables \(XLPE/ PVC singles\)](#); [90-55-15/353 Thermosetting insulated and PVC sheathed armoured cables](#); [90-55-15/354 Thermosetting insulated and LSZH sheathed armoured cables](#); [90-55-15/355 Thermosetting insulated metal screened LSZH sheathed multicore cables](#); [90-55-15/366 Balanced twisted-pair cables](#); [90-55-15/385 Prefabricated LSZH insulated singles in flexible conduit](#); and [90-55-15/386 Prefabricated LSZH insulated and sheathed multi-core](#).

- **Cables generally:**
 - **Concealed cable runs to wall accessories:** Run vertically from the accessory.
 - **Exposed cable runs:** Contractor's choice.
- **Distance from other services running parallel (minimum):** 150 mm. Position cables below heating pipes.

Low voltage cables concealed in walls and partitions

Shared by: [90-55-15/342 Fire resistant, insulated and sheathed cables](#); [90-55-15/343 Fire resistant, insulated and sheathed armoured cables](#); [90-55-15/344 Mineral insulated cables type A and type B](#); [90-55-15/345 PVC insulated cables](#); [90-55-15/346 PVC insulated cables for interconnecting wiring](#); [90-55-15/351 Thermosetting insulated cables](#); [90-55-15/352](#)

Thermosetting insulated and PVC sheathed cables (XLPE/ PVC singles); 90-55-15/355 Thermosetting insulated metal screened LSZH sheathed multicore cables; 90-55-15/385 Prefabricated LSZH insulated singles in flexible conduit; and 90-55-15/386 Prefabricated LSZH insulated and sheathed multi-core.

- **Position:** In a zone within 150 mm of wall perimeter (except at the floor); and run vertically or horizontally from these zones, or from floor level, to switches, accessories, etc and At least 50 mm from the surface. Ensure all routes are agreed with architect (working drawings) to ensure historic fabric is maintained.
- **Protection:** Rigid conduit and Cover with galvanized steel channel nailed to substrate.

Extra low and low voltage cables in accessible roof spaces

Shared by: 90-55-15/340 Flexible cords; 90-55-15/342 Fire resistant, insulated and sheathed cables; 90-55-15/343 Fire resistant, insulated and sheathed armoured cables; 90-55-15/344 Mineral insulated cables type A and type B; 90-55-15/345 PVC insulated cables; 90-55-15/346 PVC insulated cables for interconnecting wiring; 90-55-15/351 Thermosetting insulated cables; 90-55-15/352 Thermosetting insulated and PVC sheathed cables (XLPE/ PVC singles); 90-55-15/353 Thermosetting insulated and PVC sheathed armoured cables; 90-55-15/354 Thermosetting insulated and LSZH sheathed armoured cables; 90-55-15/355 Thermosetting insulated metal screened LSZH sheathed multicore cables; 90-55-15/366 Balanced twisted-pair cables; 90-55-15/385 Prefabricated LSZH insulated singles in flexible conduit; and 90-55-15/386 Prefabricated LSZH insulated and sheathed multi-core.

- **Cables running across ceiling joists:** Cable baskets;
Cable trays;
and Cable trunking and cable ducting systems.

Extra low and low voltage surface mounted cables

Shared by: 90-55-15/340 Flexible cords; 90-55-15/342 Fire resistant, insulated and sheathed cables; 90-55-15/343 Fire resistant, insulated and sheathed armoured cables; 90-55-15/344 Mineral insulated cables type A and type B; 90-55-15/345 PVC insulated cables; 90-55-15/346 PVC insulated cables for interconnecting wiring; 90-55-15/351 Thermosetting insulated cables; 90-55-15/352 Thermosetting insulated and PVC sheathed cables (XLPE/ PVC singles); 90-55-15/353 Thermosetting insulated and PVC sheathed armoured cables; 90-55-15/354 Thermosetting insulated and LSZH sheathed armoured cables; 90-55-15/355 Thermosetting insulated metal screened LSZH sheathed multicore cables; and 90-55-15/366 Balanced twisted-pair 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.

Installing low voltage cables in conduit and trunking

Shared by: 90-55-15/342 Fire resistant, insulated and sheathed cables; 90-55-15/343 Fire resistant, insulated and sheathed armoured cables; 90-55-15/344 Mineral insulated cables type A and type B; 90-55-15/345 PVC insulated cables; 90-55-15/346 PVC insulated cables for interconnecting wiring; 90-55-15/349 Single-core heat resisting insulating cables; 90-55-15/351 Thermosetting insulated cables; 90-55-15/352 Thermosetting insulated and PVC sheathed cables (XLPE/ PVC singles); 90-55-15/353 Thermosetting insulated and PVC sheathed armoured cables; 90-55-15/354 Thermosetting insulated and LSZH sheathed armoured cables; 90-55-15/355 Thermosetting insulated metal screened LSZH sheathed multicore cables; 90-55-15/366 Balanced twisted-pair cables; 90-55-15/385 Prefabricated

LSZH insulated singles in flexible conduit; and 90-55-15/386 Prefabricated LSZH insulated and sheathed multi-core.

- **Cable installation:** Orderly and capable of being withdrawn.
- **Single core wiring:** Arrange using the loop-in method.
- **Cables within trunking:** Tie at 2 m intervals for cables of the same circuit reference. Label ties with circuit reference number at 10 m intervals.
- **Cables in vertical conduit:** Provide cable clamps in accessible conduit boxes at 5 m intervals.
- **Extra low voltage cables:** Install within a separate partition from low voltage cables where installed in multi compartment trunking.

Cable installation on channel cable supports, cable tray, cable ladder and cable basket

Shared by: 90-55-15/342 Fire resistant, insulated and sheathed cables; 90-55-15/343 Fire resistant, insulated and sheathed armoured cables; 90-55-15/344 Mineral insulated cables type A and type B; 90-55-15/345 PVC insulated cables; 90-55-15/346 PVC insulated cables for interconnecting wiring; 90-55-15/351 Thermosetting insulated cables; 90-55-15/353 Thermosetting insulated and PVC sheathed armoured cables; 90-55-15/354 Thermosetting insulated and LSZH sheathed armoured cables; and 90-55-15/355 Thermosetting insulated metal screened LSZH sheathed multicore cables.

- **Cabling:** Install when cable supports are complete.
- **Position:** Place single and multi-core cables side by side.
- **Fastening:**
 - **Fastenings generally:** Secure cables, do not indent sheaths. Position to enable any submain cable to be individually removed.
 - **Submain cables <95 mm²:** Cable cleats.
Spacing (maximum): 600 mm.
 - **Submain cables >95 mm²:** Cable cleats and Cable bands.
Spacing (maximum): 600 mm.
 - **Final circuit cabling:** Cable ties.
Spacing (maximum): 600 mm.
 - **Extra low voltage, communications and fibre optic cabling:** Cable ties.
Spacing (maximum): 600 mm.

Installing pull cords

- **Mounting arrangement:** Ceiling mounted.
- **Position within room:** Within reach of persons using the toilet;
 Within reach of persons using the bath;
 Within reach of persons using the changing accommodation;
 and Within reach of persons in bed.

Installing press button units

- **Mounting arrangement:** Wall mounted.
- **Position within room:** Within reach of persons using the toilet and Within reach of persons using the changing accommodation.

Installing overdoor indicators

- **Position:** 200 mm above door top.

Installing remote indicators

- **Position:** At reception or disabled refuge panel

Installing reset units

- **Position:** Within reach of persons in a wheelchair;
Within reach of persons using the toilet;
Within reach of persons using the bath;
Within reach of persons using the changing accommodation;
and Within reach of persons in bed.

Installing power supply units

- **Position:** Contractor's choice.
- **Final connection:**
 - **Accessory type:** Unswitched fused connection unit.
 - **Cable type:** Contractor's choice.

System completion

Testing and commissioning assistance call systems generally

Shared by: 75-70-05/110 Assistance call system; and 75-70-05/120 Emergency voice communication system.

- **Standards:**
- **Notice before commencing commissioning:** 7 d.
- **System commissioning agent:**
- **Controls:** Verify operation.
- **Alarm signalling:** Verify operation.
- **Results:** Submit.

Calibration certificates

Shared by: 75-70-05/110 Assistance call system; and 75-70-05/120 Emergency voice communication system.

- **Certificates of calibration for meters and instruments:** Submit.

Documentation for assistance call systems

- **Operating and maintenance instructions:**
 - **Scope:** Submit for the system giving optimum settings for controls.
 - **Product information:** Include product description, date of purchase, performance characteristics, application (suitability for use), method of operation and control, and cleaning and maintenance requirements.
 - **Format:** Paper copy.
 - **Number of copies:** Three.

- **Record drawings:**

- **Content:** General arrangement drawings showing the location of all power supply units to actuators, reset units, and visual alarm signal devices and Schematic diagram showing all control cabling, the cable origin, route from power supply units to actuators, reset units, visual alarm signal devices. Include conductor material and c.s.a, insulation type and colour, number of cores per cable, number of cables in ducts, on tray or ladder.
- **Format:** A1 paper print drawing and Electronic drawing.
- **Number of copies:** Three.

- **Submittal date:** At handover.

Maintenance

Shared by: 75-70-05/110 Assistance call system; and 75-70-05/120 Emergency voice communication system.

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

Ω End of system

Emergency voice communication system

System outline

Emergency voice communication system

- **Description:** The contractor shall design, supply install, test and commission a complete disabled refuge alarm system. The system shall be designed to comply with BS5839-9:2011

A disabled refuge alarm may be required at each upper level of staircases and lift lobbies. Positions as indicated in MEP layouts & architectural drawings

The alarms shall be wired back to the central monitored control point located, adjacent the fire panel, at the main reception.

Emergency Voice Communication system to BS 5839-9: A refuge communications system shall be provided for any person unable to use the stairs in the event of an evacuation of the building. This shall consist of one or more allocated spaces adjacent to each staircase where a wheelchair can be parked. At each of these locations a two-way communications panel shall be provided, linked back to a similar panel adjacent to the fire alarm panel. Outstation panels shall be vandal resistant and where normally accessible to general public, shall feature active monitoring to detect attempted sabotage.

The system will enable fire wardens and designated evacuation leaders to identify who needs assistance and to direct the evacuation prior to the arrival of the Fire and Rescue Service;

Outstation panels shall be appropriate signage to BS 5499. The proposed signage & units shall be submitted to the CA for comment prior to installation. The master station shall have a type A handset and shall be fully recessed for a neat installation. Regardless of the technically permissible wiring configurations, the system shall be wired using fire resistant cable to provide improved resilience and durability in the event of an incident. The cable shall be fire resistant to BS 5839 "enhanced".

The power supply for the EVC system shall be derived directly from the nearest distribution board and shall be connected to the master station using "enhanced" fire resistant cable and a key switched fused connection-unit engraved "DO NOT SWITCH OFF".

The EVC master station shall incorporate an integral battery sized to allow for 72 hours quiescent operation followed by 60 minutes of continuous active operation.

The EVC system may optionally be combined with the Accessible WC Alarm. However, this shall not compromise the specification or integrity of the EVC system.

A Disabled Refuge intercom unit shall be provided at the refuge point as indicated on the drawings (Excluding lower ground floor) and shall communicate with the two master control stations to enable two way communications between the attending fire brigade/responsible persons and a disabled / trapped persons awaiting

assistance at the refuge.

Each intercom unit shall be connected to an induction loop amplifier, to assist with hard of hearing persons.

The intercom units at the disabled refuge points shall not operate unless an input is received from the fire alarm system. The intercom units within the toilets shall be continuously operational.

The specialist shall provide and install all wiring, power supplies and containment (Cable Basket) for the system.

The specialist shall contact the manufacturer during tender to determine exact cabling and containment requirements and allow for such in their tender.

All cable routes and proposals shall be detailed within technical submittals and working drawings.

The specialist shall include within the tender for 1 days training and demonstration of the system to the Client.

- **System Performance:** The systems shall be designed and installed in accordance with all relevant Standards, Regulations and best practice:-
 - BS 8300
 - BS 7594
 - BS 5839-9
 - BS 5588
 - BS 9999

Integration with other alarm and security systems and Design of emergency voice communication systems.

- **System manufacturer:** Protec, equivalent or approved
- **Operating voltage:** Extra low voltage to BS 7671.
- **Zones:** Contractor's design.
- **Equipment interconnectivity:** Wired.
- **Call actuator:** Disabled refuge outstations.
- **Disabled refuge master station:** Disabled refuge master station.
- **Alarm indication:** Sounders;
Visual alarm signal devices type A;
and Visual alarm signal devices type B.
- **Power supply unit:** Power supply units
- **Circuit monitoring:** Open circuit and short circuit.
- **Cabling:**
 - **Type:** Mineral insulated cables type B.
- **Containment:** Cable trunking and cable ducting systems.
- **Rewireable installation:** Required.
- **System accessories:** Acoustic hoods and Portable communicators.
- **Execution:** Installing emergency voice communication systems.
- **System completion:** Testing and commissioning assistance call systems generally;
Calibration certificates;

Maintenance;
Documentation for emergency voice communication systems;
Verification certificate;
 and Acceptance certificate.

System performance

Design of emergency voice communication systems

- **System designer:** System manufacturer.
- **Design:** Complete the design of the emergency voice communication system in accordance with BS 5839-9.
- **Requirement:** Submit proposals including detailed design drawings, technical information, calculations and manufacturers' literature.
- **Communication strategy:** Initiated from the outstation and Calls to outstation to be initiated from master station.
- **System design certificate:** Submit with design proposals.

Integration with other alarm and security systems

Shared by: 75-70-05/110 Assistance call system; and 75-70-05/120 Emergency voice communication system.

- **Objectives:** Contractor's choice.
- **Systems to be integrated:** Assistance call and emergency voice communication systems

Products

Cable cleats

Shared by: 70-70-45/110 Low voltage distribution system; 70-70-75/110 Hard wired low voltage small power system; and 90-55-15/735 Cable installation on channel cable supports, cable tray, cable ladder and cable basket.

- **Manufacturer:** Contractor's choice.
- **Standard:** To BS EN 61914.
- **Format:** Contractor's choice.
- **Material:** Metallic.
- **Temperatures for permanent installation:**
 - **Maximum:** 105°C.
 - **Minimum:** -25°C.
- **Resistance to impact:** Heavy.
- **Type of retention or resistance to electromechanical forces:** Resistant to electromechanical forces, withstanding one short circuit.
- **Environmental influences:**
 - **Non-metallic and composite components:** Resistant to ultraviolet light.
 - **Metallic and composite components:** High resistance to corrosion.

Cable ties

Shared by: 70-70-45/110 Low voltage distribution system; 70-70-75/110 Hard wired low voltage small power system; and 90-55-15/735 Cable installation on channel cable supports, cable tray, cable ladder and cable basket.

- **Manufacturer:** Contractor's choice.
- **Standard:** To BS EN 62275.
- **Format:** Wrap around self-locking releasable.
- **Material:** Nylon and Metal.
- **Loop tensile strength (minimum):** Manufacturer's standard.
- **Temperatures for permanent installation:**
 - **Maximum:** 60°C.
 - **Minimum:** -15°C.
- **Contribution to fire:** Non-flame propagating.
- **Environmental influences:**
 - **Non-metallic and composite components:** Resistant to ultraviolet light.
 - **Metallic and composite components:** Resistant to corrosion.

Cable bands

Shared by: 70-70-45/110 Low voltage distribution system; and 90-55-15/735 Cable installation on channel cable supports, cable tray, cable ladder and cable basket.

- **Manufacturer:** Contractor's choice.
- **Material:** Manufacturer's standard.
- **Protective covering:** Manufacturer's standard.

Cable baskets

Shared by: 70-70-45/110 Low voltage distribution system; 70-70-75/110 Hard wired low voltage small power system; 70-80-35/110 Hard wired general lighting system; 75-45-20/110 Data distribution system; 75-60-10/110 CCTV system; 75-60-40/110 Intruder detection and alarm system; 75-65-30/110 Fire detection and alarm system; and 90-55-15/650 Extra low and low voltage cables in accessible roof spaces.

- **Manufacturer:** Contractor's choice.
- **Material:**
- **Coating material:** Hot dip galvanised, powder coated RAL colour to architectural specification
- **Features:**
 - **Segregation:** Cable dividers.
 - **Protective cover:** Required.
- **Execution:** Installing cable basket;
Multiple cable runs;
and Cable support zones.
- **Standard:** To BS EN 61537.

Cable trays

Shared by: 70-70-45/110 Low voltage distribution system; 70-70-75/110 Hard wired low

voltage small power system; 75-60-10/110 CCTV system; and 90-55-15/650 Extra low and low voltage cables in accessible roof spaces.

- **Manufacturer:** Contractor's choice.
- **Standard:** To BS EN 61537.
- **Material:** Steel.
- **Resistance against flame propagation:** Non-Flame propagating.
- **Electrical properties:**
 - **Continuity characteristics:** Without electrical continuity.
 - **Conductivity characteristics:** Without electrical conductive system component.
- **Coating material:** Hot dip galvanised, powder coated RAL colour to architectural specification
- **Temperature properties for transport, storage, installation and application:**
 - **Minimum:** Manufacturer's standard.
 - **Maximum:** Manufacturer's standard.
- **Mechanical properties:**
 - **Cable tray free base area:** Manufacturer's standard.
 - **Resistance to impact:** Manufacturer's standard.
- **Features:**
 - **Flange type:** Return.
 - **Segregation:** Cable dividers.
 - **Protective cover:** Required.
- **Execution:** Installing cable tray and cable ladder;
Installing cable supports on roofs;
Multiple cable runs;
and Cable support zones.

Rigid conduit

Shared by: 70-70-25/660 Installing main earthing conductor; 70-70-45/110 Low voltage distribution system; 70-70-75/110 Hard wired low voltage small power system; 70-80-35/110 Hard wired general lighting system; 75-45-40/110 Audio-frequency-induction-loop system; 75-60-05/110 Access control system; 75-60-40/110 Intruder detection and alarm system; 75-65-30/110 Fire detection and alarm system; 75-70-05/110 Assistance call system; and 90-55-15/645 Low voltage cables concealed in walls and partitions.

- **Manufacturer:** Contractor's choice.
- **Standards:** To BS EN 61386-21.
- **Mechanical properties:**
 - **Resistance to compression:** Heavy.
 - **Resistance to impact:** Heavy.
- **Transport, installation and application:**
 - **Lower temperature (minimum):** Manufacturer's standard.
 - **Upper temperature (maximum):** Manufacturer's standard.
- **Resistance to bending:** Rigid.
- **Electrical characteristics:** With electrical continuity properties.
- **Resistance to external influences:**

- **Protection against ingress of solid objects (minimum):** To BS EN 60529, IP3X.
- **Protection against ingress of water (minimum):** To BS EN 60529, IPX0.
- **Resistance to corrosion:** To BS EN 61386-1, Class 4.
- **Tensile strength:** Heavy.
- **Resistance to flame propagation:** Manufacturer's standard.
- **Suspended load capacity:** Heavy.
- **Colour:** Submit proposals.
- **Sizes (OD):** 25 mm.
- **Execution:** Installing rigid metallic conduit;
Installing rigid non metallic conduit;
Installing conduit connections to equipment;
and Conduit, trunking and ducting zones.

Cable trunking and cable ducting systems

Shared by: 70-70-45/110 Low voltage distribution system; 70-70-75/110 Hard wired low voltage small power system; 70-80-35/110 Hard wired general lighting system; 75-60-05/110 Access control system; 75-60-40/110 Intruder detection and alarm system; 75-65-30/110 Fire detection and alarm system; 75-70-05/110 Assistance call system; 75-70-05/120 Emergency voice communication system; and 90-55-15/650 Extra low and low voltage cables in accessible roof spaces.

- **Manufacturer:** Contractor's choice.
- **Standards:** To BS EN 50085-1 and BS EN 50085-2-1.
- **Material:** Metallic;
Non-metallic;
and Steel.
- **Construction:** To include means of preventing contact between liquids and insulated conductors and live parts.
- **Temperature properties:**
 - **Storage and transport temperature (maximum):** Manufacturer's standard.
 - **Installation and application temperature (minimum):** Manufacturer's standard.
 - **Application temperature (maximum):** Manufacturer's standard.
- **Resistance to flame propagation:** Required.
- **Electrical properties:** With electrical continuity characteristics.
- **Ingress protection (minimum):** To BS EN 60529, IP x4.
- **Protection against corrosive and polluting substances:** High protection outside and inside.
- **Access method:** With tools.
- **Screening:** Required.
- **Execution:** Conduit, trunking and ducting zones and Installing trunking generally.

Mineral insulated cables type B

Shared by: 70-70-75/110 Hard wired low voltage small power system; and 75-70-05/120 Emergency voice communication system.

- **Manufacturer:** Contractor's choice.
- **Standard:** To BS EN 60702-1.

- **Third party certification:** British Approvals Service for Cables (BASEC) certified and LPCB.
- **Metallic sheath:** Contractor's choice.
- **Light duty mineral insulated with outer sheath (LD MICS/ LSZH):**
 - **Construction:** To tables 7, 8 and 9.
 - **Size:** Contractor's choice.
- **Heavy duty mineral insulated with outer sheath (HD MICS/ LSZH):**
 - **Construction:** To tables 10, 11 and 12.
 - **Size:** Contractor's choice.
- **Execution:** Extra low and low voltage cable routes;
Low voltage cables concealed in walls and partitions;
Extra low and low voltage cables in accessible roof spaces;
Extra low and low voltage surface mounted cables;
Installing low voltage cables in conduit and trunking;
and Cable installation on channel cable supports, cable tray, cable ladder and cable basket.

Disabled refuge outstations

- **Manufacturer:** Protec, equivalent or approved
- **Standard:** In accordance with BS 5839-9, Type A and In accordance with BS 5839-9, Type B.
- **Mounting:** Flush;
Semi recessed;
and Surface mounted.
- **Accessories:** Induction Loop
- **Execution:** Installing disabled refuge outstations.

Disabled refuge master station

- **Manufacturer:** Protec, equivalent or approved
- **Standard:** In accordance with BS 5839-9.
- **Mounting:** Wall mounted;
Flush mounted;
Semi recessed;
and Surface mounted.
- **Communication interface:** Telephone handset and Microphone on flexible arm with panel mounted loudspeaker.
- **Accessories:** Manufacturer's standard.
- **Execution:** Installing disabled refuge master station.

Power supply units

Shared by: 75-70-05/110 Assistance call system; and 75-70-05/120 Emergency voice communication system.

- **Manufacturer:** As assistance call manufacturer
- **Standard:** In accordance with BS EN 54-4.
- **Standby source:** Rechargeable battery.
- **Standby capacity:** Manufacturer's standard.
- **Integral replaceable fuse:** Required.

- **Power-on indicator:** Required.
- **Execution:** Installing power supply units.

Acoustic hoods

- **Manufacturer:** Protec, equivalent or approved
- **Mounting arrangement:** Wall.
- **Colour and finish:** Manufacturer's standard.
- **Execution:** Installing acoustic hoods.

Portable communicators

- **Manufacturer:** Protec, equivalent or approved
- **Number to be supplied:** Manufacturer's standard.
- **Chargers:** Supply one for each portable communicator.

Fire detection devices generally

Shared by: 90-75-30/325 Combustion gas detectors; 90-75-30/330 Manual call points; 90-75-30/335 Optical beam smoke detectors; 90-75-30/340 Point flame detectors; 90-75-30/345 Point heat detectors; 90-75-30/350 Point smoke detectors; 90-75-30/360 Sounders ; and 90-75-30/415 Visual alarm signal devices type A and type B.

- **Device address setup:** Automatic via CIE.
- **Removal of devices:** Must require a special tool. Must not affect the operation of alarm equipment.
- **Device bases:** Maintain circuit continuity when device is removed.
- **Short circuit isolators:** Integral to control equipment.

Sounders

Shared by: 75-65-30/110 Fire detection and alarm system; and 75-70-05/120 Emergency voice communication system.

- **General requirements:** Fire detection devices generally.
- **Manufacturer:** As per CIE manufacturer
- **Standard:** To BS EN 54-3.
- **Sounder type:** Electronic sounder.
- **Sounder cut off time (maximum):** 30 minutes.
- **Ingress protection standard:** Type A and Type B.
- **Colour:** White.
- **Directional output at 1 m (minimum):** 100 dBA.
- **Integral beacon:** Required.
- **Mounting:** Recessed;
Semi-recessed;
and Surface.
- **Power supply:** From loop;
From sounder circuit;
and From sound driver module.
- **Execution:** Installing sounders.

Visual alarm signal devices type A

Shared by: 75-65-30/110 Fire detection and alarm system; and 75-70-05/120 Emergency voice communication system.

- **General requirements:** Fire detection devices generally.
- **Manufacturer:** As per CIE manufacturer
- **Standard:** To BS EN 54-23.
- **Device type:** LED.
- **Environment type:** A.
- **Category:** Manufacturer's standard.
- **Lens colour:** Red.
- **Execution:** Installing visual alarm signal devices.

Visual alarm signal devices type B

Shared by: 75-65-30/110 Fire detection and alarm system; and 75-70-05/120 Emergency voice communication system.

- **General requirements:** Fire detection devices generally.
- **Manufacturer:** As per CIE manufacturer
- **Standard:** To BS EN 54-23.
- **Device type:** LED beacon.
- **Environment type:** A.
- **Category:** Manufacturer's standard.
- **Lens colour:** Red.
- **Execution:** Installing visual alarm signal devices.

Execution

Installing emergency voice communication systems

- **Standard:** To BS 7671 and in accordance with BS 5839-9.
- **Wiring arrangement:** Contractor's choice.

Installing cable tray and cable ladder

Shared by: 90-55-10/330 Cable ladders; and 90-55-10/335 Cable trays.

- **Standards:** To BS 7671 and in accordance with IET guidance note 1.
- **Preparation:**
 - **Burrs and sharp edges:** Make smooth.
 - **Cutting:** Minimize and make good edges. Cuts to cable tray to be square along an unperforated line.
 - **Treatment of cut surface:** Extend 25 mm beyond the cut. Match finish of cable supports.
- **Access:** Provide space around cable ladder and tray 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 ladder and tray:** Maximize.
- **Ends:** Blank with end plates.
- **Changes of size and direction:** Manufacturer's accessories of the same material type, pattern, finish and thickness as cable supports.
- **Fire barriers:** Provide where required to maintain fire performance of fabric.
- **Protective covers:** Provide to cables requiring mechanical protection.
- **Support:**
 - **Fixing arrangement:** Independently fix and support from building structure using threaded rod fixed to channel cable support with shake proof washers and hex nuts;
Independently fix and support from building structure using threaded rod fixed into expanding anchors;
and Independently fix and support from building structure using threaded rod fixed into resin injection anchors.
 - **Clearance from building fabric (minimum):** 20 mm.
- **Components:** Avoid contact between dissimilar metals.
- **Routing of cable ladder and tray:** Submit working drawings showing the final routes.

Installing cable basket

- **Standards:** To BS 7671 and in accordance with IEE Guidance Note 1.
- **Joints:**
 - **Cut:** Adjacent cross basket wires. Make smooth any burrs or edges.
 - **Earth conductors:** Connect across joints.
- **Accessories:** Form on site and connect with basket manufacturer's coupling components.
- **Fire barriers:** Provide where required to maintain fire performance of fabric.
- **Support:**
 - **Fixing arrangement:** Independently fix and support from building structure using threaded rod fixed to channel cable support with shake proof washers and hex nuts;
Independently fix and support from building structure using threaded rod fixed into expanding anchors;
and Independently fix and support from building structure using threaded rod fixed into resin injection anchors.
 - **Clearance from building fabric (minimum):** 20 mm.
- **Components:** Avoid contact between dissimilar metals.
- **Routing of cable basket:** Submit working drawings showing the final routes.

Installing cable supports on roofs

Shared by: [90-55-10/330 Cable ladders](#); and [90-55-10/335 Cable trays](#).

- **Position:** Elevate above roof.
- **Mounting:** Load spreading supports.

Multiple cable runs

Shared by: 90-55-10/325 Cable baskets; 90-55-10/330 Cable ladders; and 90-55-10/335 Cable trays.

- **Requirement:**

Cable support zones

Shared by: 90-55-10/325 Cable baskets; 90-55-10/330 Cable ladders; and 90-55-10/335 Cable trays.

- **Ceiling voids:**
 - **Clear distance between underside of cable supports and brackets and topside of ceiling (minimum):** Contractor's choice.

Installing conduit, trunking and ducting

Shared by: 90-55-10/460 Conduit fittings; 90-55-10/715 Installing pliable and flexible conduit; 90-55-10/720 Installing rigid metallic conduit; 90-55-10/725 Installing rigid non metallic conduit; 90-55-10/735 Installing conduit connections to equipment; and 90-55-10/765 Conduit, trunking and ducting zones.

- **Standards:** In accordance with BS 7671 and IET Guidance Note 1.
- **Preparation:** Cut square. Remove burrs and sharp edges to make smooth.
- **Protection of metallic conduit, trunking and ducting:**
 - **Joints and ends:** Remove grease, oil, dirt and rust before applying protective paint. Paint immediately following installation.
 - **Protective paint:**
 - Generally:** Compatible with conduit, trunking and ducting finish.
 - Type:** Match factory finish.
- **Cross-sectional area:** Maintain throughout the conduit, trunking and ducting length.
- **Arrangement:** Position vertically and horizontally in line with equipment served, and parallel with building lines.
- **Spare containment:** Install one spare 25 mm diameter conduit from each distribution board to the nearest accessible void space, terminating in a conduit box with lid.
- **Draw wires:** Install galvanized soft iron wires within spare conduit, trunking and ducting.
- **Distance from other services running parallel (minimum):**
 - **Generally:** 150 mm.
 - **Above radiators:** 1000 mm.
 - **Steam services:** 600 mm.
- **Drainage of conduit, trunking and ducting:** Locate drainage outlets at lowest points in conduit, trunking and ducting installed externally, and where condensation may occur.
- **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, trunking and ducting from building structure.

- **Cleaning:** Clean insides of conduit, trunking and ducting before installing cables.
- **Cabling:** Install when conduit, trunking and ducting enclosure is complete.
- **Submittals:** Submit manufacturer's technical information. Submit drawings showing the proposed routes of conduit, trunking and ducting and the location of service outlets.

Installing conduit generally

Shared by: 90-55-10/715 Installing pliable and flexible conduit; 90-55-10/720 Installing rigid metallic conduit; 90-55-10/725 Installing rigid non metallic conduit; and 90-55-10/735 Installing conduit connections to equipment.

- **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:**
 - **Generally:** 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:**
 - **Generally:** Install flush with finished surfaces. Provide extension rings if required.
 - **Fixing screws:** Countersunk, or round-headed screws.
 - **Number of fixings (minimum):** Two.
 - **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):** Two.
 - **Floors:** Do not install draw-in boxes in floors.
- **Conduit in walls:** Avoid concealed horizontal runs.
- **Suspended ceiling installations:** Fasten outlet boxes to structure above ceiling.

Installing rigid metallic conduit

- **General requirements:** Installing conduit generally and Installing conduit, trunking and ducting.
- **Fixings:** Distance saddle; Saddle; and Spacer bar saddle.
- **Joints:** Plain and 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.

Installing rigid non metallic conduit

- **General requirements:** Installing conduit generally and Installing conduit, trunking and ducting.
- **Fixings:** Distance saddle; Saddle; and Spacer bar saddle.
- **Joints:** Compression and Threaded.
- **Conduit connections to boxes and items of equipment:** Threaded bushed entries.

Installing conduit connections to equipment

Shared by: 90-55-10/360 Flexible conduit; and 90-55-10/380 Rigid conduit.

- **General requirements:** Installing conduit generally and Installing conduit, trunking and ducting.
- **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 of adequate length to facilitate removal of equipment for maintenance. Final termination in swivel connectors.
- **Connections to external equipment:** Flexible conduit.

Installing trunking generally

- **Supports and mounting arrangement:** Wall mounted; Ceiling mounted; Floor mounted; Purpose made brackets; and Suspension rods and steel channels.
- **Changes of direction:** Manufacturer's bends and tees.
- **Joints:**
 - **Generally:** 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.

- **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.

Conduit, trunking and ducting zones

Shared by: 90-55-10/360 Flexible conduit; 90-55-10/380 Rigid conduit; and 90-55-10/410 Cable trunking and cable ducting systems.

- **General requirements:** Installing conduit, trunking and ducting.
- **Ceiling voids:** Provide clear distance of 150 mm (minimum) between underside of any conduit, trunking or trunking and the topside of ceiling.

Extra low and low voltage cable routes

Shared by: 90-55-15/342 Fire resistant, insulated and sheathed cables; 90-55-15/343 Fire resistant, insulated and sheathed armoured cables; 90-55-15/344 Mineral insulated cables type A and type B; 90-55-15/345 PVC insulated cables; 90-55-15/346 PVC insulated cables for interconnecting wiring; 90-55-15/351 Thermosetting insulated cables; 90-55-15/352 Thermosetting insulated and PVC sheathed cables (XLPE/ PVC singles); 90-55-15/353 Thermosetting insulated and PVC sheathed armoured cables; 90-55-15/354 Thermosetting insulated and LSZH sheathed armoured cables; 90-55-15/355 Thermosetting insulated metal screened LSZH sheathed multicore cables; 90-55-15/366 Balanced twisted-pair cables; 90-55-15/385 Prefabricated LSZH insulated singles in flexible conduit; and 90-55-15/386 Prefabricated LSZH insulated and sheathed multi-core.

- **Cables generally:**
 - **Concealed cable runs to wall accessories:** Run vertically from the accessory.
 - **Exposed cable runs:** Contractor's choice.
- **Distance from other services running parallel (minimum):** 150 mm. Position cables below heating pipes.

Low voltage cables concealed in walls and partitions

Shared by: 90-55-15/342 Fire resistant, insulated and sheathed cables; 90-55-15/343 Fire resistant, insulated and sheathed armoured cables; 90-55-15/344 Mineral insulated cables type A and type B; 90-55-15/345 PVC insulated cables; 90-55-15/346 PVC insulated cables for interconnecting wiring; 90-55-15/351 Thermosetting insulated cables; 90-55-15/352 Thermosetting insulated and PVC sheathed cables (XLPE/ PVC singles); 90-55-15/355 Thermosetting insulated metal screened LSZH sheathed multicore cables; 90-55-15/385 Prefabricated LSZH insulated singles in flexible conduit; and 90-55-15/386 Prefabricated LSZH insulated and sheathed multi-core.

- **Position:** In a zone within 150 mm of wall perimeter (except at the floor); and run vertically or horizontally from these zones, or from floor level, to switches, accessories, etc and At least 50 mm from the surface. Ensure all routes are agreed with architect (working drawings) to ensure historic fabric is maintained.
- **Protection:** Rigid conduit and Cover with galvanized steel channel nailed to substrate.

Extra low and low voltage cables in accessible roof spaces

Shared by: 90-55-15/340 Flexible cords; 90-55-15/342 Fire resistant, insulated and sheathed cables; 90-55-15/343 Fire resistant, insulated and sheathed armoured cables; 90-55-15/344 Mineral insulated cables type A and type B; 90-55-15/345 PVC insulated cables; 90-55-15/346 PVC insulated cables for interconnecting wiring; 90-55-15/351 Thermosetting insulated cables; 90-55-15/352 Thermosetting insulated and PVC sheathed cables (XLPE/ PVC singles); 90-55-15/353 Thermosetting insulated and PVC sheathed armoured cables; 90-55-15/354 Thermosetting insulated and LSZH sheathed armoured cables; 90-55-15/355 Thermosetting insulated metal screened LSZH sheathed multicore cables; 90-55-15/366 Balanced twisted-pair cables; 90-55-15/385 Prefabricated LSZH insulated singles in flexible conduit; and 90-55-15/386 Prefabricated LSZH insulated and sheathed multi-core.

- **Cables running across ceiling joists:** Cable baskets; Cable trays; and Cable trunking and cable ducting systems.

Extra low and low voltage surface mounted cables

Shared by: 90-55-15/340 Flexible cords; 90-55-15/342 Fire resistant, insulated and sheathed cables; 90-55-15/343 Fire resistant, insulated and sheathed armoured cables; 90-55-15/344 Mineral insulated cables type A and type B; 90-55-15/345 PVC insulated cables; 90-55-15/346 PVC insulated cables for interconnecting wiring; 90-55-15/351 Thermosetting insulated cables; 90-55-15/352 Thermosetting insulated and PVC sheathed cables (XLPE/ PVC singles); 90-55-15/353 Thermosetting insulated and PVC sheathed armoured cables; 90-55-15/354 Thermosetting insulated and LSZH sheathed armoured cables; 90-55-15/355 Thermosetting insulated metal screened LSZH sheathed multicore cables; and 90-55-15/366 Balanced twisted-pair 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.

Installing low voltage cables in conduit and trunking

Shared by: 90-55-15/342 Fire resistant, insulated and sheathed cables; 90-55-15/343 Fire resistant, insulated and sheathed armoured cables; 90-55-15/344 Mineral insulated cables type A and type B; 90-55-15/345 PVC insulated cables; 90-55-15/346 PVC insulated cables for interconnecting wiring; 90-55-15/349 Single-core heat resisting insulating cables; 90-55-15/351 Thermosetting insulated cables; 90-55-15/352 Thermosetting insulated and PVC sheathed cables (XLPE/ PVC singles); 90-55-15/353 Thermosetting insulated and PVC sheathed armoured cables; 90-55-15/354 Thermosetting insulated and LSZH sheathed armoured cables; 90-55-15/355 Thermosetting insulated metal screened LSZH sheathed multicore cables; 90-55-15/366 Balanced twisted-pair cables; 90-55-15/385 Prefabricated LSZH insulated singles in flexible conduit; and 90-55-15/386 Prefabricated LSZH insulated and sheathed multi-core.

- **Cable installation:** Orderly and capable of being withdrawn.
- **Single core wiring:** Arrange using the loop-in method.
- **Cables within trunking:** Tie at 2 m intervals for cables of the same circuit reference. Label ties with circuit reference number at 10 m intervals.
- **Cables in vertical conduit:** Provide cable clamps in accessible conduit boxes at 5 m intervals.

- **Extra low voltage cables:** Install within a separate partition from low voltage cables where installed in multi compartment trunking.

Cable installation on channel cable supports, cable tray, cable ladder and cable basket

Shared by: 90-55-15/342 Fire resistant, insulated and sheathed cables; 90-55-15/343 Fire resistant, insulated and sheathed armoured cables; 90-55-15/344 Mineral insulated cables type A and type B; 90-55-15/345 PVC insulated cables; 90-55-15/346 PVC insulated cables for interconnecting wiring; 90-55-15/351 Thermosetting insulated cables; 90-55-15/353 Thermosetting insulated and PVC sheathed armoured cables; 90-55-15/354 Thermosetting insulated and LSZH sheathed armoured cables; and 90-55-15/355 Thermosetting insulated metal screened LSZH sheathed multicore cables.

- **Cabling:** Install when cable supports are complete.
- **Position:** Place single and multi-core cables side by side.
- **Fastening:**
 - **Fastenings generally:** Secure cables, do not indent sheaths. Position to enable any submain cable to be individually removed.
 - **Submain cables <95 mm²:** Cable cleats.
Spacing (maximum): 600 mm.
 - **Submain cables >95 mm²:** Cable cleats and Cable bands.
Spacing (maximum): 600 mm.
 - **Final circuit cabling:** Cable ties.
Spacing (maximum): 600 mm.
 - **Extra low voltage, communications and fibre optic cabling:** Cable ties.
Spacing (maximum): 600 mm.

Installing disabled refuge master station

- **Standard:** In accordance with BS 5839-9.
- **Position:** Next to main fire alarm panel
- **Power supply:** Derive from a dedicated circuit from the main switchboard and connect to CIE via unswitched fused connection units.

Installing disabled refuge outstations

- **Standard:** In accordance with BS 5839-9.
- **Position:** In all disabled evacuation locations, excluding ground floor.
- **Mounting height generally (above finished floor level):** To comply with Part M and DDA requirements
- **Power supply:** Derive from local final circuit and connect via unswitched fused connection units.

Installing power supply units

- **Position:** Contractor's choice.
- **Final connection:**
 - **Accessory type:** Unswitched fused connection unit.
 - **Cable type:** Contractor's choice.

Installing acoustic hoods

- **Position:** Contractor's choice.

Installing sounders

- **Circuit wiring:** Install one sounder above the main control panel served by a circuit separate to those installed throughout the building and Distribute and interleave multiple sounder circuits around the building.
- **Protective cage:** Required. Sports hall etc

Installing visual alarm signal devices

Shared by: 90-75-30/415 Visual alarm signal devices type A and type B.

- **Position:** As per fire alarm drawings
- **Mounting height generally (above finished floor level):** 2.1 m.
- **Protective cage:** Required. Sports hall etc
- **Mounting height:** 2.1 m above finished floor level.

System completion

Testing and commissioning assistance call systems generally

Shared by: 75-70-05/110 Assistance call system; and 75-70-05/120 Emergency voice communication system.

- **Standards:**
- **Notice before commencing commissioning:** 7 d.
- **System commissioning agent:**
- **Controls:** Verify operation.
- **Alarm signalling:** Verify operation.
- **Results:** Submit.

Calibration certificates

Shared by: 75-70-05/110 Assistance call system; and 75-70-05/120 Emergency voice communication system.

- **Certificates of calibration for meters and instruments:** Submit.

Documentation for emergency voice communication systems

- **Operating and maintenance instructions:**
 - **Scope:** Submit for the system giving optimum settings for controls.
 - **Product information:** Include product description, date of purchase, performance characteristics, application (suitability for use), method of operation and control, and cleaning and maintenance requirements.
 - **Format:** Paper copy.
 - **Number of copies:** Three.
- **Record drawings:**
 - **Content:** General arrangement drawings showing the location of all outstations, master stations, sounders, visual alarm signal devices and power

supply units and Schematic diagram showing all control cabling, the cable origin, route from power supply units to master stations and outstations, sounders, visual alarm signal devices. Include conductor material and c.s.a, insulation type and colour, number of cores per cable, number of cables in ducts, on tray or ladder.

- **Format:** A1 paper print drawings and Electronic drawings.
- **Number of copies:** Three.
- **Submittal date:** At handover.
- **Test certificates:**
 - **Design certificate:** Submit two copies in accordance with BS 5839-9 Annex C.1.
 - **Installation certificate:** Submit two copies in accordance with BS 5839-9 Annex C.2.
 - **Commissioning certificate:** Submit two copies in accordance with BS 5839-9 Annex C.3.

Maintenance

Shared by: 75-70-05/110 Assistance call system; and 75-70-05/120 Emergency voice communication system.

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

Verification certificate

- **System verification agent:** Specialist manufacturer / installer
- **Verification certificate:** Submit two copies in accordance with BS 5839-9 Annex C.5.

Acceptance certificate

- **Acceptance certificate:** Submit two copies in accordance with BS 5839-9 Annex C.4.

Ω End of system