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SATELLITE APPLICATION DISC II

Building Services Performance Specification

SATELLITE APPLICATION CATAPULT

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Building Services

Version 1217

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00-05-10 Project definition

101 The Project

- **Project reference:** 1016090
- **Project title:** MTC Project Satellite DISCS
- **Project description:** As set out in the Main contract Preliminaries, described below and in the various parts of this specification.

110 Project documents

- **Deference to Main Contract Preliminaries:** The requirements of this specification are supplementary to those set out in the Main Contract Preliminaries. In the event of conflict regarding general conditions,the Main Contract conditions prevail. If there is a conflict with detailed requirements raise a query with the CA.
- **Document type:**
  General:
  Refer to the Main Contract Preliminaries and Invitation to Tender

  Tender drawings:
  As detailed within the technical specification

  Contract drawings:
  The same as the tender drawings

  Pre-construction information:
  Details of the pre-constrution Health and Safety Plan are:
  - attached to the Main Contract Preliminaries and other documents issued as part of the Invitation to Tender.
  Details of the pre-construction Site Waste Management Plan are:
  - attached to the Main Contract Preliminaries and other documents issued as part of the Invitation to Tender.

  Allocation of design responsibilities:
  The allocation of design activities and responsibilities including those of the contractor/ subcontractor have been identified using the standard proforma as published by BSRIA in BG 6/2014.
  The copy marked up to indicate the requirements applicable to these works is included in the M&E performance specification.

  Other documents:
  Drawings and other documents related to the contract generally may be inspected, by appointment prior to submission of the tender.
  Arrangements for such inspections to be made via:
  - authority responsible for the issue of the tender documentation.

120 B Health and safety file

- **Available for inspection:** CDM manager appointed by the client.

00-05-15 Works terminology

110 Terminology

- **Meaning:** Terms, derived terms and synonyms used are as defined in this section or in the appropriate document, including:
  - British Standard or British Standard glossary
  - CIBSE, IOP and BSRIA Technical Publications
  - Loss Prevention Council - Rules for Automatic Sprinkler Installations
  - Requirements for Electrical Installations (IEE Wiring Regulations)
  - Associated Statutory Acts

115 References to BSI documents

- **Meaning:** References to BSI documents are to the versions and amendments listed in the British Standards Catalogue:
  - and in subsequent issues of BSI Update Standards.
  - any subsequent versions and amendments specifically referred to in the project documents.
  - includes all BS, BS EN and BS EN ISO and Codes of Practice.

210 Description terminology

- **Attendance:** Includes
  The use of the Main Contractor's temporary roads, pavings and paths, standing scaffolding, standing power operated hoisting plant,
  The provision of temporary lighting of an equivalent brightness to the finished lighting brightness,
  The provision of water,
  The clearing away of rubbish and paying all charges in connection with its disposal, the provision of secure hard standing space for the sub-contractor's own offices, plant and material storage,
  The use of standing mess rooms, sanitary accommodation and welfare facilities and
  The provision of all Health and Safety facilities and all Fire Safety precautions, services, equipment, signage, facilities, Marshalls and the like necessary to comply with the relevant parts of the Joint Fire Code.
  Additional requirements should be described as 'Special attendance'.
- **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.
- **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, Subcontractor, etc. as the context dictates, which may be defined terms in certain standard contract forms.
  It is envisaged that domestic sub contracts will be placed by the Contractor (Main Contractor) for all or parts of the building services works described and detailed in the specifications, schedules and drawings. In some instances, and for clarification, expanded descriptions may be used within the documents in respect of works anticipated to be carried out by different trades or disciplines. Typical examples are:
  - mechanical contractor or mechanical sub contractor
  - electrical contractor or electrical subcontractor
  - controls/ BMS contractor or controls/ BMS specialist
  - fire alarm contractor or fire alarm specialist
  As used in the specifications, schedules and drawings the terms contractor and subcontractor are to be deemed as synonymous. Regardless of how any sub divisions of the works are finally

arranged, overall responsibility for the subcontract works resides with the Contractor (Main Contractor).

- **Contractor's choice:** Selection delegated to the Contractor, to meet specified performance and criteria and subject to acceptance by the CA.
- **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.
- **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), or the 'Main' contractor in contractor/ subcontractor agreements - which may be defined terms in certain standard contract forms
- **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.
- **Existing:** Items retained in place to receive new work.
- **Fastener:** Device for mechanically attaching something to something else.
- **Manufacturer and Product reference:** Definition, when used in this combination:
  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.

  Currency:
  References are to the particular product as specified in the manufacturer's technical literature current one month prior to the date on the Invitation to Tender.
- **Manufacturer's standard:** Where used in conjunction with a specified proprietary product, accessories to be those recommended by the product manufacturer.
- **Permanent Work:** Work to be constructed and completed in accordance with the Contract.
- **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.
  Includes: Goods, plant, materials, site materials and things for incorporation into the Works.
- **Project specific documentation:** Includes all specifications, schedules, drawings, the invitation to tender and any response to clarifications, and contract instructions.
- **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.
- **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.

- **Sizes:** Products are specified by their nominal sizes.
- **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.

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.
  Unless specified otherwise this is to be in writing to the party named as Contract Administrator (CA).
  Direct communication by or to any subcontractor, other than via the Main Contractor, to be subject to the provisions of the contract and/ or other written agreement.
  Do not proceed until response has been received.
- **Confirm:** See 'Communicate'.
- **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 CA.
- **Inform:** See 'Communicate'.
- **Install:** as supply and fix below.
- **Keep for recycling:** As 'keep for reuse' 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 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:** Provide a fixedfigure for cost and / ortime for works or elements of works.
- **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. Excludes taking out and disposing of associated pipework, wiring, ductwork

or other services.
Removal of a system includes this work.
All removal and disposal to be subject to the requirements of the site waste management plan (SWMP).

- **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.
- **Submit:** Deliver an item in a specified format to a specified person within a specified time frame.
- **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.
  Includes all labour and site equipment for unloading, handling, storing and execution.
  All products to be supplied and fixed unless stated otherwise.

410 Drawings - general

- **Definitions:** Generally to BSRIA Guide - A design framework for building services. Design activities and drawing definitions BG 6/2014, and as the detailed requirements of this section, as below.
- **CAD data:** Generally in accordance with BS 1192.
  and detailed requirements of this section, as below.
- **BIM protocols:** As Client EIR, BG 6/2014, PAS 1192-3

415 Sketch drawings

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

420 Tender drawings

- **Definition:** The drawings listed and included within the technical specification
- **Description:** The tender drawings show the general arrangement of the engineering services to be provided and the inter-relationship of the Works with work to be installed by others.

425 Schematic drawings

- **Description:** A line diagram describing the interconnection of components in a complex system
- **Main features:** A two dimensional layout drawing with divisions to show the distribution of the system between building levels.
  - Alternatively, an isometric style layout indicating the distribution of systems across individual floor levels.
  - Drawing is not necessarily constructed to scale.
  - Includes all functional components which make up the system, i.e. plant items, pumps, fans, valves, strainers, terminals, electrical switchgear, distribution and components, in accordance with the detail in BSRIA Guide BG 6.
  - Symbols and line conventions in accordance with all relevant British Standards and their recommendations for symbols and other graphic conventions

- Symbols and line conventions in accordance with any standard symbols drawings listed in 00-05-10:110
- Drawing labelled with appropriate pipe, duct and cable sizes where these are not shown elsewhere.
- Components indicated which have a sensing and control function and show the links between them, e.g.. building management systems, fire alarms and HV controls.
- Major components indicated so that their whereabouts in specification or manual and on other drawings can be easily determined.

Schematic drawings forming part of the commissioning specification to include:
- All data essential to testing and commissioning including volumetric flow rates, design total pressure losses at equipment, locations of dampers, valves and flow measuring stations, electrical fault levels, current ratings, short circuit capacities and tripping times.

430 Detailed design drawing

- **Description:** A drawing showing the intended locations of plant items and service routes in such detail as to indicate the design intent.
- **Main features:** - Plan layouts to a scale of at least 1:100.
  - Plant areas to a scale of at least 1:50 and accompanied by cross-sections.
  - The drawing will not indicate the precise position of services, but it should be feasible to install the services within the general routes indicated. It should be possible to produce coordination drawings or installation drawings without major re-routing of the services.
  - Pipework represented by single line layouts.
  - Ductwork and items such as flues represented by either double or single line layouts as required to ensure that the routes indicated are feasible.
  - Symbols and line conventions in accordance with all relevant British Standards and their recommendations for symbols and other graphic conventions
  - Symbols and line conventions in accordance with any standard symbols drawings listed in 00-05-10:110
  - Indicate on the drawing the space available for major service routing in both horizontal and vertical planes.

435 Coordination drawing

- **Description:** A drawing showing the inter-relationship of two or more engineering services and their relation to the structure and building fabric.
- **Main features:** - Plan layouts to a scale of at least 1:50, accompanied by cross-sections to a scale of at least 1:20 for all congested areas.
  - A spatially coordinated drawing, i.e. no physical clashes between the system components, or with the building fabric / structure,when installed at the scaled-off positions shown on the drawing. Provide dimensions in areas where tolerances are minimal.
  - Make allowance for the service at its widest point for spaces between pipe and duct runs. Allows for insulation, standard fitting dimensions and joint widths on the drawing.
  - Make allowance for those plant items specified and identified in the design specification.
  - Make allowance for installation working space and space to facilitate commissioning and maintenance.
  - Indicate positions of main fixing points and supports where they have significance to the structural design.
  - Arrange the services so that it is possible to demonstrate a feasible sequence of installation.
  - Support the drawing with individual services drawings for clarity.
  - Plantroom layouts to a scale of at least 1:20, accompanied by cross-sections and elevations to a scale of at least 1:20.

440 Installation drawing

- **Description:** A drawing based on the detailed design drawing or coordination drawing with the primary purpose of defining that information needed by the tradesmen on site to install the works.
- **Required features:** - Plan layouts to a scale of at least 1:50, accompanied by cross-sections to a scale of at least 1:20 for all congested areas.
  - A spatially coordinated drawing, i.e. no physical clashes between the system components or building fabricwhen installed at the scaled-off positions shown on the drawing.
  - Make allowance for inclusion of all supports and fixings necessary to install the works.
  - Make allowance for the service at its widest point for spaces between pipe and duct runs. Allow for insulation, standard fitting dimensions and joint widths on the drawing.
  - Make allowance for installation details provided from shop drawings.
  - Make allowance for installation working space; space to facilitate commissioning and space to allow on-going operation and maintenance in accordance with the relevant health and safety requirements.
  - Make allowance for plant and equipment including those which are chosen as alternatives to the designers specified option.
  - Provide dimensions where the positioning of services is considered to be important enough not to leave to the tradesmen on site.
  - Plantroom layouts to a scale of at least 1:20, accompanied by cross-sections and elevations to a scale of at least 1:20.

445 Installation wiring diagram

- **Description:** 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.
- **Required features:** - Maximum electrical loading for each supply cable.
  - Cable termination facilities.
  - Cable identification and all terminal numbers.

450 Shop drawings

- **Description:** Drawing prepared by a fabricator or supplier unique to the project. Including subcontractor or sub subcontractor drawings for ductwork, pre-fabricated pipework, sprinkler systems, control and switchgear panels and associated internal wiring.

455 Manufacturer's drawing

- **Description:** Drawing provided by a manufacturer or supplier to indicate a typical representation of the product, components or plant items to be supplied for a particular project.

460 Manufacturer's certified drawing

- **Description:** 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.

465 Builderswork drawing

- **Design stage:** A drawing to show the provisions required to accommodate the services which significantly affect the design of the building structure, fabric and external works. Also drawings (and schedules) of work to be carried out by building trade, and required to be costed at the design stage e.g. plant bases.
- **Installation stage:** Drawing to show requirements for building works necessary to facilitate the installation of the Works (other than where it is appropriate to mark out on site).

470 Controls logic diagrams

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

475 Switchgear, starter and control instrumentation panel drawings

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

480 As installed drawing

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

485 Record drawing

- **Description:** A drawing showing the building and services installations as installed at the date of practical completion. Drawings to be based on information on "As Installed Drawings" maintained on site as the Works progress and to a scale not less than that of the installation drawings with plans and sections at a scale of 1:20 for plantrooms, service subways, trenches, ducts and any 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.
- **Required features:** - Base on information on "As Installed Drawings" maintained on site as the Works progress and to a scale not less than that of the installation drawings with plans and sections at a scale of 1:20 for plantrooms, service subways, trenches, ducts and any 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.
  - Location, including level if buried, of Utility Service connections, including those provided by the appropriate Authority, indicating points of origin and termination, size and material of service, pressure and/or other relevant information.
  - Disposition and depth of all underground systems.
  - Schematic drawings of each system indicating principal items of plant, equipment, zoning, means of isolation, etc.. in sufficient detail to make it possible to comprehend the system operation and the inter-connections between various systems.
  - Diagrammatic dimensioned plans and sections of each system or service showing sizes and locations of all ancillaries, plant, equipment controls, test points, means of isolation and the like, 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.
  - Indicate where routes of cable/conduit is surface mounted, concealed in wall chase, in floor screed, cast in-situ, above false ceiling etc.
  - Details of coordination 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.
  -Identify on the drawings the positions of access points for operating and maintenance purposes.

  Manufacturers' record drawings and schedules should include, but not be limited to:

- drawings of equipment indicating general arrangement and assembly of component parts which may require servicing.
- internal wiring diagrams together with sufficient physical arrangement details to locate and identify component parts.
- schedules as required to locate, reference and provide details of ratings and duty of all items incorporated into the Works together with all fixed and variable equipment settings established during commissioning.

BMS and control system record drawings and schedules to include, but not be limited to:
- Details of the principles of application of automatic controls and instrumentation.
- For each programmable control item: schedules indicating for each input and output point connected, full data in respect of that point including reference, type of input/output, connected equipment reference, set values of temperature or pressure etc., set values of start/stop/speed change times, alarm priority, control specification reference and any other such parameters as are applicable. Each spare input and output point including reference, type of input/output and space for future entry of appropriate parameters as listed above.
- Logic flow diagrams for each individual control or monitoring specification and for each building services engineering system to illustrate the logical basis of the software design.
- Schedules setting out details of all initial values of user-defined variables, text statements for alarm messages etc.

All documents should be endorsed as 'RECORD DRAWINGS'.

Where agreed with the CA certain detailed information may be provided in schedule form.

Reduced scale copies to be included in the operating and maintenance manuals.

490 Plant and switchroom drawings, schedules and schematics

- **Description:** Schedules and drawings protected, framed andfixrd in each plant room and any other appropriate location or where directed by the CA.
- **Required features:** - Schematic drawings of circuit layouts showing identification and duties of equipment, numbers and locations, controls and circuits.
  - Schedules in the form of printed sheets showing the number, type, location, application/ service and symbol, and normal operating position of each valve and any other means of isolation.
  - Control schematics.
  - Location of mechanical and electrical plant and equipment items.
  - Location of all plant and equipment items including plans and elevations of main switchgear showing physical disposition of switches.
  - Location of all incoming service isolating and metering facilities.
  - Emergency operating procedures and telephone numbers for emergency call out service applicable to any system or item of plant and equipment.
  - First aid instructions for treatment of persons after electrical shock.
  - All other items required under Statutory or other regulations.

  Surface of drawings and schedules to be protected by:
  pressure lamination

510 Operating and maintenance manual

- **Description:** Manual(s) providing operating and maintenance instructions for the whole of the building services installations included as part of the Works. The manual(s) to form part of the overall building manual for the project and as applicable the building health and safety file.
- **Required features:** - Full details of all parties including the employer, Principal Designer, designers and professional team, Principal Contractor, contractors, subcontractors, suppliers, manufacturers.

- Full description of each of the systems installed, written to ensure that the Employer's staff fully understand the scope and facilities provided.
- Description of the mode of operation of all systems including services capacity and restrictions.
- Diagrammatic drawings of each system indicating principal items of plant, equipment, valves etc.
- Details of how to re-commission so that complex plant services within the building can be re-commissioned by an engineer without any historic knowledge of the systems.
- Photo-reduction of all record drawings together with an index. - 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.
- 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.
- Copies of manufacturers' current COSHH data sheets and recommendations for cleaning, repair and maintenance.
- Copies 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 Works and plant, equipment, valves, etc., used in the Works.
- Copies of all guarantees or warranties, together with maintenance agreements offered by subcontractors/ sub subcontractors/ manufacturers/ suppliers.
- Copies of insurance & inspecting authority certificates and reports. - Starting up, operating and shutting down instructions for all equipment and systems installed.
- Control sequences for all systems installed.
- Schedules of all fixed and variable equipment settings established during commissioning.
- Procedures for seasonal change-overs and/or precautions necessary for the care of apparatus subject to seasonal disuse.
- Detailed recommendations for the preventative maintenance frequency and procedures which should be adopted by the Employer to ensure the most efficient operation of the systems.
- Details of maintenance procedures required to ensure compliance with Approved Code of Practice L8.
- Details of lubrication systems and lubrication schedules for all lubricated items.
- Details of regular tests to be carried out (e.g. water cooling towers etc.)
- Details of procedures to maintain plant in safe working conditions. - Details of the disposal requirements for all items in the Works.
- A list of normal consumable items.
- A list of recommended spares to be kept in stock by the Employer, being those items subject to wear or deterioration and which may involve the Employer in extended deliveries when replacements are required at some future date.
- A list of any special tools needed for maintenance cross referenced to the particular item for which required.
- Procedures for fault finding.
- Emergency procedures, including telephone numbers for emergency services
- Hospital Operational Policy (where applicable).
- Copies of relevant HSE/ CIBSE/ IET (IEE) guidance notes etc.
- Contractual and legal information including but not limited to details of local and public authority consents; details of design consultants, 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.
- Design Warranty information

520 BMS operating and maintenance manual

- **Description:** Manual(s) providing, as part of the overall building services operation and maintenance manual, a particular section related to the operation and maintenance of the BMS

and environmental control systems.
Format and appearance to be as that for the remainder of the manual(s).

- **Required features:**
  - A written description of plant operation.
  - Control strategy / logic diagrams recording the final version of configuration software installed at handover.
  - Network Schematic(s).
  - Details of system application software configuration.
  - Points list including hard and soft-points (all points to have a unique mnemonic)
  - Description of user adjustable points.
  - Commissioning record details.
  - Detailed data sheets for all control components and equipment.
  - Wiring circuit details including origin, route and destination of each cable.
  - Control panel wiring diagrams.
  - Basic security access to the system.
  - Comprehensive instructions for switching on, operation, switching off, isolation, fault finding and procedures for dealing with emergency conditions.
  - Instructions for any precautionary measures necessary.
  - Instructions for the routine operation of the control system including simple day-to-day guidance for those operating the control system with limited technical skill.
  - Instructions for servicing and system upkeep including provisions for update and modification.
  - 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.
  - Incorporate graphics screen shots to suport descriptions and instructions.
  - Details of the software revisions for all programmes provided.
  - Back-up copies of any system software and of all software items, as commissioned.

  Demonstrate that the O&M manual includes comprehensive system operating instructions.
- **Additional requirements:** Format and appearance to be as that for the remainder of the manual(s).
  Demonstrate that the O&M manual includes comprehensive system operating instructions.

530 Building log book

- **Description:** Log book providing sufficient information about the building services and their maintenance requirements so as to allow their operation in such manner as to use no more fuel and power than is reasonable in the circumstances as required by:
  - Building Regulations Part L2 Conservation of fuel and power in buildings other than dwellings.
- **Base book on:** ***- CIBSE TM31 building log book toolkit.***
  Content to include target emissions rate (TER) and building emissions rate (BER) and all data used to calculate TER/ BER.

540 Residential completion pack

- **Description:** Operating and maintenance instructions providing sufficient information about the building services and their maintenance requirements so as to allow their operation in such manner as to use no more fuel and power than is reasonable in the circumstances as required by:
  - Building Regulations Part L1 Conservation of fuel and power in dwellings.
- **Base book on:** Guidance in:
  - Approved Document L1.
- **Supplementary requirement:** Provide a simple user guide, providing simplified user instructions for temperature controls, control of lighting, L8 water draw-off frequencies, location of emergency

isolation valves / switches and the like, who to contact in an emergency, and a list of key maintenance requirements.

00-05-20 Project participants

110 B Project participants

- **Title:** Contract Administrator.
- **General:** The term Contract Administrator (CA) is used throughout the documents and the duties will be undertaken by Employer (Client).

00-05-70 Project location

110 A Project location

- **Details:** Refer to the Main Contract Preliminaries for details of the project, including details of the location.

160 B Existing mains and services

- **Requirement:** Contractor/ subcontractor to ensure full understanding of nature and extent of all existing services within or within close proximity of site prior to commencing works.
- **Drawings (Information shown is indicative only):** Details of existing defined in the specification and on the drawings

165 Survey

- **Requirement:** 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 buried services, affected by the works.

  Examine all available drawings of the engineering services and report any discrepancies to the CA

180 Site visit

- **Requirement before tendering:** Ascertain the nature of the site, access thereto and all local conditions and restrictions likely to affect the execution of the Works.
- **Arrangements for visit:** Via authority responsible for the issue of the tender documentation

00-10-70 Works Contract Content

110 Preparatory work by others

- **Details:** Enabling works comprising:
  - Survey Work
  - Provision of utility services to site.

  Building fabric works comprising:
  - Air permeability test in accordance with ATTMA publication Measuring air permeability of building envelopes.

  Provision of certification stating:
  - The building air permeability conforms with the requirements of the Building Regulations, Approved Document L1, conservation of fuel and power in dwellings; and/ or L2, conservation of fuel and power in buildings other than dwellings, and that it meets the criteria set out in the project Energy Statement.
  - The thermal performance of the building envelope conforms with the requirements of the Building Regulations, Approved Document L1, conservation of fuel and power in dwellings; and/ or L2, conservation of fuel and power in buildings other than dwellings, and that it meets the criteria set out in the project Energy Statement.

  Works to be carried out by:
  - Contractor
  - Utility companies

120 The main contract works

- **Description:** As described in the Main Contract Preliminaries and the invitation to tender.

125 The building

- **Description:** Refer to architectural and structural drawings for details.

130 Work by others concurrent with the Contract

- **Details:** Allow for coordinating the Works with the works of other trades and installations which may be on site during the period of the subcontract.
  See also section 00-50-70
- **Associated works by main contractor, or main contractor appointed subcontractor:** Works including but not limited to:
  - Builder's work.
  - Structural Design.
  - Structural support and secondary support/ steelwork.

135 A The subcontract work

- **Details: Scope**:
  The works as described in the specifications, drawings, schedules and all associated documents for the following:
  - mechanical services installations
  - public health services installations
  - electrical services installations
  - automatic controls installation
  - fire protection systems installation
  - building management system installation

Complete the design development and/ or undertake the detailed design as indicated in the specifications, the drawings, the contract documentation including the contractor's design portion supplement (CDPS) or similar which forms part of the contract documentation.

Provide all drawings, supporting documentation and technical submissions, energy assessments and certification as required in these preliminaries, the buildings services specifications, schedules and the associated documentation detailed elsewhere as forming part of this subcontract.

Supply, install, balance, test and commission the building services installations defined in the following sections:
- The buildings services specifications, schedules and the associated documentation detailed elsewhere as forming part of this subcontract.

Undertake responsibilities as defined in:
- 00-05-10:110 Allocation of Design Responsibilities.

Provide:

Design information: Including calculations, logically and neatly laid out, with a summary of all assumptions for all key elements, including the following:

- General approach to plant and equipment sizing, including ducts, pipes and cables
- Part L calculations, SAP calculations, Energy Performance Certificates, calculations related to BREEAM or other assessments.
- Weather data
- Solar heat gain (direct & indirect)
- Solar heat through glazing data
- Storage of heat in building structure
- Heat gain through structure (sol-air or equivalent temp)
- Shading factors
- Internal sensible and latent heat gains (occupants, lights, equipment, processes, evaporation, and any other considerations)
- Infiltration and/or ex-filtration
- Ventilation
- Pressurisation
- Heat losses
- Zone cooling loads
- Zone heating loads
- Air quantities (supply & extract)
- Diffuser & grille selection
- Detailed duct sizing, pipe sizing, fan sizing, pump sizing, flue sizing, plant & equipment sizing, hot water system sizing, cold water system sizing, gas pipe sizing, and sizing for any other distribution systems.
- Acoustic calculations
- Electrical load assessment
- Transformer sizing
- Switch board sizing
- Cable sizing, Tray & trunking sizing
- Daylight and artificial lighting level calculations
- Emergency lighting
- Earthing
- Lighting protection
- PA system, FA system, and any other systems.

- Security system
- Fire fighting systems, including wet and dry risers, sprinklers, hose reels, and the like.
- Smoke ventilation and controls systems.
- Plant selections based on the assumptions and calculations.

Production information: Including drawings, technical submissions and samples, based on the drawings, these preliminaries and general clauses, the technical specifications and schedules, and other information provided, showing such details of the Works as the CA may reasonably require.

Request additional information as necessary from the CA in a timely manner and provide information as necessary in time to meet teh programme.

160 Products provided by, or on behalf of employer

- **General:** Details of products to be fixed as part of the subcontract are given in the relevant sections of the specifications.
  Use for no other purpose than the Works.
- **Notice to CA of date products required on site:** Notice not less than two calendar months
  Advise of revised dates to suit any changes to the contract programme.
- **Handling:** Accept delivery, check against receipts and take into appropriate storage.
  Advise CA details and numbers of items received.
- **Surplus products:** Keep safe and obtain instructions.
- **Items once received:** All other conditions of the contract to be applicable to these items.

165 Works by, or on behalf of employer

- **General:** Details of such works are given in the relevant sections of the specifications.
- **Allow for general attendance:** As required by the conditions of contract
- **Notice to CA of date required on site:** Notice not less than two calendar months
  Advise of revised dates to suit any changes to the contract programme.

200 Work by statutory undertakers

- **Details:** Make necessary applications based upon design duties. Allow sufficient lead time to meet programme.

General requirements

410 Common design criteria

- **Criteria listed:** *In the respective sections of the building services specifications*

420 Electrical supply

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

430 Plant operating conditions

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

- Height above sea level not exceeding 1000m.
- Air cooling at an average temperature over 24 hours not exceeding 35°C dry bulb.
- Maximum conditions of 40°C dry bulb and 50 per cent relative humidity.
- Minimum ambient temperature -20°C sat
- Supply voltage approximately sinusoidal

- **Default conditions:** In the absence of any specific requirements within particular sections of the specifications, provide equipment for operation with the environment as specified below:
  Internal
  - Temperature 0 to 40°C
  - Humidity (% rh) 10 to 70, average 50
  External
  - Temperature -20 to 50°C

  In the absence of any specific requirements within particular sections of the specifications, provide protection to IP rating to BS EN 60529 as follows:
  - Equipment located internally or externally and subject to dust or water penetration IP 54
  - Equipment subject to severe environmental or weather conditions IP 65
  - Provide sun and rain shielding (the latter to be designed to shed water clear of the equipment)

440 Room terminal locations

- **Position:** 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 architect / CA, which terminals are subject to final positioning on-site.
  Allow for the movement of all such terminals up to a radius of 1200mm from the positions shown on the drawings.
- **Mounting height:** Mounting heights indicated in tender documents are for tender purposes only. Confirm mounting heights with the architect / CA before commencing work on site.

450 Detailed space planning and final plant positions

- **Requirement:** Develop and confirm the position of all plant and equipment.
  Develop and confirm the positions of all of ancillary equipment associated with items of plant and equipment.
  All final positions of plant and equipment to allow installation and space for ongoing and future maintenance.

460 B Electromagnetic compatibility

- **Requirement:** Ensure all equipment and systems are installed to provide electromagnetic compatibility within the system and with any other systems installed in the same area.
  Ensure all systems and buildings are assessed for protection to, and that such protection meets the requirements of all relevant British, EN and ISO standards.
  Ensure all apparatus covered by the Wireless Telegraphy Act 1998 meets regulations issued by the Radiocommunications Agency and the Office of Communications.
  Ensure all equipment and systems related to or interfacing with telecommunication equipments and systems meet the safety requirements of all relevant British, EN and ISO standards for safety.
  Ensure that all cable installations meet the minimum guidance separation in EMC of Installations and Recommended Cable Separations published by the ECA.

470 Performance characteristic detail

- **Requirement:** Provide details of the equipment as selected for inclusion into the Works and include, in a format to be agreed, 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 characteristics - (sound power level dB in octave band frequencies weighted dB(A) at stated distance from machine or other source).
- Weight - (dry and wet).

480 B Software

- **Rights and permissions:** Obtain on behalf of the end user all appropriate licenses, permission, 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 all relevant British and EN standards, and that all software and hardware with embedded firmware has the latest proven software, with no known vulnerabilities.

490 Pressure directive

- **General:** All pressure equipment and assemblies with a maximum allowable pressure greater than 0.5 bar must comply with the European Community (EU) Pressure Equipment Directive (PED) 97/23/EC.
- **Identification:** Mark pressure equipment as a minimum with:
  a) unique identification of the manufacturer
  b) unique identification of model and serial number
  c) the year of manufacture
  d) maximum/minimum allowable pressure limits
  e) CE marking
- **Declaration:** Provide a declaration of conformity for all pressure equipment and provide copies as part of the record documentation.
- **Equipment requirements:** Equipment must be:
  a) Designed for adequate strength taking into account internal / external pressure, ambient and operational temperatures, static pressure and mass of contents in operating and test conditions, corrosion and erosion, fatigue, etc.
  b) Provided with means to ensure safe handling and operation and of examination, draining and venting.
  c) Provided with protection against exceeding the allowable limits of pressure.
  d) Designed and fitted with suitable accessories to meet damage limitation requirements in the event of external fire, where necessary

  Ensure that:
  - all components or sub-assemblies in their finished assembly are used within their safe operating range and correctly installed and tested.
  - adequate instructions are provided by the manufacture for the safe installation, testing and operation.
  - Instructions shall be provided to ensure for the safe maintenance and operation of the equipment when in operation.
- **Equipment below the specified thresholds:** Pressure equipment and assemblies below the specified pressure / volume thresholds must be:
  a) safe.
  b) designed and manufactured according to sound engineering practice.

00-20-70 Works contract

SUBCONTRACT

- **The Contract:** As the Main Contract
- **Requirement:** Allow for the obligations, liabilities and services described.
- **Clause headings:** Notwithstanding NRM 1.5.1.1.2 a schedule of clause headings of standard conditions is not given.
- **Guarantee bond:** Ensure compatibility with the Main Contract guarantee bond. For details refer to:
  Main Contract Preliminaries and Invitation to Tender
- **Warranties:** Enter into the following Warranties:
  Refer to Main Contract Preliminaries and Invitation to Tender.

00-30-70 Works Contract Procurement

Subcontract tendering

110 Compliance with Tender rules

- **Scope:** The requirements of this section are supplementary to those stated elsewhere in the tender documents.
- **Tendering procedure:** Tendering procedure is to be as stated in:
  - The Invitation to Tender and the Form of Tender and Agreement
- **Compliance:** Failure to comply may result in Tenders being rejected at the sole discretion of the Employer.
- **Acceptance:** The Employer and his representatives offer no guarantee that the lowest, or any tender, will be recommended for acceptance or accepted
- **Costs:** No liability is accepted for costs incurred in the preparation of a Tender.

115 Building services preliminaries

- **Compliance with NRM:** These Preliminaries and General Clauses (sections 00-05-10 to 00-80-70inclusive) must not be relied on as complying with NRM.

155 Period for issue of nomination instructions

- **Minimum period:** Where a minimum period has been stipulated in the Invitation to Tender, it must not be altered without the written approval of:
  - The authority responsible for the issue of the tender documentation.

180 Tender queries

- **Notification requirements:** As advised in the Invitation to Tender

190 Tender instructions

- **Qualifications:** Do not amend or alter documents without written instruction.
  Written instructions to be given by:
  - Authority responsible for the issue of the tender documentation.

  Tenders containing such alterations or qualifications may be rejected.
- **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.

210 Pricing

- **Performance specified work:** Ensure tenders include for all work necessary to meet the requirements for the performance specified work and its completion and proper integration with the Works generally.
- **Quantities in the subcontract specification:** Must not be relied on as complying with NRM. Must be priced taking account of the information given elsewhere in the tender documents, including for all associated and ancillary work shown or clearly apparent as being necessary for the complete and proper execution of the work.

- **Specification without quantities:** Where and to the extent that quantities are not included in the specification, tenders must include for all work shown or described in the tender documents as a whole or clearly apparent as being necessary for the complete and proper execution of the Works.
- **Items not priced:** Costs relating to items in the specification which are not priced will be deemed to have been included elsewhere in the tender.

230 Return of Tender

- **Return of Tender:**
  - **Details:** As set out in the Invitation to Tender.
    Include the requirements of this section and elsewhere within the specification.
- **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.
  Inform:
  Authority responsible for the issue of the tender documentation and CA.

250 Submission of documents

- **Schedule of rates:** Prepare a schedule of rates in accordance with any requirements stated in:
  - The Invitation to Tender and on the Form of Tender and Agreement.

  Submit: With tender.
- **Proposal for annual maintenance contract:** Submit with the tender a supplementary proposal for a comprehensive annual maintenance contract for:
  - The whole of the Works forming this subcontract.

  Proposal to include for maintaining the installation in efficient working order including routine checks, adjustments, servicing in accordance with manufacturers requirements, lubrication, replacement of consumable spares, system and equipment cleaning and maintenance of system water quality, etc.
  Set out the terms of the offer, the work to be carried out, the guarantees of performance and the price for the period as stated after practical completion of the Works or section thereof:
  - Period 12 months.

  Ensure that the quotation is based on identified maintenance activities and details any activities which are excluded. The proposal will not necessarily be considered as part of the tender for the Works and the Employer does not undertake to accept it.
- **BMS maintenance:** Submit with the tender supplementary quotations for BMS maintenance contracts for periods indicated:
  - (1) 12 months
  -(2) 5 years

  BMS maintenance in to be in accordance with the relevant sections of:
  - BMS Maintenance Guide, BG 4/2003, BSRIA.

  Ensure that the maintenance provided covers:
  - Software upgrades.
  - Data backup and archiving.
  - Documentation upkeep.
  - Emergency call out.
  - Checking operation of field controllers and communication networks.
  - Checking control, alarm and data logging functions.
  - Checking of sensors for satisfactory accuracy.

- Checking proper operation of actuators.
- Assessment of plant control actions and rectification of poor performance.
- Checking correct operation of occupant controllers.
- Undertaking all necessary upgrades/ changes to maintain the required functionality of any gateways.

Ensure that the quotation is based on identified maintenance activities and details any activities which are excluded. The proposals will not necessarily be considered as part of the tender for the Works and the Employer does not undertake to accept them.

- **Programme:** Prepare a summary programme of work showing the sequence and timing of the principal parts of the Works and periods for planning and design. Itemise any work which is excluded.

  Submit: With tender.
- **Information release schedule:** Prepare an information release schedule, corresponding to the programme above, identifying planned release dates of key information for review.

  Submit: *With tender.*
- **Tender stage method statements:** Prepare method statements describing how and when the following is to be carried out:
  - Health and safety
  - Quality assurance
  - Supervision and coordination of the Works
  - Resourcing for design duties
  - Site waste management
  - Testing and commissioning

  Submit: With tender.
- **Proposed manufacturers / suppliers:** List details of products, equipment and plant.
  Include all items for which the choice of manufacturer/ supplier is at the discretion of the contractor/ subcontractor.

  Submit: With tender.
- **Substitute products::** If products of different manufacture to those specified are proposed, provide details giving reasons for each proposed substitution.
  Substitutions, which have not been notified as indicated below, may not be considered.
  Substitutions accepted will be subject to the verification requirements of clause 00-60-70:120.

  Submit: With tender.
- **Quality control resources:** Describe the organisation and resources to control the quality of the Works, including the work of subcontractors/ sub subcontractors.
  Identify in the statement the number and type of staff responsible for quality control, with details of their qualifications and duties.

  Submit: With tender.
- **Health and safety information:** Describe the organisation and resources to safeguard the health and safety of operatives, including those of subcontractors/ sub subcontractors, and of any person whom the Works may affect. Include:
  - A copy of the health and safety policy document, including risk assessment procedures.
  - Accident and sickness records for the past five years.
  - Records of previous Health and Safety Executive enforcement action. - Records of training and training policy.
  - The number and type of staff responsible for health and safety on this project with details of

their qualifications and duties.

Submit: With tender.

- **Health and safety statement:** Describe any significant and unavoidable hazards which may arise as a result of carrying out the Works including the related design items 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 tender.

- **Site waste management plan:** Include allowance for fully complying with the requirements of:
  - Site Waste Management Plan Regulations 2008 - Environmental targets in the client plan.

  Cooperate with the Principle Contractor, the Contractor and all others in the implementation of the the SWMP. Subject to any provisions included in the Main Contract Preliminaries and the draft SWMP, provide as a minimum details of:
  - Types and quantities of waste that will be generated.
  - Resource management options for these wastes including proposals for minimisation/ reuse/ recycling.
  - The use of appropriate and licensed waste management contractors.
  - Record keeping procedures.
  - Waste auditing protocols.

  Submit: With tender.

310 Assessment

- **Alternative Tenders:**
  - **Basis:** In addition to and at the same time as tendering for the Works as defined in the tender documents, alternative methods of construction / installation may be submitted for consideration. Alternatives, which would involve significant changes to other work, may not be considered.
    Such alternatives will be deemed to be alternative tenders and each must include a complete and precise statement of the effects on cost and programme.
    Carry out a health and safety risk assessment for each alternative and where appropriate provide a safety method statement suitable for incorporation in the Health and Safety Plan.

    Submit full technical data for each alternative together with details of any consequential amendments to the design and/ or construction of other parts of the Works.
  - **Submission:** Alternative method tender and all related information: *With tender.*

315 Subletting / supply

- **Listed subcontractors / sub-subcontractors:** For reasons including that of continuity or compatibility a number of specialist suppliers / contractors have been listed in respect of particular works.
  Where the documents provide that certain work must be carried out by a person of the contractor's / subcontractor's choice selected from a list of persons given therein:
  - The selected person shall be a sub-subcontractor as provided for in the contract.
  - The CA may add additional persons to the list at any time prior to the execution of a binding sub-subcontract agreement.
  - With the consent of the CA, the contractor may add additional persons to the list and must, if requested, submit to the CA (in an approved form) evidence of the suitability of such additional persons to carry out the sub-subcontract work.

  If at any time prior to the execution of a binding sub-subcontract agreement none of the persons

named in the list (including any persons added as provided above) is able and willing to carry out the relevant work, notify the CA without delay.
The CA will then forthwith add the name(s) of other person(s) as provided above; alternatively will confirm that he does not wish to do so within:
- Two (2)working weeks of notification.

Should the CA chose to do neither within this time of the notification, the work shall be carried out by the contractor who may sub-subcontract in accordance with the provisions of the contract. Before the start of the work to which the list relates, enter into a binding sub-subcontract agreement and confirm to the CA that this has been done, giving the name of the selected sub-subcontractor.

- **Subcontractors:** Provide details of portions of Works to be sublet / sub-sublet and names and addresses of proposed subcontractor / sub-subcontractor.

  Submit: With tender.

00-40-70 Works Contract Establishment

HEALTH AND SAFETY INFORMATION

320 CDM regulations

- **Comply by:** - Adhering to the requirements of the Project Health and Safety Plan.
  - Reporting accidents, injuries or dangerous occurrences.
  - Providing appropriate input to the health and safety plan, including risk assessments, and to the health and safety file.
  - Providing information on the Works which might affect the health or safety of any person.
  - Providing risk and hazard assessments for Works which include contractor design elements.
  - Following safe working practices.

330 Health and safety hazards

- **Hazards:** Hazards that are or may be present are identified in the pre-construction Health and Safety Plan.
- **Limitations:** The nature and condition of the site and/ or buildings cannot be fully ascertained before they are opened up.
- **Information:** The accuracy and sufficiency of this information provided about existing hazards is not guaranteed by the Employer or the CA. Ascertain if additional information is required to ensure the safety of persons and the Works.
- **Training:** Ensure that all relevant personnel are aware of the hazards listed and have received appropriate training to deal with them.

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:**

MANAGEMENT AND STAFF

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.

  Systems used before practical completion for the benefit of the Contractor/ contractor/ subcontractor/ sub subcontractor must have all consumable elements (including filters, lamps and tubes) replaced by new not more than seven days prior to practical completion.
- **Additional requirements where systems are used before practical completion:** Do not put any system into use prior to handover to the Employer, except for testing and commissioning,

unless in accordance with the following procedure:
- Following the receipt of written instructions, the contractor/ subcontractor may operate designated parts of the Works, provided that such operation is practicable and does not prejudice the contractor's responsibilities and obligations under the Contract.

Additionally and with adjustment to the contract sum, the contractor must, if instructed, provide:
- comprehensive insurance including indirect loss for any plant being operated
- maintenance of the installation
- reinstatement of the installation to as new condition prior to handover to the Employer
- allow the defects liability period to commence on handover.

00-50-70 Works Contract Management

GENERALLY

102 General

- **Scope:** The requirements of this section are supplementary to those stated elsewhere in Main Contract Preliminaries and the Invitation to Tender documentation.
- **Delegation by CA:** The CA may delegate certain powers and duties. The CA will indicate the duties and powers of the following:
  - Those who from time to time are defined either in writing or verbally.

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.
  Subject to the extent and scope of the Works appoint a foreman-in-charge/ supervisor/ manager to ensure constant management and supervision of the Works.
- **Evidence:** Provide names, CVs, qualifications and any other documentary evidence.
- **Replacement of supervisory personnel:** Give maximum possible notice before changing supervisory personnel.

135 Coordination of engineering services

- **Coordination of the Works to be carried out:** As part of contractors/ subcontractors responsibilities and in conjunction with any other contractors responsible for other parts of the engineering services installations.
- **Agree principles of coordination with all parties concerned:** Incorporate details provided by others into the coordination drawings.
  Provide all necessary details/ drawings/ schedules etc. required to enable their own coordination drawings to be prepared by others.
- **Allowances:** Ensure the installation drawings make due allowance for all building elements, structure and other services.
- **Prior to submission of information:** Check and approve all drawings, schedules and any other information provided by manufacturers, suppliers or sub-subcontractors to ensure that all the requirements of the contract documentation have been incorporated.
- **Certification:** Accompany all documents submitted with a certificate indicating that they have been checked by the contractor/ subcontractor prior to issue.

140 Cooperation and liaison

- **Requirement:** Co-operate with the Contractor, all subcontractors, suppliers, local authorities and statutory undertakings in the execution of their work.

  In particular, the following works carried out by others will require close and careful liaison and co-operation.
  - Other engineering services subcontractors

- Structural / steelwork subcontractors
- External fabric / curtain walling subcontractors
- Internal partitioning subcontractors
- Ceiling / flooring subcontractors
- Other fitout subcontractors

PROGRESS

170 Programme / progress report

- **General:** The Main Contractor is obligated to produce a master programme for the contract works. The appointed contractors/ subcontractors are required to assist and provide programmes for their works as requested by the Contractor or the CA.
- **Requirement:** Due allowance is to be made in the programme(s) for the Works, including but not limited to, the following:
  - Ordering and installation periods.
  - Completion of design and design development work as required in the contract, contractor design portion, allocation of design responsibilities schedule, specification and drawings.
  - The completion of all drawings etc. including the minimum working days from receipt for comment by the CA.
  - Work resulting from instructions issued in respect to the expenditure of provisional sums.
  - Availability of incoming and statutory services.
  - Concurrent work by other trades.
  - Any temporary works necessary for the completion of the engineering services installations.
  - Testing, pre-commissioning, commissioning and performance testing of the engineering services installations for which sensible time scales must be allowed.
  - Preparation and provision of Record Drawings and Operating and Maintenance Manuals.
- **Additional requirement for commissioning:** Provide a separate and detailed commissioning programme for agreement with the Contractor and the CA.
  Make due allowance for the following:
  - Commissioning, demonstration and instruction procedures.
  - Provision of written notice before each (or series of) test, inspection, commissioning or demonstration procedures are to be carried out, not less than 7 days
  - Demonstration to the CA that test instruments and equipment are accurate.
- **Content:** Provide programme information as either a bar chart or a critical path network depending on requirements of the Contractor for integration of the contract/ subcontract programme into the main programme
- **Monitoring:** Record progress of the Works weekly on a copy of the programme kept on site.

  Update or redraft programme without delay if any circumstances arise which affect the progress of the Works.

  Mark up "As Installed" details weekly and before any work is hidden from view.
- **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.

175 Inspection and measurement of the works

- **Provide:** All necessary assistance to enable CA to examine or measure the Works.
- **Photography:** Provide numbers and types of progress photographs of the Works as required in Main Contract Preliminaries.

180 Commissioning project management

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

185 Test notices

- **General:** Provide all formalities in connection with Test Notices, Agreement and Application for Supply Forms etc.
  Ensure all documents requiring the Employer's signature are forwarded to the CA in time to meet the Works programme in order for the necessary test and supply arrangements to be made.
  No additional payments will be made for expenses incurred due to reconnections, re-visits etc., by Supply Authorities or any other officials.
- **Liaison with Statutory Authorities:** Liaise with the Statutory Authorities and provide any test notices required to ensure final connections are made in accordance with the requirements of the testing and commissioning programme. Orders for the incoming services to be placed by:
  - Contractor/subcontractor.

190 BMS witnessing requirements

- **Requirement:** Implement the following witnessing requirements and ensure that on-site commissioning staff facilitate the witnessing process.
  - Ensure that the BMS hardware is installed in accordance with the specification.
  - Verify any operator software and associated graphics.
  - Witness completely the control of any main and / or critical items of plant along with a random sample of other points.
  - If number of points is less than 300, witness all.
  - Between 300 and 1,000 points, witness 50% (minimum of 300).
  - If more than 1,000 points witness 20% (with a minimum of 500 points witnessed).
  - Reserve the right to witness 100% of the points if the failure rate is greater than 5%.
  - Witness a sample of specific functions, e.g. 10% of alarms and 10% of data logging.
  - Witness one of several identical items of plant in detail with the others witnessed on a random basis.
  - Verify the system security access.
  - Verify that all safety-related functions perform to that specified, e.g. plant shutdown on fire condition.
  - Verify all plant restarts according to that specified after building power failure and local power failure.
  - Witness all power meter data-points to ensure that they match the meters.
  - Ensure that trend logs are used when witnessing points in order to monitor the performance of

control actions.
- Verify the handover of all operating manuals and system documentation.
- Verify the handover of backup copies of software.
- Verify the completion of any specified system operator training.

OPERATION

200 Employer's representatives inspections

- **Access:** Provide at reasonable times and in accordance with the Main Contract conditions.
- **Inspections:** Agree dates and times several days in advance (5 minimum), 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, in accordance with the Main Contract conditions.

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.

IDENTIFICATION

350 Numbering materials, plant and equipment

- **General:** Ensure that materials, plant and equipment bear the brand name, serial / batch number and any other data required to identify their nature in relation to the Works.

PROTECTION FROM

510 A Waste

- **Requirement:** Comply with requirements of the site waste management plan (SWMP).

520 Electromagnetic interference

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

PROTECTION OF

620 Materials and products

- **Delivery:** Provide an adequate and safe protection for all materials and products during transport to site.

Deliver all ductwork, tubes, conduit, trunking and associated equipment with open ends effectively plugged, capped or sealed.

- **Handling:** Offload and transport about the Works all materials and products as recommended by manufacturers.
  All materials or products to be offloaded onto a clean, dry and secure surface. Any materials or products deposited otherwise, for instance onto a muddy surface, will be rejected, required to be removed from the site and replaced.
- **Storage:** Store all materials and products as recommended by manufacturers:
  - Provide sufficient, safe and secure storage for all materials and products.
  - Provide racks to prevent distortion for storage of conduits, pipes and similar materials.
  - Store all fittings, accessories and sundry items in clean bins or bagged and stowed in racks and maintained under suitable weatherproof cover.
  - Store all items raised off the floor on pallets or other appropriate support.

640 Existing work and services

- **Protection:** Fully protect and maintain any existing services serving or passing through the site or the premises during the progress of the Works. Such items may include but are not limited to:
  - Gas
  - Water
  - Electricity
  - Telephones
  - Data and communications
  - Soil and waste
  - Rainwater
  - Fire detection and alarms
  - Fire suppression systems

  Provide any additional work and materials necessary to maintain these services at all times during the duration of the contract. Any existing services disturbed by the Works are to be reinstated fully in accordance with the standards of quality defined in the specification and to the satisfaction of the CA.
  Make all connections to existing services out of normal working hours.
- **Removal:** Minimum amount necessary.
- **Replacement work:** To match existing.

690 Protection of subcontract work

- **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 and after erection all easily damaged materials with hardboard covers or heavy duty polythene sheet. Such items include but are not limited to
  - air handling units - refrigeration machines
  - 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.

- **Rotating plant:** Immediately prior to practical completion adjust, ease and lubricate moving parts as necessary to ensure easy and efficient operation.
  Ensure that, whenever necessary, temporary supplies are provided to enable motive plant items delivered and/ or installed to be run at regular intervals to avoid damage or deterioration.
  Ensure that rotating plant is hand-turned periodically if temporary supplies are not available.

00-60-70 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.
- **Reasons:** Submit reasons and relevant information for the proposed substitution.
- **Information to be submitted:** Manufacturer and product reference.
  Cost (including that of any redesign by the design team, and any others, to accommodate the change. The redesign costs to be paid by the Contractor proposing the change).
  Availability.
  Relevant standards.
  Performance.
  Function.
  Compatibility of accessories.
  Details of any resulting non compliances with requirements of the tender / contract specifications and drawings
  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.

140 Substitution of standards

- **Specification to British or European Standard:** Substitution may be proposed complying with a grade or category within a national standard of another Member State of the European Community or an international standard recognised in the UK.
- **Before ordering:** Submit notification of all such substitutions.
- **Documentary evidence:** Submit for verification when requested as detailed in clause 120 above. Any submitted foreign language documents must be accompanied by certified translations into English.

DOCUMENTS AND INFORMATION

150 Currency of documents

- **Currency:** Except where other and specific information is included in particular documents,

references to published documents are to the editions, including amendments and revisions, current on the date one month prior to that on 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.
  - **Submit:** Submit full technical details for review prior to placing any order
- **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.

190 Environmental assessment information

- **Assessment Information:**
  - **Scope and content:** Refer to assessment tracker
  - **Format:** Refer to BRE website for details
  - **Submit:** Within one week of request.

220 Technical information, maintenance instructions and guarantees

- **Retain:** Available on site for reference by supervisory personnel and the CA. (Obtain copies If not delivered with components and equipment).
  Hand over to CA on or before practical completion of the works.
  Notify CA of telephone numbers for emergency services by subcontractors, manufacturers, suppliers after practical completion (in addition to including in the operating and maintenance manuals).
- **Information:** Manufacturer's current information and relevant British, EN, ISO standards and Codes of Practice, relating to all products to be used in the Works.
- **Registration:** Register with manufacturer as necessary.

225 Information for enhanced capital allowance (ECA) claim

- **General:** Enhanced capital allowances (ECA) may be claimable by the Employer on qualifying items including: - energy saving plant and machinery - water conservation plant and machinery
- **Prepare and provide:** Supporting documentation on products used in the Works that:
  - meet the criteria presented in the energy technology criteria list (ETCL) and are listed on the energy technology product list (ETPL)
  - meet the ETCL but are not listed on the ETPL
  - do not directly qualify for an ECA but have one or more components that do

  Required information to include but not be limited to:
  - invoices
  - dated screen prints from the ECA website
  - documentation to prove installation of the equipment

  Provide to CA *when requested.*

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.

250 Quality of materials, products and works

- **Generally:** Provide all materials and works in accordance with the appropriate British Standard (BS / BS EN) or Code of Practice (CP) and CE Marking, or where no BS / BS EN or CP is applicable, the Agrément Certificate for the particular item as issued by the BBA.

  Ensure all equipment and systems are designed and installed in accordance with the relevant standards and that operational compatibility exists between the systems and any other system installed at the same location.

  Supply plant and equipment to achieve the specified design conditions and to provide stable control.
- **Comply with:** - All statutory instruments and regulations, and local byelaws relating to the area of the site current at one month prior to the date of tender.
  -Requirements of the local authority building control or other appointed building regulations approval authority.
  - All relevant requirements included in the Main Contract Preliminaries regarding statutory obligations.
  - Equipment manufacturer's current printed recommendations.
  Where no specific design, performance or installation standards are quoted the editions of the following current at one month prior to the date of tender shall apply:
  - CIBSE Guides, Codes and other technical publications.
  - BSRIA technical publications.
  - Institute of Plumbing, Plumbing Engineering Services Design Guide.
  - The Wiring Regulations (BS).
- **Notification:** Notify all authorities in accordance with their regulations and obtain any required approvals for the installation.

255 Deleterious materials

- **General:** Do not use materials which are generally known to be deleterious to health and safety or to the durability of the project.

  Select and check all new materials against the current edition of 'Good Practice in the Selection of Construction Materials', published by BCO

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.

265 Site modifications

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

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

- **Products or executions:** Submit samples of material and workmanship proposed by the contractor / subcontractor to be used in the Works and/ or as required in the specification or identified in other contract documentation.
  - drawings may be temporarily substituted for the samples
  - drawings when accepted will be retained until the articles concerned are supplied, as a sample.

  Samples submitted and approved, to remain the property of the Employer until the completion of the contract.

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

375 Dimensions

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

380 Setting out

- **General:** Where this is done by the another contractor or subcontractor check its accuracy and obtain that contractor's agreement / approval before proceeding with the works.

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, including schedule of WRAS certificates for all materials, brassware and the like in contact with wholesome water.
- **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 Byelaws.
  - **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 Inspection and testing

- **Inspections and tests on and off site:** Submit schedules showing those parts of the Works for which inspections and tests are required in the specifications, to substantiate conformity with the requirements of the specification and for which records are required to be maintained.
  Should any alternative item be proposed which does not carry appropriate certification, ensure independent testing is carried out at no expense to the Employer to confirm compliance.
  Where required, provide formal method statements supported by risk assessments detailing the procedures for carrying-out on site tests.
  Agree in advance with all parties procedures for inspections and tests including periods of notice.
  Where a test indicates non-compliance with the specification submit immediately details of the non-compliance and proposals for corrective action.
  Arrange access for personnel who require to be in attendance, to manufacturer's or other off site premises when any inspections and tests carried out, and allow for reasonable expenses likely to be incurred, inclusive of travel.
  Attendance or otherwise of the Employer, the CA, or their appointed representatives during specified inspections or tests will not reduce the obligations or restrictions of the contract.
  Carry out all tests required by legislation under the direction of a competent person.
- **Type tests:** Provide certificates of verification of type tests. Ensure that drawings and other documents forming part of certificate are available prior to any order being placed.
- **Test certificates:** Where testing specific to the project is required, ensure test certificates include as a minimum:
  - Project title.
  - Date of test.
  - Details of test.
  - Instruments used, serial numbers, calibration dates.
  - Signature of those witnessing test.

- Contractor's name.
- Specific location of the item in the Works

- **Inspections and test records:** Prepare a set of drawings and / or report sheets to record accurately the test and inspection information including the following:
  - Plant identification, section and installation under test.
  - Manufacturer's reference number.
  - Date, time, duration of test, weather conditions.
  - Test results with itemised readings including records of all other checks and tests.
  - Maintain records of all specified inspections and tests performed including third party and works test certificates.
  - Include in records, as appropriate, details of the element, item, batch or lot, the nature, number and date of the inspections and tests, the number and type of deficiencies found, any corrective action taken and other relevant particulars.
  - Maintain all records on site for inspection. On completion of the Works, include copies in the operating and maintenance manuals.
  - When requested submit copies of records: within one week.
- **Final tests and commissioning:** Carry out so that services are in full working order at completion of the Works. All work to be carried out as set out within the technical specification and in accordance with relevant CIBSE and BSRIA pre-commissioning and commissioning guidance and codes.

  Agree with the Contractor a programme for pre-commissioning checks, setting to work, commissioning and performance testing, and allow for all costs incurred.
  Where required, provide formal method statements supported by risk assessments detailing all commissioning procedures.
  Give notice to the Contractor and CA and state any requirements for the attendance and cooperation of others:
  - Not less than fourteen calender days.

  Provide all necessary facilities to enable tests to be witnessed and inspections carried out either on site or at manufacturer's works.
  The CA will only witness test proceedings, confirm recorded results and determine if the specified requirements have been satisfied.
  If following test or inspection any plant or part thereof is shown to be defective or not conforming to the specification the CA will reject such defective parts by written notice, within reasonable time, indicating area of dispute.
  Appoint an "approved engineer", to supervise the whole of the testing, commissioning, performance testing and instruction of Employer's staff.
  Provide all specialised personnel (including manufacturer's representatives) and coordinate their activities.
  Test all equipment, material and systems as detailed in sections. If an inspection or test fails, repeat the procedure, until satisfactory results are obtained.
  Complete all tests before any paint, cladding or similar materials are applied or before services are concealed.
  Ensure all requirements such as cleanliness, protection from harmful external and internal elements etc. are provided prior to commencement of commissioning.
  Following satisfactory completion of testing and when the installations are in a safe and satisfactory condition, set to work, regulate and adjust, as necessary, to meet the specified design requirements.
  Provide all necessary instruments and recorders to monitor systems during commissioning and performance testing.
  Provide test equipment subject to which has been subject to an agreed British Standard quality assurance procedure.
  Do not start performance testing, including system demonstration, system proving or environmental and capacity testing, until commissioning of the system is completed to the

satisfaction of the CA.
Maintain on site full records of all commissioning and performance testing, cross referenced to system components and on completion of the Works include a copy in each Operating and Maintenance Manual.
Provide all certification documents for approval by the CA before any system is offered for final acceptance.

Gas, fuel oil, electricity and water for testing and commissioning will be provided: as set out in the Main Contract Preliminaries

- **Commissioning procedures:** Observe the following requirements when commissioning the Works.
  Progressive static testing will be witnessed by the CA when work is presented for testing. This will include but not be limited to the following:
  - Insulation resistance tests.
  - Earth fault loop impedance tests.
  - Earth continuity tests.
  - Pipeline pressure tests.
  - Air Ductline Pressure Tests.

  Pre-commissioning examination and testing to ensure that each system or item of equipment is complete, in a safe condition and all notices are displayed. Completion for operational purposes implies the bulk of snagging has been offered to the CA and that remedial work has been completed. All fans, pumps etc. tested for operation, polarity, phase sequence and impedance etc.
  Finalise commissioning programme, taking into account site progress and availability of related services. Agree programme with CA and the Contractor, also agree access required for controls etc.
- **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.
  Deliver before Practical Completion.
- **Operational demonstration:** Provide via the Contractor a written statement to the CA confirming that each installation has been correctly tested and commissioned and that the performance requirements can be achieved.
  Demonstrate to the CA that all system components are operating correctly, and the completely integrated installation will function in accordance with the specified performance requirements.
  Run each plant for the periods defined in the Specification or as agreed with the CA.
  Provide a log book and record all hours run.
  Carry out performance testing in both summer and winter conditions. Where weather conditions or the season does not allow either or both to be demonstrated during the period of the contract allow for return visits at agreed times during the defects liability period to fully complete these requirements.
  Provide equipment to simulate loads to allow for the full testing of the:
  - System(s) for all air-conditioned or mechanically cooled areas.
  - Automatic systems providing natural ventilation and cooling.
- **Inspection by Employer's insurance company:** Where indicated items are to be inspected by a competent person acting for the Employer's insurance company appointed under the provisions of the Factories Act or other relevant legislation. The installations concerned to satisfy the insurance company's requirements in all respects.
  Agree a programme for inspection and certification of specified equipment and via the Contractor inform the CA when equipment is to be ready for examination.
  The Employer will place an order with the insurance company. Details and nature of the order will be provided to all interested parties.
  Provide all additional copies of detailed drawings etc. of the equipment which may be required to

enable the insurance company to comment on design before manufacture.
Arrange for the attendance of the insurance company's engineer / surveyor at each stage of manufacture and installation and provide all necessary access and facilities for inspecting and testing as may be required.
No plant which is subject to inspection will be accepted on behalf of the Employer until a satisfactory certificate has been received by the Employer from the insurance company.
All insurance company charges for examination and approval of drawing, inspection of works during construction and inspection and certification of the completed work will be paid by:
- Contractor / subcontractor

- **Outstanding acceptance tests:** Any items which have failed their acceptance tests or where such tests are delayed by the Employer, these are to be listed and dates agreed, during the defects liability period when reasonable demands for consumer requirements are available.
- **Records:** A copy to be lodged in the Building Manual.
- **Covering up:** Ensure no section of the Works is covered, concealed or insulated until completion of a witnessed satisfactory test.
  Give notice when Works which are to be covered or concealed are ready for examination and/ or measurement, not less than 48 hours.
  Give notice the Contractor and the CA.
- **Record of concealed works:** Maintain photographic record of concealed services together with dimensional information for services installed in concealed locations - in order to facilitate their location in the future. Include these records within the hand-over documentation.
- **Post handover checks:** Ensure that the following post-handover checks are performed and that each meets the specified requirements. Global level checks
  - Internal air temperature.
  - Relative humidity.
  - Ventilation.
  - Energy consumption (ensure that the pulse-input counters match the meters). System level checks
  - Control strategies. Check that any suspect control strategies are appropriate for the intended application. Check that the suspect control strategy has been implemented and commissioned correctly. Check that the control strategy is still appropriate for the intended use.
  - Network communications. Check that all relevant field controllers communicate properly. Check for correct sharing between controllers of relevant data and correct inter-controller operation.
  - Control set-points. Check that the set-points in question are correct and appropriate for the actual operating conditions.
  - Control loop settings. Check that the control loop settings result in accurate and stable control. Check that all self-learnt characteristics are valid.
  - Control zones. Check that the control zones are appropriate.
  - Occupant controls. Check that occupant controls work correctly. Sub-system / component level
  - Sensors. Check the accuracy and location of any suspect sensors.
  - Actuators. Check that any suspect actuators operate correctly.
  - Dampers and valves. Check that any suspect dampers and valves are not jammed and that they operate as intended.

490 Operation of systems before production of record drawings and / or operating and maintenance manuals

- **Requirement:** In the event that the record drawings and / or operating and maintenance manuals are not available when the Works would, in the opinion of the CA, otherwise qualify for practical completion:
  - Provide attendance, at no expense to the Employer, to put into service, operate 24 hours a day and maintain the systems to the Employer's requirements, including the provision of suitable competent labour

Failure to provide this service satisfactorily shall entitle the Employer to make his own arrangements and recover the full cost through the contract.

520 Energy performance certificate

- **Assessment:** Undertake using a member of an approved accreditation scheme. Submit details of scheme name and evidence of qualifications when requested.
- **General:** Information for all calculations and assessments to be obtained from the contract drawings, specifications and schedules and to take into account any changes or variations that have arisen during the period of the Contract.
  Identify any additional information that may be required to complete the calculations and via the Contractor liaise with the CA to obtain it.
- **Building type:** Non domestic and common parts of those containing multiple dwellings
- **Method:** - Undertake approved calculations of all energy ratings, the target emission rate (TER) and building emission rate (BER) for inclusion in the building log book.
- **Building type:** Dwellings
- **Method:** Provide an energy performance certificate in accordance with requirements of:
  - Building Regulations Part L1 Conservation of fuel and power in dwellings.
- **Certificate:** Include in the Building Manual or home information pack as appropriate. Provide additional copy for display in each dwelling.
- **Report:** Provide summary report including all EPCs indexed.
- **Submittal date:** Prior to PC.

QUALITY CONTROL

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 for review by CA
  - **Submittal date:** As 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.

00-70-70 Works Contract Administration

USE OF DOCUMENTS

120 Cross references

- **Accuracy:** Check remainder of the annotation or item description against the terminology used in the section or clause referred to.
- **Related terminology:** Where a numerical cross-reference is not given the relevant sections and clauses of the specification will apply.
- **Relevant clauses:** Clauses in the referred to specification section dealing with general matters, ancillary products and execution also apply
- **Discrepancy or ambiguity:** Before proceeding, obtain clarification or instructions.

130 Referenced documents

- **Conflicts:** Specification prevails over referenced documents.

140 Dimensions

- **Dimensions:** Do not scale.

DOCUMENT AND DATA INTERCHANGE

200 Electronic Data Interchange (EDI)

- **Requirements:** Comply with all requirements in respect electronic and any other form or method of data exchange.

  Types and classes of communication, parties who may communicate and requirements as to form of communication, electronic and otherwise to be as:
  - indicated in the Main Contract Preliminaries and / or the Invitation to Tender.
  -identified in PAS 1192-3 for integrated projects
  or, alternatively, as subsequently agreed between the Contractor and the CA.

DOCUMENTS PROVIDED ON BEHALF OF THE EMPLOYER

235 Drawn and other information

- **Provision as follows:** - Tender drawings as listed in 00-05-10:110
  - Technical specifications and schedules
  - Pre-construction and other information as indicated in 00-05-10
  - Additional drawings / schedules that may be issued by the CA during the period of the contract.

DOCUMENTS PROVIDED BY CONTRACTOR / SUBCONTRACTOR

380 Method statements

- **Method statements:** Prepare describing how and when procedures are to be carried out.

- **Submittal date:** Within ten days of request and before carrying out the relevant procedure.

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 Subcontractor.
- **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:** When hazard is identified.

650 Sub subcontractors

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

INFORMATION

740 Proposed instructions

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

745 Builderswork information

- **General:** Confirm and amplify any information provided by the CA.
  Builderswork involving construction is excluded from the Works.
  Drilling and / or plugging walls, floors, ceilings and the like for fixings for services and such work is included in the Works.
- **Provide:** Builderswork information, appropriate to the stage of design development, and include requirements for foundations, bases, and supporting structures for plant and equipment.
  Fully dimensioned drawings showing both size and position of builder's work.
- **On site:** Mark out all cut holes and chases required, any pockets cast in concrete, any inserts, any built in sleeves or similar items.

  Holes may not be cut in steelwork, reinforced or precast concrete without written permission from the CA.

  Under no circumstances will holes be cut in pre-stressed concrete. Permitted holes in steelwork must be drilled - burning by means of welding equipment is prohibited.

750 Design and production information

- **General:** Complete the design and detailing of the work and provide complete production information (including, as appropriate, coordination drawings, fabrication / installation drawings, design calculations, specifications, and any other necessary information or details).
- **Provide:**

- **Production information:** Including drawings, technical submissions and samples, based on the drawings, these preliminaries and general clauses, the technical specifications and schedules, and other information provided, showing such details of the Works as the CA may reasonably require;

- **Liaison:** Ensure coordination of the work with related building elements and services, liaising with the CA, CDM Coordinator, Contractor and his appointed subcontractor(s) and others as necessary.
  - **Additional information:** Request as necessary and provide information in time to meet the programme.
- **Submission to Contractor:** Submit sufficient copies of the design / production information to the Contractor (or CA if the Contractor has not been appointed). The Contractor (if he has been appointed) to check the information and submit his comments to the CA. The CA will record his comments and those of the Principal Designer and return to the Contractor (or subcontractor if Contractor has not been appointed).

  Make any necessary amendments without delay.
  Until confirmed that resubmission is not required, resubmit for further checking and comment, and incorporate necessary amendments.
- **Design and production information:** Submit sufficient copies of the final design / production information to the Contractor (or CA if the Contractor has not been appointed) for distribution to all affected parties.
- **Proposed changes to contract requirements:** If submitted design / production information differs from the requirements of the contract documents, provide a request for substitution or variation for each such difference, supported by all relevant information.
- **Contractor's amendments:** Subject to the overall requirements of the contract, should any amendment required by the CA be considered to involve a variation to the requirements, which has not already been acknowledged as a variation by the issue of an official instruction, notify without delay (maximum period 7 days), and do not proceed with ordering, fabrication, or fixing until instructed. Claims for extra cost, if made after it has been carried out, may not be allowed.

760 Drawn and other information

- **Types and formats:** Provide for inspection by the CA drawn information of the following types and formats. Initial copies for comment and final copies for distribution:
  - print form
  - CAD format

  Provide via electronic file sharing site,
  or electronic issue on memory stick with hard copy only where a number is specifically indicated below.

  Drawings and documents:
  - prepare to commonly recognised scales.
  - generally on A1 sheets for drawings and A3 or A4 sheets for details and schedules.
  - agree scales, drawing sheet sizes and formats with CA before preparing any documents.
  - use symbols and line conventions in accordance with British Standard recommendations for symbols and other graphic convections.

  and
  - use symbols and line conventions in accordance with any standards symbols drawings in section 00-05-10:110.

  CAD drawings to comply with:
  - Requirements of relevant British Standards
  - AutoCad (current format)
  - DWG / DXF

Document numbering / registration:
- Comply generally with PAS 1192-3
- Agree with the CA the system to be used before preparing any documents.

- **Numbers required:** Unless indicated otherwise in the Main Contract Preliminaries or Invitation to Tender provide drawn information to the CA in the following numbers:

  All drawings including: sketch drawings, schematic drawings, detailed design drawings, coordination drawings, installation drawings, installation wiring drawings, builder's work information, shop drawings, manufacturer's drawings, manufacturer's certified drawings, controls logic diagrams, switchgear, starter and control instrumentation panel drawings:
  - Initial copies for comment electronic
  - Final copies for distribution electronic

  As-installed drawings:
  - Site record copy

  Record drawings:
  - Initial copies for comment electronic
  - Preliminary sets for use during commissioning [***2***]
  - Reduced set incorporated into each operating and maintenance manual [***1, where physical manual is required***] format [***A3***]
  - Full size print set for Employers use [***1***]
  - Electronic copy

  Plant room schedules and schematics:
  - Initial copies for comment electronic
  - Preliminary sets for use during commissioning [***2***]
  - Framed set for plantrooms [***1***]
  - Reduced set incorporated into each operating and maintenance manual [***1, where physical manual is required***] format [**A3**]
  - Full size print set for Employers use [**1]**
  - Electronic copy

  Operating and maintenance manuals (all types) and log books:
  - Initial copies for comment electronic.
  - Temporary manuals with provisional record drawings and preliminary performance data available at commencement of commissioning for familiarisation of Employer's staff electronic copy.
  - Final manuals [to match the numbers of building manuals/ building health and safety files required in Main Contract Preliminaries: or as otherwise advised by CA].
  - Log book **[1].**

  In addition provide drawings and any other documents required for construction in form and number as required by the Contractor format [***A3***]
  - Full size print set for Employers use [***1***]
  - Electronic copy

  Operating and maintenance manuals (all types) and log books:
  - Initial copies for comment electronic format.
  - Temporary manuals with provisional record drawings and preliminary performance data available at commencement of commissioning for familiarisation of Employer's staff electronic copy.
  - Final manuals [to match the numbers of building manuals/ building health and safety files required in Main Contract Preliminaries: or as otherwise advised by CA].
  - Log book [***1***].

In addition provide drawings and any other documents required for construction in form and number as required by the Contractor.

770 Technical examination and review

- **Examination of drawings and information:** The CA will examine the propositions submitted for compliance, in principle, with the design intent. Such an examination shall not relieve the originator of such documents of his responsibilities and obligations under the contract.
- **Technical submissions:** Prepare a number of technical submissions and submit via the Contractor to CA.
  Submissions to detail all elements of related to contractor design (CDPS or other), installation detail and illustrate the layout and technical performance of all plant and equipment.
  Submissions to be made in adequate time for the CA and his appointed representatives to review and pass comment on the information presented.
  The CA or his appointed representatives will not accept any responsibility for equipment installed without the appropriate submissions having been made and their comments returned.
- **Appraisal of compliance for all submissions:** Provide a full appraisal of compliance with the specification, technical schedules, design drawings, and impact on other areas of the project with each submission.

775 Review of submittals

- **Submittal requirements:** Submittals to contain all drawings, design calculations, support information, manufacturer's literature, etc. necessary to facilitate examination by the CA.
- **Submittal returns:** Submittals will be returned indicating "A", "B" or "C" action, or alternatively "D" status.

  "A" action
  - Examined no comments
  "B" action
  - Proceed provided that work is in compliance with comments made
  "C" action
  - Rejected with or without comments
  - In this case the drawings shall be re-submitted after correction or with further information added.
  "D" status
  - Not reviewed / not applicable to Cundall.

  Drawings and submittals with "B" or "C" action shall be adjusted / revised for comments immediately and re-submitted to the CA within 7 days or earlier if site progress dictates.
- **Updated and revised drawings:** Where drawings are revised and updated during the construction stage:
  - issue to the CA for examination of the revision only, clearly indicate the revision and annotate with a revision number / letter.
- **Builderswork information and installation drawings:** Builder's work information and installation drawings will not be examined in detail but will be examined by the CA for general suitability.
- **Record drawings:** Prepare record drawings as the contract works progress. These will be examined in the same manner as for other Submittals.
- **Timescales:** The timescale for review or comment or otherwise of record drawings will be ***10*** working days from the date of receipt by the CA,*or the date when notification is received by the Engineer.*

830 Ordering of materials and products

- **General:** Ensure that procurement details of materials are incorporated in the Works programme.

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

840 Ownership of products

- **Ownership:** At the time of each valuation, supply details of those products not incorporated into the Works which are subject to reservation of title inconsistent with passing of property as required by the Conditions of Contract, together with their respective values.
- **Evidence:** When requested, provide evidence of freedom of reservation of title.

850 Products stored off site

- **Evidence of title:** Submit reasonable proof that the property in such items is vested in the Contractor.
- **Supplier:** For products purchased from a supplier include a copy of the contract of sale and a written statement from the supplier that conditions of the sale relating to the passing of property have been fulfilled and the products are not subject to encumbrance or charge.

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.

900 Commissioning programme

- **Submittal date:** Minimum of 4 weeks before the start of commissioning or pre-commissioning

910 Performance testing programme

- **Submittal date:** Minimum of 4 weeks before commencement.

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.

00-80-70 Works Contract Completion

230 A Submission of documents for the Building Manual and Health and Safety file

- **General:** Provide full and complete record documents as part of the works, and to the satisfaction of the CA, prior and as a prerequisite, to practical completion.

  To satisfy the provisions of the Health and Safety at Work Act the Employer will not accept handover of the Works until full and adequate information concerning the installations is in the possession of his operating and maintenance staff.
- **Preparation:** Prepare and provide manuals in draft as the Works progress and make suitable arrangements where the Works are subject to partial possession or sectional completion.
  The record documents to be in a format so as to allow their incorporation as an integral part of the:
  - Building Manual
  - Building Health and Safety File

  Prepare and provide two temporary manuals with provisional record drawings and preliminary performance data to be available at commencement of commissioning to enable Employer's staff to familiarise themselves with the installation.
  Temporary manuals to be of same format as the final manuals with temporary insertions for items which cannot be finalised until the installations are commissioned and performance tested.
- **Latest date for submission;:** Provide the CA with copies of the final manual prior to practical completion.
  Number of weeks before: **4**

240 Building Manual

- **Information:** Record documentation for the works to form a self-contained part of the overall building manual and as applicable the building health and safety file.
  Subject to the detailed requirements in the particular clauses below, information required to include that set out in section 00-05-15:
- **The parties:** Names, addresses (including e-mail), telephone and fax numbers of subcontractors, suppliers and manufacturers.
- **Works undertaken:** Full details of loadings, loading restrictions, insulation values, fire ratings and other performance requirements.
  Full details of the operation and / or maintenance.
  A detailed description of methods and materials used.
  As built drawings recording details of construction, together with an index
  Information about repair, renovation or demolition.
  Full maintenance instructions including access provisions.
- **Product details:** Provide copies of manufacturers' current literature including COSHH dated data sheets and recommendations for cleaning, repair and maintenance.
  Schedules including manufacturer and product reference.
  Guarantees, warranties and maintenance agreements.
  Test certificates and reports required in the specification.
- **Copies of the information:**
  - **Number of copies:** As set out in 00-70-70 clause 760

250 Health and Safety file

- **General:** The Health and Safety File for the whole Works to form a self-contained part of the overall building manual.

- **Content:** Cooperate with the ***Principal Designer and Principal Contractor*** to obtain and provide the following, including all relevant details not included in other parts of the building services section of the manual, including but not limited to:
  - Residual hazards and how they have been dealt with.
  - Hazardous materials used.
  - Information regarding the removal or dismantling of installed plant and equipment.
  - Health and safety information about equipment provided for cleaning or maintaining the services.
  - The nature, location and markings of significant services.
  - Information and as-built drawings of the structure, its plant and equipment.

260 Record documents

- **General:** Subject to detailed requirements of this section provide the system records and full documentation as required in the appropriate standards.
  Standards:
  - British Standards
  - CIBSE
  - BSRIA
- **Applicable standards:**
  - British Standards
  - CIBSE
  - BSRIA
- **Provide:** Provide the following, as defined in section 00-05-15, and numbers identified in 00-70-70: 760, where appropriate:
  - Record drawings and schedules.
  - Plant room and switch room drawings, schedules and schematics.
  - Operating and maintenance manuals.
  - BMS operating and maintenance manuals.
  - Blank maintenance logs
  - Log book (buildings other than dwellings).
  - Domestic completion pack.
- **Additional requirements:**
  Ensure record documents:
  - Record the arrangements of the various sections of the works as actually installed and identify and locate all component parts.
  - Make it possible to comprehend the extent and purpose of the works and the method of operation thereof.
  - Set out the extent to which maintenance and servicing is required and how, in detail, it should be executed.
  - Provide sufficient, readily accessible and proper information to enable spares and replacements to be ordered.
  - Correlate so that the terminology and the references used are consistent with those used in the physical identification of the component parts of the installations.
  - Demonstrate as required throughout the execution of the works that complete and accurate records are/ were being maintained and that the record documents are / were being progressively compiled as the work on site proceeds.

  For non-domestic premises (and common parts and services in those with multiple dwellings) confirm that the building log book contains the information outlined in:
  - *Building Regulations Part L2 Conservation of fuel and power in buildings other than dwellings.*

270 Operating and maintenance manual

- **Production:** Employ a specialist to prepare manuals.

- **Presentation:** Agree format and contents with the [Principal Contractor and CA].
  Unless otherwise agreed in writing:
  - Encase the Manuals in A4 size, plastic-covered, loose leaf, four ring binders with hard covers.
  - Each to be 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.

280 Spare parts and tools

- **Recommended spare parts:** Before practical completion submit for the attention of the CA a schedule of spare parts as called for in individual sections and any others that it is recommended should be obtained and kept in stock by the Employer for maintenance of the services installations included in the works.
  Time scale:
  Weeks before: **4**

  State against each item the manufacturer's current price, including packaging and delivery to site. Identify those items which are additional to those specified for inclusion in individual sections of the specifications and schedules.
- **Initial supply of additional spare parts:** Submit for the attention of the CA a quotation, priced in detail, for the initial supply to the Employer of the additional spare parts identified above, and including for:
  - Checking that each spare part is suitable for the replacement of the corresponding part supplied with the item of plant or equipment.
  - Checking receipt, marking and numbering in accordance with the schedule of spare parts.
  - Referencing to the plant and equipment list in the operation and maintenance manual.
  - Painting, greasing, etc. and packing to prevent deterioration during storage.
  Time scale:
  Within number of weeks of request:**4**
- **Recommended tools:**
  Time scale:
  Weeks before: **4**

  State against each item the manufacturer's current price, including packaging and delivery to site. Identify those items which are additional to those specified for inclusion in individual Sections.
- **Supply of tools:** Provide all tools detailed within individual Sections. Submit to the CA a quotation, priced in detail, for the initial supply to the Employer of the additional tools identified above in this clause 280.
  Include for the following:
  - Checking that each item is suitable for the intended application.
  - Checking receipt, marking and identifying.
  - Referencing, where appropriate, to the plant and equipment list in the operation and maintenance manual.
  - Protecting, greasing, etc. and packing to prevent deterioration.
  - Providing a suitable means of storing and securing same.
  Time scale:
  Within number of weeks of request. **4**

290 Training of Employer's staff - generally

- **General:** In addition to any specific requirements identified elsewhere, and before Practical Completion:
  Explain and demonstrate the purpose, function and operation of the installations including all items and procedures listed in the operation and maintenance manual:

- to the Employer's maintenance staff.
- to the operational staff.

- **Training:** Include for not less than indicated number of personnel for indicated number of operating days for this purpose and demonstrate the safe day to day running and maintenance of all systems, plant and equipment.
  - Training of number of persons **3**.
  - Number of days ***5.***
  Ensure that each trained member of staff in provided with and signs a training acceptance certificate(s).

300 Training of employer's staff - BMS

- **General:** Before practical completion provide training for the operation of the controls, monitoring or BMS installations for the following levels of operator.
  This training to be in addition to general training and instruction provided in respect of operation and maintenance of the overall building services systems.
- **Training:** Basic operator:
  Ensure that the operator is trained to:
  - Call up and view point-data from plant schematics and/or points lists.
  - Acknowledge system alarms.
  - View trend logs.

  Intermediate operator:
  In addition to the requirements for a basic operator, ensure that the operator is trained for testing and routine inspection of sensors and actuators and to make basic alterations to the BMS including changes to:
  - Time and occupancy programmes.
  - Control set-points.
  - Setting up trend logs.
  - Setting up alarm routines.

  Advanced operator:
  In addition to the requirements for an Intermediate operator, ensure that the operator is trained to:
  - Add or change graphics / schematics.
  - Change control strategies.
  - Add analogue and digital inputs / outputs to the system.
  - Back-up the system and archive logged data.
  - Re-load system software / configuration details.
  - Add/ modify passwords / monitor system security.

  Provide initial training off-site at the BMS suppliers training facility. Complement this off-site training with 'hands on' on-site training. Include for not less than indicated number of personnel for indicated number of operating days for this purpose:
  - Training of number of persons **3.**
  - Number of days **5.**
  - Split between on and off site training ***[to be agreed].***

  Provide appropriate reference and training manuals for the operators at all levels.
  Ensure that each trained BMS operator is provided with and signs a training acceptance certificate(s).

  Post practical completion:
  Allow attendance for additional operator training and checking and maintenance of BMS / control systems, plant and equipment (this is in addition to any long term maintenance agreements /

proposals referred to elsewhere that may or may not be entered into following completion of the works).
- Number of days **5.**
- Period ***[to be agreed].***

310 Reading of meters

- **General requirement:** Record readings of all water, gas, and electricity meters immediately on completion of the works and forward, via the contractor, to the CA.
- **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.

320 Completion in sections or in parts

- **Requirement:** Where the Employer is to take possession of any section or part of the Works and such section or part will, after its practical completion, depend for its adequate functioning on work located elsewhere on the site:
  - Complete such other work in time to permit such possession to take place.

  Remainder of the works:
  - During execution, ensure that completed sections or parts of the Works have continuous and adequate provision of services, fire precautions, means of escape and safe access.

330 Obligations during the defects liability period

- **Requirement:** Prepare and submit records of failures or malfunctions of any part of the works during the defects liability period, together with details of remedial action taken, subsequent re-testing and the results.
  Notify the Contractor of damage, failures or malfunctions to the works demonstrably caused by incorrect operation of the installations, vandalism or other actions by a third party.
  Inform the CA, via the Contractor, in writing when all defects are finally rectified so that an inspection may be carried out prior to the issue of the Final Certificate.

Part B1

Mechanical services project specific specification and requirements

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1.0

Mechanical Services

1.0 Mechanical Services

1.1 Particular Requirements

1.1.1 Project Description

The project is a CAT B fit out of the existing industrial unit. The proposed layout consists of a warehouse, RF Test areas, flexible spaces, kitchen and break out areas, toilets and lockers.

Although the first floor areas will not be part of the refurbishment/fit out, the penetration through the slabs will be created and provided with appropriate fire barrier for future use.

It is proposed that the warehouse areas are to be provided with natural ventilation and gas fired radiant heating. RF Test areas, flexible spaces, kitchen and breakout areas will be mechanically ventilated with heating and cooling generated via DX split systems, DX multi-split systems both based on cassette room units. Toilet areas will be provided with mechanical extract ventilation systems and electric heating complete with timeclock and thermostatic control.

Mains cold water services will serve the toilets and kitchenette areas. A category 5 water supply will be provided plant room bib taps and for future use.

The ventilation strategy for the warehouse areas allows for the general ventilation only and does not include any specialist ventilation requirements driven by the proposed equipment.

The maximum allowable weight of the equipment suspended from roof/purlins is 25kg/m^2 the contractor is to factor this constrain within their detailed design.

1.1.2 Schedule of Areas

Final areas can be determined from the Architect's drawings.

1.1.3 Scope Summary for the Mechanical and Public Health Services

The contractor is responsible for the complete detailed design and installation of all the mechanical, public health and electrical engineering packages, from the start of RIBA stage 3b to RIBA stage 6 (Handover). The mechanical and public health services work include but are not limited to:

- Above ground drainage services
- Hot and cold water services
- Natural gas services
- Heating and cooling services
- Mechanical ventilation services
- Natural ventilation services
- Specialist ventilation to the warehouse/workshop areas as required by the equipment
- Automatic controls
- All builders' works
- Full design, working and as- installed drawings
- Coordination and installation drawings, coordination with structure, architectural requirements and the like, attendances to all other trades (other than MEP)
- Co-ordination with other services and building structure
- Demonstration of the equipment to the client's representative
- Details of support systems, imposed loads and method of fixing to structure to be submitted to the Contract Administrator for acceptance and to Structural engineer for comments.
- Full Testing and Commissioning.
- O& M Manuals and record drawings.
- User instruction.

The above list is not exhaustive, and the contractor is to supply all services and items of equipment to ensure the installation is fully operational and suitable for the proposed environment and include all associated costs within their tender return.

1.1.4 Design Criteria

The mechanical and public health services design is to be based on the latest editions of the following documentations:

- British Standards, Codes of Practice and Building Regulations
- CIBSE Guides and Technical Memoranda.
- BSRIA Guides.
- BCO Guidelines.
- Utility Supply Authority Regulations and Guidelines.
- IOP Guides.
- Building Engineering Services Association (BESA).

External Design Conditions:

External Design Conditions	Summer	Winter
Cooling	28.1°C db, 19.2°C wb	-5`°C saturated
Cooling Plant Selection	Selected for heat rejection at 35°C dry bulb without loss of capacity	

Internal Design Condition:

Room Type	Summer Temperature	Winter Temperature
Flexible space	24°C ± 2°C	22°C ± 2°C
Reception	24°C ± 2°C	22°C ± 2°C
Warehouse	Not Controlled *	18°C ± 2°C
RF Test	24°C ± 2°C	22°C ± 2°C
RF Chamber	24°C ± 2°C	22°C ± 2°C
Kitchen/Breakout	24°C ± 2°C	22°C ± 2°C
Toilets	Not Controlled	18°C ± 2°C
Changing/Lockers	Not Controlled	21°C ± 2°C
Dis Shower	Not Controlled	21°C ± 2°C
Circulation	Not Controlled	18°C ± 2°C
Plantroom	Not Controlled	10°C (frost protection only)
1st Floor areas	Not Controlled	10°C (frost protection only)

* - naturally ventilated spaces to meet overheating criteria as set within CIBSE TM52

Note: No humidity control is provided. All temperatures are dry bulb air temperatures, +/-2°C is the allowable measurement tolerance due to control bands and variation around room etc. Room air velocities are to be kept below 0.25m/s for cooling and 0.15m/s for heating within the occupied zone.

Heat Gains:

Room Type	Heat Gains	Design Criteria
Flexible Space, Reception, RF Test, Kitchen/Breakout Space	Occupancy	75W sensible / 50W latent
	Lighting	12W/m^2
	Small Power	25W/m^2
	Solar	As per calculated loads
Warehouse	Occupancy	Combined heat gain within this areas 40W/m^2 (does not include for any loading associated with the specialist equipment)
	Lighting	
	Small Power	
	Solar	

Ventilation Rates:

Room Type	Supply	Extract
Flexible spaces	6ac/h	6ac/h
Reception	12l/s/person	12l/s/person
Warehouse	Naturally ventilated	Naturally ventilated
RF Test	6ac/h	6ac/h
RF Chamber	6ac/h	6ac/h
Kitchen/Breakout area	12l/s/person	12l/s/person
Toilets	Via adjacent spaces	10ac/h
Changing/Lockers	6ac/h	6ac/h
Circulation	N/A	N/A
Plantroom	Naturally ventilated (low and high level louvres to meet equipment's' requirements)	Naturally ventilated (low and high level louvres to meet equipment's' requirements)

Maximum Duct Velocities:

Duct Section	Velocity
Riser	6.0 m/s
Main Branch	4.5 m/s
Final Run Outs to Grilles	2.5 m/s

Miscellaneous Criteria:

System/Component	Design Criteria
Maximum pipework velocities	Up to 40mm: <1.0m/s 50mm dia to 80mm dia: <1.5m/s 100mm dia and above: <2.0m/s
Ventilation system Specific Fan Power (SFPs)	Part L (latest) Ecodesign Directive 2009/125/EG, Regulation 1253/2014

System/Component	Design Criteria
Ventilation System Heat Recovery	Part L (latest) Ecodesign Directive 2009/125/EG, Regulation 1253/2014

Infiltration (allowance for plant sizing):

External design criteria	Summer	Winter
Infiltration	0.5ac/h	1.0ac/h

Acoustic Criteria:

Room Type	Design Criteria
Flexible Space, Reception, RF Test, Kitchen/Breakout	38NR
Warehouse	45NR
Toilets	45NR
Plantroom	50NR

Public Health Services Design Criteria:

System/Component	Design Criteria
HWS Outlet Temp	43°C (TMV 2 Mixing Valve)
HWS Outlet Temp (Disabled Person Facility)	43°C (TMV3 Fail-Safe mixing valve)
Minimum design pressure at the outlet	1.5 Bar
Maximum Pipework Velocities	Up to 50mm dia: <1.0m/s 50mm dia to 80mm dia: <1.5m/s
Soil and waste drainage	System to be designed in accordance with BS EN 12056
Soil and waste pipework flow velocity	0.75 – 1.5m/s

1.2 Above Ground Drainage System

1.2.1 Design Parameters

The system is to comply with the Building Regulations and all relevant local and statutory authorities' requirements and the following British and European Standards:

- Building Regulations
- British Standards
- BS EN 12056-1:2000 - Gravity drainage systems inside buildings. (General and performance requirements).
- BS EN 12056-2:2000 - Gravity drainage systems inside buildings. (Sanitary pipework, layout and calculation)
- BS EN 12056-3:2000 - Gravity drainage systems inside buildings. (Roof drainage, layout and calculation)
- BS EN 12056-4:2000 - Gravity drainage systems inside buildings. (Wastewater lifting plants)
- BS EN 12056-5:2000 - Gravity drainage systems inside buildings. (Installation and testing)

- BS 8000-13:1989 - Workmanship on Building Sites. Code of Practice for Above Ground Drainage and Sanitary Appliances

1.2.2 System Description

The internal sanitation will be designed to BS12056-2:2000 System III, with a ventilated discharge branch configuration, carried out in lightweight cast iron to BS EN 877, complete with UPVC & MUPVC waste pipework.

New above ground drainage will be installed to suit the proposed layout. The new above ground drainage will connect to the existing below ground drainage via the existing connections.

New condensate drainage will be installed to serve new indoor units. The new condensate drainage will work under gravity at 1:60 falls where possible however the contractor will allow for the new pumped condensate drainage if the required fall cannot be achieved due to site constrains. Connections to SVPs shall be via in line self sealing traps.

Routing of the proposed new above ground drainage will be coordinated with existing MEP services and architectural and structural elements.

The systems to be installed using the minimum pipework and fittings necessary to convey all discharges from sanitary appliances etc. quietly and with freedom from nuisance or risk of injury to health, to the below ground drainage system.

Access panel requirements in permanent boxing to expose rodding eyes etc to be provided at an approximate height of 1200 mm AFFL.

Where a PVC-u and polypropylene pipework passes through a fire compartment wall or floor an intumescent fire sleeve fixed to the building fabric to be provided in accordance with the Building Regulations Document B.

Carry out all tests and inspections to prove that the installation meets with the requirements of the Building Regulations and BS EN 12056 Gravity drainage systems inside buildings.

1.2.3 Scope of Works

The contractor to include within their tender for all materials, sundries, plant, and equipment to carry out the detailed design, supply, installation, testing and commissioning of the following works:

- New above ground sanitation to suit proposed layout
- New condensate drainage to suit equipment position
- Liaise with local statutory authorities
- Provide a proprietary manufacturers intumescent fire collar to all PVC penetrations
- Include all necessary testing and commissioning.
- Fully coordinate the proposed new drainage system with the mechanical, public health, electrical services and structural and architectural elements.
- Liaise with all other trades.
- Prepare and submit working drawings for approval, in addition to builders' work requirements drawings.
- Provide operation and maintenance documentation prior to handover.
- As fitted drawings.

1.2.4 Pipework

Pipework will be installed to the requirements set out in the Materials and Workmanship Specification.

1.2.5 Testing

The Contractor to ensure that the installation complies fully with the requirements of BSEN 12056-:2000, together with the Building Regulations Document H testing to be carried to the requirements of BSEN 12056-:2000.

All testing and commissioning to be carried out in accordance with the Materials and Workmanship Specification.

Prior to handover the contractor is to provide all necessary pressure test certificates for review. The drainage stack testing certificates to be included in the final O&M manuals.

1.3 Domestic Hot & Cold Water Systems

1.3.1 Design Parameters

The system is to comply with the Building Regulations and all relevant local and statutory authorities' requirements and the following British and European Standards:

- Building Regulations
- British Standards
- The Water Supply (Water Fittings) Regulations 1999
- BS 8558:2015 Guide to the design installation, testing and maintenance of services supplying water for domestic use within buildings and their curtilages
- Relevant Local and Statutory Authority regulations and bylaws
- CIBSE Guides
- HSE ACOP L8
- HSG 274 Legionnaires Disease
- Maximum working pressure: Mains fed & confirmed by the contractor following site test pressure readings
- Maximum HWS temperature: 65°C
- Design Return temperature drop: <5°C

1.3.2 System Description

There is an existing incoming cold water supply to the building. The contractor will design and install new domestic water systems to suit the proposed layout. The existing cold water pipework will be extended to suit the proposed layout.

A separate Category 5 cold water tank and booster pumps shall also be installed within the mechanical plantroom. The boosted Category 5 cold water supply will serve plantroom bib taps and future requirements. For the purposes of tender the contractor shall allow for a 1650 litre break tank and dual inverter driven booster pumps with packaged controls and low level float switch as per the below specification or equal and approved:

Dutypoint Systems ScubaTANK (CAT 5)

Duty Head 3 bar; Flow Rate 1.6 l/sec; Rated Power 1.1 kW (Per Pump); FLC (A) : (Total) 5.4amp (10.8amp)

New point of use electric water heaters will be installed to serve the WHBs, sinks and showers.

All supplies to basins and showers will be blended to prevent scalding, via TMV2 blending values. Any sanitary fittings serving mobility impaired facilities will be provided with TMV3 thermostatic blending valves.

Isolating valves will be fitted to the water services prior to final connection to each appliance to ensure maintenance can be undertaken with reduced impact to the remaining system. Drain-off cocks will be provided at all low points within the water systems, with manual air release valves being located at all high points.

All hot and cold water pipework will be thermally insulated to guard against heat loss/energy wastage and formation of condensation consecutively.

To ensure all fixtures and fittings incorporated within the domestic water system do not have any detrimental effect to the quality of the potable water, all items will be WRAS approved.

1.3.3 Scope of Works

The contractor to include within their tender for all materials, sundries, plant, and equipment to carry out the detailed design, supply, installation, testing and commissioning of the following works:

- New hot and cold water systems, including pipework, insulation, valves, meter, ancillary, hot water generation equipment.
- New Category 5 cold water system to plantroom and future use
- Liaise with local statutory authorities.

- Prior to works commencement take samples of the existing water quality for laboratory analysis.
- Provide WRAS approved equipment, valves & pipework fittings.
- Thermal insulation including identification labels for new and existing pipework.
- Include all necessary testing, flushing, disinfection and commissioning.
- Liaise with all other trades.
- Prepare and submit working drawings for approval, in addition to builders' work requirements drawings.
- Provide operation and maintenance documentation prior to handover.
- As fitted drawings.

1.3.4 Pipework

Pipework to be installed to the requirements set out in the Materials and Workmanship Specification.

1.3.5 Testing

The contractor to ensure that the installation complies fully with the requirements of BS 8558 2015, testing, flushing and disinfection shall be carried as required by the Water Regulations 1999 G12.1, G12.2, G12.3, G13.1, G13.2, G13.3, R12.1, R12.2 & R12.3 .

All testing and commissioning to be carried out in accordance with the Materials and Workmanship Specification.

Prior to handover the contractor to provide all necessary pressure, flushing and disinfection test certificates for review. The water services testing, flushing and disinfection certificates to be included in the final O&M manuals.

1.4 Natural Gas System

1.4.1 Design Parameters

The system is to comply with the Building Regulations and all relevant local and statutory authorities' requirements and the following British and European Standards:

- Building Regulations
- CIBSE Guides
- Local Authority Regulations and Requirements
- British Standards
- Gas Safety (Installation and Use) Regulations 1998
- IGEM UP Guidance

1.4.2 System Description

There is an existing incoming gas supply to the building. The existing gas supply will be extended to serve the high level gas fired radiant heating within the Workshops/Warehouse areas. The installation of the gas fired radiant heating will be as per the manufacturers requirements. Gas fired radiant heating as manufactured by AmbiRad/Nortek. The contractor will allow for the necessary gas booster set as required.

Automatic isolation of the gas supply will be provided by a main incoming gas solenoid valve, this will be interfaced to the fire alarm system. Each gas device will be provided with manual isolation.

1.4.3 Scope of Works

The contractor to include within their tender for all materials, sundries, plant, and equipment to carry out the detailed design, supply, installation, testing and commissioning of the following works:

- Carry out gas assessment based on the final gas requirements. Provide gas booster set as required.
- Provide new meter and gas solenoid valve and interface to fire alarm system
- Carry out gas services services installation to serve associated equipment
- Include for any pipe in pipe ventilated to atmosphere where necessary

- Provide all necessary priming, purging, testing and commissioning
- Liaise with all other trades
- Prepare and submit working drawings for approval in addition to builders' work requirements drawings
- Provide all mounted gas schematics by the gas meter
- Provide operations and maintenance documentation prior to handover
- As fitted drawings

1.4.4 Pipework

Pipework will be installed to the requirements set out in the Materials and Workmanship Specification, painted yellow and labelled 'Natural Gas'.

1.4.5 Gas Cocks

All items of equipment will be provided with line size full bore lever operated gas cocks.

1.4.6 Testing and Commissioning

All testing and commissioning will be carried out in accordance with the Materials and Workmanship Specification and in accordance with Gas Regulations requirements.

Prior to handover the contractor will provide all necessary pressure test certificates for review. The gas certificates will also be included in the final O&M manuals.

1.5 Heating and Cooling System

1.5.1 Design Parameters

The system is to comply with the Building Regulations and all relevant local and statutory authorities' requirements and the following British and European Standards:

- Building Regulations
- CIBSE Guides
- Local Authority Regulations and Requirements
- British Standard

1.5.2 System Description

The heating to the Warehouse areas will be provided via high level gas fired radiant heating as manufactured by Ambirad/Nortek.

The heating and cooling to the toilets/shower/locker areas will be provided via splash proof IP33 or better wall mounted electric radiators. The disabled toilet and disabled shower will be provided with Low Surface Temperature (LST) wall mounted electric radiator. New electric tubular heater will be installed within the plantroom for frost protection only.

The first floor areas will be provided with wall mounted electric radiators appropriately sized for frost protection only.

The heating and cooling will be provided via a DX system / DX multi system with indoor cassette type units. All DX units will be controlled via indoor temperature sensors. The outdoor condensing units will be located within the designated external plant area. When positioning the units, contractor will allow for the minimum clearance around the units as per the manufacturer installation requirements.

All external pipework shall be routed neatly clipped to trays and be complete with uPVC covers to all external sections firmly secured once the insulation has been inspected.

The ratio of indoor to outdoor system capacities shall be 100%. Evaporation temperatures shall be no less than 6°C.

1.5.3 Scope of Works

The contractor to include within their tender for all materials, sundries, plant, and equipment to carry out the detailed design, supply, installation, testing and commissioning of the following works:

- Provide and install the new DX split systems including for all indoor and outdoor units, interconnecting refrigerant pipework, and temperature sensors.
- New gas fired radiant heating for the workshop/warehouse areas as manufactured by AmbiRad/Nortek
- New electric heating to the toilets/showers/lockers/circulation areas/plantroom/first floor
- All necessary pipework and fittings including valves, brackets and fixings
- Thermal insulation including identification labels for new and existing pipework.
- Include all necessary testing, flushing, disinfection and commissioning.
- Liaise with all other trades.
- Prepare and submit working drawings for approval, in addition to builders' work requirements drawings.
- Provide operation and maintenance documentation prior to handover.
- As fitted drawings.

1.5.4 Pipework

Pipework to be installed to the requirements set out in the Materials and Workmanship Specification.

1.5.5 Testing

All testing and commissioning to be carried out in accordance with the Materials and Workmanship Specification.

Prior to handover the contractor to provide all necessary pressure, flushing and disinfection test certificates for review. The water services testing, flushing and disinfection certificates to be included in the final O&M manuals.

1.5.6 Condensate drainage

The contractor will design the condensate pipework to function under gravity, however where due to site constrains the gravity system cannot be achieved the contractor will allow for condensate pumps to be installed.

The condensate pipe work will either be installed in copper pipe work or UPVC but either material will be fully bracketed to avoid any deflection and sagging. The condensate pipe will be fully trapped prior to discharging to drain via in line self-sealing traps.

Any pumped drainage will be complete with all necessary alarm functions to disable the connected indoor unit and raise an alarm.

1.5.7 Refrigerant Pipework

The Contractor will allow for installing and testing all interconnecting refrigeration pipework between each indoor unit and each outdoor unit. Only best quality half hard seamless refrigeration grade copper tube will be used. Fittings and joints will be kept to a minimum with all bends being long radius as made using proprietary pipe bending equipment.

Flare joints will be kept to a minimum, i.e. sight glasses, dryers and final terminations only, with all other site joints being brazed on site. All brazing will take place when the pipework is being continuously purged with oxygen free dry nitrogen to ensure no moisture enters the system and preventing formation of oxides of copper. When the pipework is not being directly work on, all ends of the pipework will be capped off.

Any joints required will be correctly swaged and any pipework being cut will be done using sharp cutting wheels with any resulting burrs removed to return the pipework to its original dimension.

If the Cundall Engineer has any reason to believe that any of the above has not been carried out he/she may require the Contractor to degas and cut out any suspect joints or fittings for inspection. If any joints or fittings are found to be burred, contaminated or in any way not be best installation practice then he may instruct the Contractor to remove the entire circuit for reinstallation at the Contractors own cost. The contractor will give the engineer 5 working days' notice before the commencement of pipework brazing.

Where pipework is required to rise vertically due consideration will be made to maintaining the suction gas velocity at the correct/manufacturers recommended velocity to ensure adequate oil circulation back to the compressors. Oil traps will be installed as required by the equipment manufacturer. If required additional oil will be added to the system to take into account, the number of oil traps installed and their effect in reducing available oil at the compressors.

The Contractor will inform the Cundall Engineer of the amount of refrigeration used to charge the system and will allow in his tender to return to site during design ambient conditions to check the performance of the refrigeration plant against its design intent.

All suction lines will be insulated with 19mm Armaflex Class 'O' insulation with all joints being in accordance with the manufacturer's instructions. All insulation joints will be glued using Armaflex adhesive after the systems have been commissioned.

The Contractor will ensure the entire pipework installation is insulated with oversize Armaflex insulation to provide a vapour seal over any oversized joints, etc.

The refrigerant lines will be installed fully in accordance with the equipment manufacturers recommendations.

All refrigerant pipework will be mounted on galvanised cable tray or basket where concealed and will be located within white UPVC trunking when exposed to view in internal rooms.

1.5.8 Commissioning

The Contractor will include for two separate commissioning visits to be undertaken. The first commissioning visit will be upon completion of the installation and will include for charging the system with refrigerant gas and satisfactory setting of the system to work.

The Contractor will allow for a second commissioning visit to site, during the summer months, to undertake any necessary final adjustments to the control settings or refrigerant quantities within the system, under actual design loads.

1.6 Ventilation System

1.6.1 Design Parameters

The system is to comply with the Building Regulations and all relevant local and statutory authorities' requirements and the following British and European Standards:

- Building Regulations
- CIBSE Guides
- Local Authority Regulations and Requirements
- British Standards
- BESA Guidance Documentation
- DW 144
- BCO Guides

1.6.2 System Description

The warehouse areas will be naturally ventilated via a combination of low/mid-level louvres and roof mounted penthouse louvres as manufactured by Breathing Buildings. Any specialist ventilation requirement driven by the installed equipment will be in addition to the natural ventilation.

A new twin extract fan will be installed to serve the toilets/showers and locker areas. The new extract fan will be combined with the room side and atmospheric side attenuators. Extract valve type grilles will be installed. Each branch will be provided with Volume Control Dampers (VCDs). The exhaust will be ducted to outside and combined with exhaust louvre as indicated on the drawings.

A new Heat Recovery Unit (HRU) will be installed to serve the office accommodation. The HRU will be provided with room side and atmosphere side attenuators. The fresh air supply and extract will be distributed via ductwork and swirl type supply diffusers, extract via bellmouth and return air grilles matching in appearance to supply air diffusers. Each branch will be provided with VCDs. The fresh air intake and exhaust will be ducted to outside and combined with fresh air intake and exhaust louvres as indicated on the drawings.

The HRU will be sized to include first floor areas. Separate capped off branch will be installed for future use to serve the first floors areas. The HRU will be fully speed controlled and commissioned to suit the required duty. Any ductwork penetrations for the future use will be appropriately sealed with the required fire barrier protection.

The new cross talk attenuators will be provided to suit the acoustic requirements.

New smoke dampers and fire dampers will be provided to suit the final fire strategy.

The plantroom will be provided with low and high-level louvres as dictated by installed equipment.

1.6.3 Scope of Works

The contractor to include within their tender for all materials, sundries, plant, and equipment to carry out the detailed design, supply, installation, testing and commissioning of the following works:

- Natural ventilation system
- New mechanical ventilation systems
- Plantroom ventilation
- All attenuators and acoustic equipment
- Fire dampers, volume control dampers etc.
- Attenuators and cross-talk attenuators
- Grilles, diffusers, transfer grilles
- All ductwork
- Access doors for resetting fire dampers and internal ductwork cleaning.
- Full commissioning and testing, detailed builders work drawings, working drawings, as fixed drawings, operating and maintenance manuals and instructions.
- Thermal Insulation - aluminium cladding and identification bands, etc.
- Provide all primary and secondary support systems to install the services.
- Allow for user instruction.

1.6.4 Efficiency

The selected HRUs and extract fans will meet the requirement of the EU Regulations 1253/2014. The minimum heat recovery efficiency will be 73%. As a minimum the unit will meet the specific fan power (SFP) requirement as set up in the Non-Domestic Building Services Compliance Guide (NDBSCG).

1.6.5 Ductwork

All ductwork systems will be installed and erected in full accordance with the materials & workmanship section of this specification.

In general ductwork installations will be from galvanised sheet steel throughout.

1.6.6 Fire Dampers

As required to maintain fire integrity, within the ductwork systems fire/smoke dampers will be installed. The Contractor will supply, install and commission dampers as defined in the materials and workmanship section of this specification.

1.6.7 Volume Control Dampers

Volume control dampers will be provided to allow for balancing of the system.

1.6.8 Thermal Insulation

- All conditioned supply ductwork systems which will require vapour sealed insulation.
- All fresh air ductwork which will require vapour sealed insulation.
- Any return air ductwork within non-heated areas.

- When extract systems do not have heat recovery devices associated these will not be insulated.
- External ductwork to be provided with plastisol coated sheet steel (minimum 1mm) protective covering all in accordance with the materials and workmanship section of this specification.

1.6.9 Commissioning

The Contractor will include in his overall tender for the testing and commissioning of the installation in accordance with the materials & workmanship section of this Specification.

All commissioning to be undertaken by the Commissioning Specialist.

1.7 Control System

1.7.1 Design Parameters

The system is to comply with the Building Regulations and all relevant local and statutory authorities' requirements and the following British and European Standards:

- Building Regulations
- The 17th Edition of the IEE Wiring Regulations (BS.7671).
- British Standards
- CIBSE Guide H
- BCO Guides

1.7.2 Performance Objective

Automatically control building services systems to:

- Maintain the desired environmental conditions
- Start and stop the systems as required
- Operate the systems at maximum efficiency levels
- Take corrective action as appropriate in the event of a fire, power outage or failure of plant
- Alert the user to emergencies and fault conditions

1.7.3 System Description

The following new HVAC system will be complete with local package control facilities:

- New DX split systems with local wall mounted controllers and central controller
- New ventilation HRU with local wall mounted controllers
- New twin fan extract with local wall mounted controller
- Ambirad/Nortek radiant heating system complete with Ambirad/Nortek controller and black bulb sensors in each control zone with interface to the BMS system
- Natural ventilation system Breathing Building
- Category 5 water system

The local control panels will be provided by the equipment manufacturer as a factory fitted and tested item.

The central control system will utilise the local controls in order to provide:

- Frost protection of the building services and building fabric
- Time-clock control (optimum plant start/stop times) including for scheduling, time extensions and holiday setting facilities
- Weather compensation and optimised start
- Utilities supplies and comprehensive building energy metering system to meet Part L requirements
- Monitor common faults from equipment
- Plant extension facility for out of hours' operation

- The control system will have the facility for night purge ventilation.

1.7.4 Night Purge

During warm periods the client will have the facility to run the ventilation plant during the night in order to use the cooler external air to enter into the building via AHU summertime by-pass damper, in order to cool the building structure ahead of the next morning.

In order to avoid potential waste of energy the night purge ventilation system will use internal and external temperature sensors in order to allow the control system to determine when to start and stop the plant, depending on the conditions. All set points shall be adjustable and during the warmer months the ventilation system shall activate at midnight and ventilate the space until the internal temperature reaches 18°C dry bulb and then stop. The ventilation shall then be enabled on the agreed time schedule for the normal occupation.

1.7.5 Energy Metering

A metering facility will be provided on the BMS in order to meter:

- Ventilation, via the metered MCC panel
- DX split system, via the metered electric supply
- Water system, via M-Bus meters
- Electrical system meters (M-Bus) split between power and lighting
- Gas system, via M-Bus meter

Appendix A Mechanical Services Tender Summary

The contractor is required to provide their tender summary in the format identified below. All rates are assumed to include overhead and profit.

This summary is to be completed fully by all tenderers with cost against each element.

PROJECT TENDER COSTS				
Item		**Description**	**Item Cost**	**Section Cost**
1	A	For all costs associated with Preliminaries.		£
2	A	For all costs associated with Materials & Workmanship.		£
3		For all costs associated with Design Standards.		
	A	For all other costs associated with this section.	£	
		Sub Total		£
4		For all costs associated with Above Ground Drainage Services Installation.	£	
	A	For all costs associated with above ground drainage		
	B	For all costs associated with condensate drainage. All costs associated with the pumped condensate drainage system where required.		
	C	For all other costs associated with this section.	£	
		Sub Total		£
5		For all costs associated with Hot and Cold Water Services Installation.		
	A	For all costs associated with the Cold Water Services Installation,	£	
	B	For all costs associated with CAT-5 supply		
	C	For all costs associated with the Domestic Hot Water Installation	£	
	D	For all other costs associated with this section.	£	
		Sub Total		£
6		For all costs associated with Heating and Cooling Systems Installation.		
	A	For all costs associated with the new DX systems installation.	£	
	B	For all costs associated with the gas fired heating		
	C	For all costs associated with electric heating		
	D	For all other costs associated with this section.	£	
		Sub Total		£
7		For all costs associated with Ventilation Services Installation.		
	A	For all costs associated with the natural ventilation system to the warehouse areas	£	
	B	For all costs associated with mechanical ventilation system to the office type accommodation	£	

	C	For all costs associated with mechanical ventilation system to the toilet areas		
	D	For all other costs associated with this section	£	
		Sub Total		£
8		For all costs associated with Automatic Controls		
	A	For all costs associated BMS/ Controls.	£	
	B	For all costs associated with wiring.	£	
	C	For all costs associated with Commissioning.	£	
	D	For all costs associated with Client Demonstration.	£	
	E	For all costs associated with all other Automatic Controls.	£	
		Sub Total		£
		SUB TOTAL CARRIED FORWARD TO TENDER SUMMARY		**£**

Total amount in words……

……

Company……

Name……..

Position……..

Date……

Part B2

Electrical services project specific specification and requirements

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1.0

Electrical Services

1.0 Electrical Services

1.1 Particular Requirements

1.1.1 Project Description

The project is a new build industrial unit at Harwell Science and Innovation Campus. The proposed layout consists of workshops, flexible spaces, RF areas, kitchen, break out areas and toilets. It is proposed that the workshop areas are to be provided with LV distribution, general power, lighting and fire alarm installations.

The contractor is responsible for the detailed design of all services. Where design information is provided it is provided to demonstrate the design intent and is provided for information to aid the contractor's detailed design. The contractor is responsible for the design, supply, delivery, off-loading, co-ordination, installation, commissioning and testing of all works including the preparation and issue of final drawings, design calculations, coordination drawings, installation drawings, O&M information and associated builder's work drawings.

The contractor is responsible for the careful co-ordination of all installation work on site, including existing and new services. All sub-contractors employed are required to co-operate with the employer, or their designated representatives, prior to commencing any work, including adhering to the client's permit to work system.

It is essential, as part of the contract works that separate prices are provided for each element of the works as described in the Tender Schedule. Tender prices are to be submitted on the Tender Schedule provided at the back of this specification together with any other format as required by any other sections of the contract documents. Elements are not to be combined and included in other elements. Non-compliance with this requirement constitutes a non-compliant tender.

A wholly compliant tender submission is required. Any exclusions must be priced out or clearly identified to facilitate post tender analysis. Where it is not clearly identified as an exclusion and is a requirement of the contract documentation, then it is deemed to be included. Where equipment or suppliers are named within this document, only these preferred suppliers are to be considered within the tender. Any deviation must be identified.

The tender is deemed to be compliant on the basis of "offer and acceptance" unless noted to the contrary. The client reserves the right to invalidate any tender deemed non-compliant, without negotiation.

1.2 Schedule of Areas

Final areas can be determined from the Architect's latest drawings.

1.3 Site Restrictions

The contractor is responsible for surveying, designing (CDP) and providing all temporary measures, including diversions, temporary lighting, signage, power as well as fire detection and warning systems where the relevant system is required. This is to form part of all enabling works.

The measures provided and agreed as enabling works are to be agreed with the Contact Administrator prior to undertaking the proposed enabling works for each area.

The contractor's program including phasing is to be agreed and approved in writing prior to any work starting on site.

The contractor is to allow for all necessary out of hours' work required as a result of phasing.

1.4 Scope Summary for Services

The Building Services works include, but are not limited to the following:

- A survey of the site to identify and verify the extent of the works required.
- Full detailed design of the electrical services associated with the building, including but not limited to the following:
  - Design calculations.
  - Detailed design drawings, including layouts and schematics.

  - Co-ordination and installation drawings.
  - Full co-ordination with the structure (both new and existing), the architectural requirements and all other trades (other than MEP).
- Provision of LV distribution equipment, busbars and switchgear.
- Lighting installations.
- Lighting control equipment.
- Emergency lighting systems.
- Small power installations.
- Fire alarm system.
- Security and CCTV access control systems.
- Containment systems.
- Earthing and bonding.
- Facilities for disabled persons.
- Data services.
- All builder's work.
- Demonstration of equipment to the client's representatives.
- Details of support systems, imposed loads and method of fixing to structure to be submitted to the Contract Administrator for acceptance.
- Full Testing and Commissioning.
- O&M Manuals and record drawings.
- User instruction.

The above list is not exhaustive, and the contractor is to supply all services and items of equipment to ensure the installation is fully operational and suitable for the proposed environment and include all associated costs within their tender return.

1.5 Design Parameters

The design parameters listed within the following section represents both the parameters used in the development of the stage 3 performance design. These parameters are to be carried forward by the contractor and used in the development of their detailed design, unless specifically advised otherwise by the Contract Administrator.

1.5.1 General Design Standards

In addition to the project specific design criteria the services are to be designed and installed in accordance with the following industry standards and good practice guidelines:

- British Standards, Codes of Practice and Building Regulations
- CIBSE Guides and Technical Memoranda
- BCO Guide to Specification 2014
- BCO Guide to Fit Out 2011
- BSRIA Guides
- Local and Statutory Authority Requirements
- IET Wiring Regulations (BS 7671)
- Utility Supply Authority Regulations and Guidelines
- CDM Regulations
- Electricity at Work Regulations
- Health and Safety at Work Act
- HSE Guidance
- IOP Guides
- BESA Publications (formally HVCA)

- BCGA Codes of Practise
- Manufacturers' Literature

1.5.2 Electrical Design Criteria

Where possible, criteria are drawn from those recommended by CIBSE (Chartered Institution of Building Services Engineers).

The contractor is to note the following specific design criteria on which Cundall's Stage 3 design has been based:

Power Densities

- Circulation: 15 W/sq.m
- HVAC: 40 W/sq.m
- Water heating: 3000 W each
- Lighting: 10 W/sq.m
- Small power 25W/sqm
- Workshop general power: 200w/sqm

Provide a minimum 25% spare electrical capacity for the electrical system.

Provide a minimum of 25% spare ways in each panel board and distribution board.

Provide a minimum of 25% spare capacity in the cable containment systems.

The contractor is responsible for preparing all calculations to support the final detailed design proposal, copies of these calculations are to be provided for review. As a minimum, the following are to be provided:

- Cable calculation for all circuits
- General lighting calculations
- Emergency lighting calculations
- Cable containment sizing
- Technical details of all items proposed for the installation

1.5.3 Lighting installation

Where possible, criteria are drawn from those recommended by CIBSE (Chartered Institution of Building Services Engineers) and those detailed within the end user blue book. If there are discrepancies identified, then this is to be made known to the Contract Administrator to provide written clarification.

Reflectance values to be verified and agreed with the Architect.

Area	Design Criteria	Control
Workshop – Used for Research	Maintained illuminance of 750 lux at working plane with 80% uniformity. Reflectance of 70%-50%-30% (Ceiling Walls Floor) Maintenance factors are to be as per the CIBSE Guide for each space and luminaire type. UGR<22	Manual control ON/OFF Provide full details with schedules, drawing and specification.

Area	Design Criteria	Control
Flexi Space and gathering areas	Maintained illuminance of 500 lux at working plane with 80% uniformity. Designed with consideration to LG7. Capacity to achieve 500 lux. Reflectance of 70%-50%-20% (Ceiling - Wall - Floor) Maintenance factors to be as per the CIBSE Guide for each space and luminaire type. UGR<19	Presence detection w/ daylight dimming. Provide full details with schedules, drawing and specification.
Toilet Areas and Changing Room	200 lux at floor level with a 60% uniformity UGR<25	Presence detection. Provide full details with schedules, drawing and specification.
Reception Areas	Feature lighting to be agreed with Contract Administrator. Lighting levels to be 300 lux on the reception desk and 200 lux in surrounding areas. Reflectance of 70%-50%-20% (Ceiling Walls Floor) 60% uniformity UGR<22	Manual dimming. Lights manually switched to provide 0%, 33%, 67%, 100% of light level above desk.
Circulation	100 lux at floor level with a 60% uniformity Reflectance of 70%-50%-20% (Ceiling Walls Floor) UGR<28	Presence detection. Provide full details with schedules, drawing and specification.
Plantrooms	200 lux at floor level. UGR<25	Manually switched Provide full details with schedules, drawing and specification.
Store	100 lux at floor level. UGR<25	Presence detection Provide full details with schedules, drawing and specification.
Emergency Lighting	1 lux minimum on escape routes, 0.5 lux minimum in open plan areas. 10% of normal illuminance (or 15 lux) in 'high risk task' areas including in front of LV distribution board main isolators.	Scheme to be based on self test with self-contained batteries

LED luminaires are to be used throughout the building.

Where there are discrepancies between the requirements given above and information given within other tender drawings, documents, clarification is to be obtained from the Contract Administrator. Any assumptions made is at the contractor's own risk and no additional costs will be entertained as a result of these assumptions.

1.5.4 Sustainability / BREEAM

There are no BREEAM requirements associated with the proposed projects. However, the contractor is to undertake the design of the building services installation in such a way as to minimise their disruption as far as reasonably practicable.

1.5.5 Sub Metering

Separate energy sub meters are to be provided to enable at least 90% of the estimated annual energy consumption of each fuel to be assigned to the various end-use categories of energy consuming systems to meet the requirements of Part L of the Building Regulations, and CIBSE TM39. The end energy consuming uses are to be identifiable to building users either through labelling or data outputs. They are to be located in an area of the building that is easily accessible to facilitate for regular monitoring and reading by the building staff and facilities manager.

1.6 Electrical Requirements

1.6.1 LV Distribution

The contractor is to note that drawings have been provided to assist in developing the design. The contractor may use these drawings to assist in developing their design.

The contractor is to note that they are responsible for the design of electrical services.

1.6.2 Design Parameters

Design, supply, install, test and commission the LV distribution to comply fully with the latest edition (including amendments) of all relevant British Standards, legislation and CIBSE Guides, current at the time of tender. Attention is to be paid to the following:

- BS 7671 - Requirements for Electrical Installations.
- Electricity at Work Act.
- British Standards and BS Code of Practice.
- CE Marked (all equipment).
- Health and Safety at Work Act.
- The Construction Design and Management Regulations (CDM).
- Building Regulations.

1.6.3 System Description

The LV distribution equipment is to distribute power throughout the building via sub main cables, horizontal power busbar and final circuit cables as shown on the LV Schematic Layout drawing. The MCCB sizes on the schematic layout are indicative sizes for tender purposes and the contractor is to be responsible for detailed design of the LV distribution including providing the sizes and ratings of the LV equipment.

There is an existing 1600A TPN main incomer as shown on the power layout drawing and schematic layout. The main incomer is to be used to supply new MCCB switchgear. The new MCCB switchgear is to in turn supply the distribution boards, panel boards, busbars, lift, mechanical power supplies and fire alarm panel in the building. The main MCCB switchgear is to include surge protection and check meter.

The LV distribution equipment is to consist of:

- A new main MCCB switchgear to supply the panel boards, distribution boards and building services power
- A new MCCB panel board to supply the HVAC system.
- A new split load lighting and power distribution board for small power and lighting installations.
- A new split load lighting and power distribution board for the plant rooms.
- A new distribution board for the external lighting complete with contactors and time clock switch.

Provide all LV distribution equipment with sub-meters in accordance with Building Regulation requirements.

Design, supply, install, test and commission a new MCCB panel board to supply the HVAC system in the building including the plant room and in the workshop areas.

The switchgear, panel boards and final circuit distribution boards are to be located as shown on the small power and cable containment layout drawings.

The new main MCCB switchgear is to be a floor mounted, free standing and factory-built assembly for indoor installation complying with BS EN 61439-2, and extendible at each end. Panel boards supplying HVAC system and process equipment are to be wall mounted MCCB panel boards.

The external lighting on the site are supplied from a lighting and power distribution board in the plant room. The external lighting final circuits are to be reterminated into a new separately metered external lighting distribution board. Make allowance to extend and modify the external lighting final circuits and provide additional cabling and containment as necessary.

Design, supply, install, test and commission a split load lighting and power distribution board with separately metered sections to provide final circuit cabling to the small power and lighting installations in the workshop areas and administration office areas.

A framed A1 size schematic of the building electrical distribution is to be provided next to the panel boards. All outgoing and incoming cables are to be labelled using black traffolyte labelling with white lettering.

The main LV panel board is to be provided with a check meter on the incoming mains, plus additional meters on the outgoing sub-mains to meet Building Regulations Part L (no meters are to be provided on small supplies e.g. to the fire alarm).

The facility load is to be balanced across the three-phases of the supply.

Provide a minimum of 25% spare ways in each panel board.

The LV distribution equipment is to be supplied by Schneider Electric. Contact Jonathan Wilson.

Mobile: 07929 369317

Email: jonathan.wilson@schneider-electric.com

Provide all new distribution boards with typed circuit charts indicating the function, location, breaker type and size, circuit type and cable type used for each final circuit. The circuit chart is to be located in a transparent plastic envelope securely fixed to the inside of the door. If the door is not large enough to accommodate an A4 circuit chart, the typed chart is to be fitted in a glazed hard wood frame located adjacent to the distribution board.

Each distribution board is to be suitably sized for their proposed operation.

Provide a minimum of 25% spare ways in the distribution boards.

Fit all distribution equipment with engraved, traffolyte type labels detailing type of board, function of board and a unique board reference number. The unique reference is to start with floor number, followed by initials indicating equipment type and end with a two-digit reference number. The engraved traffolyte identification labels are to be black with white letters screw fixed to the front of the distribution board lid.

Utilise type C MCBs / RCBOs generally for lighting circuits with maximum rating of 10A.

Utilise type B MCBs generally for small power circuits.

Utilise type D MCBs generally for motor loads.

Miniature circuit breakers are to be minimum 10kA rated, with a minimum 16kA rating close to the transformers/point of supply. The rating of the circuit breaker is to exceed any design or measured fault levels.

Provide and install single module RCBO devices in the distribution boards where RCD protection is specified/required.

Fit all spare ways on the board with blanking pieces to prevent access to live parts.

Balance the lighting and small power loads as far as is practical across the three-phases of the supply in the distribution boards.

General purpose miniature circuit breaker (MCB) distribution boards are to serve the lighting, small power, mechanical services and all ancillary services on site.

All distribution boards are to be complete with a dedicated earth bar for the main earthing conductor and for the circuit protective conductors for each outgoing circuit.

Distribution boards are to have hinged access doors with suitable dust proof seals and facilities for locking comprising a recessed lock with keys. Each board is to have insulated protective shields to prevent accidental contact with live parts.

The contractor is to provide all power supplies and accessories for all the services that are associated with the electrical installations.

The contractor is to provide and install full and complete power circuits to main items of mechanical services, plant and equipment.

The contractor is to liaise with the mechanical contractor to provide and install all power cabling, containment and isolator switches.

The contractor is to submit all electrical calculations utilising the latest versions of Amtech for review.

The contractor is to supply, install, test and commission appropriately sized sub-main cables as required. If the sub-distribution board/equipment is local, sub-main cables are to be LSHF single core copper cables in metal galvanised trunking. If sub-distribution boards/equipment are remote, XLPE/SWA/ LSHF copper cables are to be used. Fire enhanced cabling in accordance with BS8519:2010 is to be used where required. Sub-main cables are to have separate copper CPC run in parallel from the main distribution equipment.

Surface run multiple cable drops are to be contained in metal trunking, suitably protected with a grommet strip where required.

All cables are to be BASEC approved.

All new cables and conductors are to be clearly identified with insulation colour coding as per amendment 001 BS7671 Table 51.

1.7 General Power

The contractor is to note that drawings have been provided to assist in developing the design. The contractor may use these drawings to assist in developing their design.

The contractor is to note that they are responsible for the design of electrical services.

1.7.1 Design Parameters

Design, supply, install, test and commission the general small power to comply fully with the latest edition (including amendments) of all relevant British Standards, legislation and CIBSE Guides, current at the time of tender. Attention needs to be paid to the following

- BS 7671 - Requirements for Electrical Installations.
- IET Guidance notes - (All).
- BS 7430 - Code of Practice for Earthing.
- The Electricity at Work Act 1989.
- The Health & Safety at Work Act.
- Building Regulations.
- Construction Design & Management (CDM) Regulations.
- All power cables and containment are to be suitably sized to enable at least 25% space/clear capacity for expansion for more cables. Cables are not to be installed through small apertures or containment creating a maintenance liability and potential for damage or accelerated deterioration.

1.7.2 System Description

The small power installation is to be designed and installed in accordance with the recommendations of BS 7671 and all associated guidance notes.

New small power installation comprising of 13A socket outlets, 13A fused connection units, industrial outlets and isolator switches are to be provided as shown on the small power drawing.

It is presently assumed that general services in the workshop area are to be surface mounted and exposed with power distribution utilising a network of low voltage cables routed via metal trunking and steel conduit terminating in surface

mounted accessories or dado trunking with flush accessories. Small power installations in the office areas are to be concealed in the walls and ceiling void.

The contractor is to allow for the labelling of all industrial outlets detailing usage and circuit reference. All labels are to be of the engraved traffolyte type.

Protect all 13A socket outlets in general using 30mA trip, RCBO circuit breakers. Exceptions are socket outlets serving essential equipment.

Provide dedicated switched 13A single gang socket outlets for cleaning purposes and wire the final circuits supplying the sockets on 32A, 30mA, RCBO breaker, dedicated ring circuits.

Provide labels or engraved descriptions as “Cleaner’s Socket” or “Maintenance Socket” on socket outlets which are provided for specific purposes. Obtain clarification from the Architect prior to the installation of the labels.

Position the cleaner’s socket outlets to enable full serviceable coverage when using vacuum cleaners with an operational reach of a radius of 15 metres.

Provide outlets so the extension leads do not need to pass under doors.

The mounting heights and wiring accessories face plate colour is to be in line with the Equality Act and Building Regulations Part M requirements. Agree the final mounting heights and exact position of wiring accessories with the Architect prior to installation on site.

Services are to be coordinated with other systems and the building structure and be set at heights to be agreed with the Architect. The overall arrangement is to be agreed with the Architect.

Finishes of wiring accessories are detailed within the electrical accessories schedules and tender drawings.

Provide sockets outlets with high integrity dual earth terminals in areas where there is a likelihood of high earth currents (e.g. sockets supplying ICT equipment and computers).

Final circuit wiring is to comprise of single LSZH copper cable installed in concealed steel trunking. Provide concealed PVC / galvanised metal conduit droppers (or risers) to electrical wiring accessories. CPCs are to be fully sized generally.

Install galvanised metal containment systems where the containment system is visible. The use of plastic (PVC) containment systems must be avoided. Paint any surface mounted containment system (i.e. the conduit dropper) to match the wall finishes. Agree with the architect where surface mounted conduits are allowed prior to installation on the site.

Install galvanised metal containment systems and wiring accessories with metal clad face plates in the plant rooms, ceiling voids and electrical cupboards.

Install the correct type of wiring accessories in terms of ingress and impact protection to suit the environment where the power supply is installed.

All 13A socket outlets and general purpose 16A maintenance socket outlets in general are to be protected by RCDs, generally 30mA trip.

Maintenance (industrial) socket outlets are to be wired on dedicated ring circuits with a maximum of 8 sockets per ring circuit.

Industrial socket outlets feeding process equipment are to be wired on dedicated radial circuits.

Small power is to be provided to support other building systems including but not limited to:

- Industrial sockets – un-switched metal clad fused connection unit
- Local mechanical services
- Display screens
- Roller shutter doors – SPN Isolators

The mounting heights and colours of socket outlets, switches and controls are to be in line with the Equality Act /Part M requirements.

The contractor is to liaise with the mechanical contractor and provide all power cabling, containment and isolating switches located as appropriate to suit the location of mechanical services.

The mechanical strength and rigidity of all wiring systems are to be suitable to withstand the dangers of mechanical damage which might occur during the construction and operation of the building.

The contractor is to supply, install, test and commission appropriately sized XLPE/SWA/LSZH sub-main cables as required.

All cables are to be BASEC approved

Sub-main cables are to include an appropriately sized, separate G/Y CPC copper cable in accordance with Table 54.7 of BS 7671 as a minimum.

Finishes of services are detailed within the electrical accessories schedules and drawings.

Design, supply and install 250A TPN horizonal power busbars with tap-off facilities at 1.5m centres in the workshop areas as shown on the small power layout. Provide tap-offs up to 100A TPN, supports and brackets as necessary. The horizontal power busbar is to be supplied by Schneider Electric.

The contractor is to be responsible for sizing all final circuit cabling and protection devices using Amtech cable calculation software.

The contractor is to refer to the client's Blue Book for guidance regarding the sizes of circuit breakers required for the various machines and the electrical ratings.

1.8 General Lighting

The contractor is to note that drawings have been provided to assist in developing the design. The contractor may use these drawings to assist in developing their design.

The contractor is to note that they are responsible for the design of electrical services.

1.8.1 Design Parameters

Design, supply, install, test and commission the general lighting to comply fully with the latest edition (including amendments) of all relevant British Standards, legislations and CIBSE Guides, current at the time of tender. Attention is to be paid to the following:

- CIBSE Code for Lighting.
- BS.5266 & BSEN.1838 – Emergency Lighting.
- BRE Digest 498 – Lighting Control.
- CIBSE Guide LG3.
- CIBSE Guide LG7.
- BSEN 12464-1.

1.8.2 System Description

The new lighting scheme is to be installed within the units to provide the required illumination levels for each area and activity.

The lighting installation is to comprise of LED linear luminaires mounted on lighting busbar trunking system in the workshop areas.

Lighting is to be typically manually controlled in all areas with electrical distribution from the lighting and power distribution board located in the plant area.

Luminaires with either prismatic or polycarbonate diffusers are to be selected to minimise glare and provide good vertical illuminance and minimise maintenance.

The lighting control strategy is to be as detailed within the specification and schedules.

Provide LED luminaires with a minimum 5-year guarantee and obtain the 5-year guarantee for the client that is to include but not limited to:

- Recording all luminaires serial number

- Record date of delivery for each luminaire
- Record date luminaires were first switched on.
- Complete all paper work required to enable the client to obtain the guarantee.
- Record all information detailed above including contact details for the relevant department of the lighting manufacturer within the O&M manuals.
- Any other details as required by the lighting manufacturer.

All LED luminaires are to have a MacAdam ellipse of 3 or less.

Provide all luminaires with associated lamps/light source with all lamps to be white colour 4000K unless indicated otherwise on the drawing, schedule or specification.

The contractor is to refer to the drawings and schedule for a detailed description of proposed luminaire types and locations within each area of the building.

Wiring for lighting and power is to be generally carried out using LSHF insulated single core cablesin galvanised steel trunking and steel conduits. CPCs are to be fully sized generally. Conduits are to be Class 2 in most areas, but galvanised Class 4 in wet or humid areas, or where set in screeds or concrete.

Install the correct type of wiring accessories in terms of ingress and impact protection to suit the environment where the power supply is installed

Minimum cable size for lighting systems is to be 1.5sq.mm.

Type C MCB's are to be utilised generally for lighting circuits with maximum rating of 10A.

Light switches are to comply with Part M of the Building Regulations especially in terms of heights and colour contrast.

Finishes of light switches are detailed within the electrical accessories schedules. Colours and finishes are to be agreed with the Architect.

The contractor is to provide calculations for all internal lighting for review using the latest versions of Dialux or Relux. These calculations are to include UGR, as well as light level and uniformity.

1.9 Emergency Lighting

The contractor is to note that drawings have been provided to assist in developing the design. The contractor may use these drawings to assist in developing their design.

The contractor is to note that they are responsible for the design of electrical services.

1.9.1 Design Parameters

Design, supply, install, test and commission the emergency lighting system to comply fully with the latest edition (including amendments) of all relevant British Standards, legislation and CIBSE Guides, current at time of tender. Attention needs to be paid to the following:

- CIBSE LG12 – Emergency Lighting Design Guide.
- The CIBSE Code for Interior Lighting.
- BS.5266 & BSEN.1838 – Emergency Lighting.

Submit calculations using the latest versions of Dialux or Relux software.

1.9.2 System Description

Provide new emergency lighting to workshop and internal areas comprising of surface LED emergency spot lights with self-test facilities. Illuminated exit signs are to be provided to ensure safe egress.

Provide the emergency lighting to include a combination of:

- Area LED emergency spot lights with self-test facilities.
- Escape route LED emergency spot lights with self-test facilities.

- Illuminated exit signs with self-test facilities indicating exit routes in line with the fire strategy.

Provide emergency lighting comprising of LED emergency spot lights and illuminated exit signs as shown on the lighting layout drawing and described in the luminaire schedule.

Provide LED emergency spot lights and illuminated exit signs as specified within the specification, schedule and drawings. No alternatives are to be considered.

Provide Illuminated exit signs to meet the European Signs directive format.

LED emergency spot lights are to provide 3 hours backup in the event of mains failure, either generally or as result of local lighting circuit failure.

The contractor is to provide calculations for all emergency lighting for review using the latest versions of Dialux or Relux.

1.10 Fire Detection and Alarm System

The contractor is to note that drawings have been provided to assist in developing the design. The contractor may use these drawings to assist in developing their design.

The contractor is to note that they are responsible for the design of electrical services.

1.10.1 Design Parameters

Design, supply, install, test and commission the fire detection and alarm system to comply fully with the latest edition (including amendments) of all relevant British Standards, legislation and CIBSE Guides, current at time of tender. Attention needs to be paid to the following:

- BS.5839.1 - Fire detection and fire alarm systems for buildings
- EN 54-23 Visual alarm devices.
- Loss Prevention Council Publication.
- Local Authority standing orders and bylaws

1.10.2 System Description

Design, supply, install, test and commission a new fire alarm system to achieve an L1 category coverage shown on the fire alarm layout drawings to support the overall fire strategy for the building.

The fire alarm system is to incorporate analogue addressable technology devices and field devices comprising of detectors, break glass call points, sounders, visual alarms (flashing beacons), interface units.

Provide an interface unit to connect the building's fire alarm system to the Landlord's site-wide fire alarm system.

Provide optical smoke detectors generally in the building and heat detectors in areas having a high risk of false alarms e.g. kitchen areas, mechanical plant rooms.

Optical smoke detection devices are to include LED status indication for start-up, dirty, fault alert or alarm.

Plant rooms, electrical risers and lift rooms are to be provided with detection. Void detection is to be provided where required under the British Standard.

Interface the fire alarm system with the following as a minimum:

- Mechanical Control Panels in the plant rooms.
- Lift in the lift motor room.
- Aspirating system.
- Access controlled doors. Note, subject to agreement with Building Control, the external doors are to be kept secure to maintain security of the building.
- Gas Solenoid Valve.

Install fire rated soft skinned pliable cable such as FP200 or Firetuf with a red outer sheath.

The fire alarm system wiring is to run on its own dedicated containment systems, segregated from other wiring systems.

Where cables are exposed to sunlight or run externally they are to be installed within galvanised steel trunking or conduit.

A concealed installation is required. Surface run installations are acceptable in the plant room, electrical risers and only where shown on the drawings and indicated within the specification and schedules. Install cables that are exposed or run externally within galvanised steel trunking or conduit.

Provide Aspiration system pipes from Aspirating panels within the demise of the workshop and the first-floor ceiling void. Sample test points are to be provided in accordance with Statutory requirements. The Aspirating fire alarm system is to comply with BS EN 54-20 requirements and all relevant codes of practice.

Aspirating system test points are to be located at low level for maintenance staff.

Provide sampling point coverage to achieve an L1 classification as defined in BS 5839.

Test and commission the fire alarm installation on completion.

1.11 Earthing and Bonding

The contractor is to note that drawings have been provided to assist in developing the design. The Contractor may use these drawings to assist in developing their design.

The contractor is to note that they are responsible for the design of electrical services.

1.11.1 Design Parameters

Design, supply, install, test and commission the earthing and bonding system to comply fully with the latest edition (including amendments) of all relevant British Standards, legislation and CIBSE Guides, current at the time of tender. Attention needs to be paid to the following:

- BS7671: Requirements for Electrical Installations.
- BS 7430 - Code of Practice for Earthing
- The Electricity at Work Act 1989
- The Health & Safety at Work Act

1.11.2 System Description

A new earthing installation is to be provided in accordance with Statutory requirements.

All relevant metal construction elements including structural steelwork and water pipes are to be earthed and bonded as required by BS7671 including amendments.

All metal trunking and tray runs are to be installed with earthing links installed at each jointed section.

Provide equipotential and supplementary cross bonding conductors as required by BS7671 to all new metalwork, ductwork, drainage, cable containment, water pipes etc.

1.12 Intruder Detection System

The contractor is to note that drawings have been provided to assist in developing the design. The contractor may use these drawings to assist in developing their design.

The contractor is to note that they are responsible for the design of electrical services.

1.12.1 Design Parameters

Design, supply, install, test and commission the intruder alarm system to comply fully with the latest edition (including amendments) of all relevant British Standards, legislations and CIBSE Guides, current at time of tender. Attention needs to be paid to the following:

- EN50131-1 Generic standard

- EN50131-2 Standard for detection devices
- EN50131-3 Standard for control panels and peripherals
- EN50131-4 Standard for warning devices, bells, sounders etc
- EN50131-5 Standard for interconnections, wires, wireless links etc.
- EN50131-6 Standard for power supplies
- EN50131-7 Application guidelines, mainly for installers
- PD 6662: 2004 – Published Document.
- NACOSS Code of Practice

1.12.2 System Description

The intruder alarm system is to be designed, supplied, tested and commissioned by a company approved and certified by The National Approval Council for Security System (NACOSS).

System design parameter as detailed below;

- Security Grade 3
- Access Level TBC
- Component's Environmental Class. Class II: Indoor General. This covers detectors, keypads and control panels etc.

All components installed are to be of the same grade and marked with their environmental class.

The intruder alarm installation generally comprises of central control panel, remote keypad dual technology movement sensors and internal electronic sounders.

Provide telephone outlet and auto dialler signalling facilities for the intercom system. When intercom signal is not replied to by any of the receptions, the auto dialler is to redirect the signal to Satellite Apps main reception.

The contractor is to be responsible for all builder's work in conjunction with the electrical services installation work.

The location of all electrical components and accessories are to be agreed with the intruder alarm installer on site before any final fixing takes place.

Dual-tech PIR detectors are to be used to protect the internal areas as shown on the layout drawing. The intruder detectors installed are to be sequential verification, grade 3 detector with combined, non-overlapping PIR and Microwave detection.

Supply, install, test and commission heavy door contacts as shown.

Wiring to each detection device are to be generally concealed within the building fabric. The wiring is to be monitored by the control panel to provide fault and tamper indication. The contractor is to supply and install concealed containment for all security cabling.

Provide an appropriately sized and routed cable containment system for the intruder alarm system.

Intruder alarm system equipment is to include the following accessories supplied and manufactured as part of the Honeywell Galaxy range;

- Grade 3 intruder alarm
- Dual tech intruder detector
- Remote key pad
- Robust door contact (not plastic)
- Facility to connect to internet
- Indoor sounder /bell
- Power supply as required
- RIO as required
- Allow for the required software
- Facilities for remote monitoring (GSM)

1.13 Door Access Control System

The contractor is to note that drawings have been provided to assist in developing the design. The contractor may use these drawings to assist in developing their design.

The contractor is to note that they are responsible for the design of electrical services.

1.13.1 Design Parameters

Design, supply, install, test and commission the access control system to comply fully with the latest edition (including amendments) of all relevant British Standards, legislations and CIBSE Guides, current at time of tender. Attention needs to be paid to the following:

- BS EN50133-1 Alarm Systems – Access Control Systems for use in Security Applications System Requirements
- NACOSS Certification.
- EN 50133-2-1:2000 Access control systems for use in security applications – General requirements for components.
- EN 50133-7:1999 Access control systems for use in security applications - Applications guide.
- EN 50102:1995 Degrees of protection provided by enclosures for electrical equipment against external mechanical impacts (IK code).
- EN 50130-5:1998 Alarm systems - Part 5: Environmental test methods.
- EN 50133-1:1997 Alarm systems - Access control systems for use in security applications - Part 1: System requirements.
- EN 60529:1991 Degrees of protection provided by enclosures (IP code) (IEC 60529:1989).

1.13.2 System Description

Provide an access control system as indicated on the electrical services drawings and include the following components at each door location:

- An emergency break glass with legend ‘Emergency Door Release’ to deactivate the power to the door in the event of an emergency.
- Proximity card reader.
- Access controllers. Include 12-hour (minimum) battery backup with all access controllers
- Green push to open push button for normal egress on the exit side of the door.
- Fire alarm interface to release the door on the event of a fire alarm activation.
- Key override for final exit doors.
- Data outlet with metal cable face plate and back box in the ceiling void to link the access controller door to the main controller.
- 13A un-switched fused connection unit above the ceiling to provide 230v single phase supply to the access control panel.
- Magnetic locks to each leaf of the door complete with Z-brackets and all necessary fixing accessories to automatically release and fail-safe the door on signal from fire alarm panel or the push to release switch.
- Wiring installation installed in wall recessed cable containment system and provide additional recessed cable containment system as necessary.

The standalone access control system on each door is to be linked to a central network-based controller in the comms room using RJ45 CAT 6a data cable via data outlets installed for each door access controller.

Link all internal doors to the fire alarm system. In the event of a fire alarm, internal doors are to fail safe open otherwise they are to remain closed if the security alarm is set.

The new access control system including accessories are to be supplied by Paxton.

Video Entry System

Provide an audio-video intercom and entry system as shown on the security layout drawing. The intercom system is to transmit coloured video images and provide 2-way audio communications between the entry panel and the receiving hand set.

Audio-video entry system is to be wired using multicore cables

1.14 CCTV System

The contractor is to note that drawings have been provided to assist in developing the design. The contractor may use these drawings to assist in developing their design.

The contractor is to note that they are responsible for the design of electrical services.

1.14.1 Design Parameters

Design, supply, install, test and commission the CCTV system to comply fully with the latest edition (including amendments) of all relevant British Standards, legislation and CIBSE Guides, current at the time of tender. Attention needs to be paid to the following:

- BS 6330 Reception of Sound and Television Broadcasting
- BS 6259 Code of Practice for Design, Planning, Installation, Testing and Maintenance of Sound Systems

1.14.2 System Description

The contractor is to employ a NSI Gold certified specialist contractor to design, install, test and commission the CCTV system.

The contractor is to make all due allowance for the following:

- All new CCTV cameras required by the proposed design. The CCTV camera is to be a Panasonic WV-S2231L Full HD indoor camera. (or approved equal).
- All Cat 6a patch cabling required by the proposed design.
- All camera license (PSIM) required by the proposed design.
- All cabling and cable containment system.
- All programming\ reprogramming of the CCTV and Control System as required.
- All PoE Network point required by the proposed design.
- All 230V Power required by the proposed design.
- All fire stopping.
- Allocation of storage on recording platform (Digital Video Recording).
- Testing and commission of the CCTV system.
- CCTV images (subject to authorised access) are to be viewable from a LCD 15” colour flat screen monitor adjacent to the primary CCTV DVR. The DVR is to be rack mounted and located within the server room cabinet.

A coloured, IP CCTV system is to be designed, supplied and installed to monitor the doors utilising fixed ceiling mounted dome cameras. Images are to be recorded 24 hours per day and 7 days per week. Images are to be capable of being stored for a minimum of 21 days.

The contractor is to provide a DVD writer with the DVR to enable copying of the images to DVD for permanent storage as required by the Client.

The recording and monitoring equipment are to be connected on the same phase of mains voltage power supply.

Test and commission the CCTV system on completion.

1.15 Facilities for Disabled Persons

The contractor is to note that drawings have been provided to assist in developing the design. The contractor may use these drawings to assist in developing their design.

The contractor is to note that they are responsible for the design of electrical services.

1.15.1 Design Parameters

Design, supply, install, test and commission the facilities for disabled persons to comply fully with the latest edition (including amendments) of all relevant British Standards, legislation and CIBSE Guides, current at time of tender. Attention needs to be paid to the following:

- BS EN 60118-4
- BS 8300.

1.15.2 System Description

1.15.2.1 Assistance alarms

Assistance alarms are to be supplied and installed within the disabled persons toilets. Each alarm is to sound locally and include a local visual beacon with local reset switch.

Assistance alarms are all to be linked to a main alarm indication panel, which for the purposes of this tender is assumed to be located within the reception office at ground level. Final location to be agreed with Contract Administrator prior to commencement of the works.

The contractor is to obtain written clarification of the location of the main indicator panel prior to installation.

1.16 Wiring and Provisions for ICT

The contractor is to note that drawings have been provided to assist in developing the design. The contractor may use these drawings to assist in developing their design.

The contractor is to note that they are responsible for the design of electrical services.

1.16.1 Design Parameters

Design, supply, install, test and commission the ICT cabling system to comply fully with the latest edition (including amendments) of all relevant British Standards, legislation and CIBSE Guides, current at time of tender. Attention needs to be paid to the following:

- The MTC IT Infrastructure Design Specification for New Buildings.
- BS 6701 Telecommunications equipment and telecommunications cabling. Specification for installation, operation and maintenance
- BS EN 28877 Information technology. Telecommunications and interaction exchange between systems. Interface connector and contact assignments for ISDN Basic Access Interface located at reference points S and T
- BS EN 41003 Particular safety requirements for equipment to be connected to telecommunications networks
- ISO/IEC 11801 Information technology – Generic cabling for customer premises
- BS EN 50173-1: Information technology - Generic cabling systems.
- BS EN 50173-2: Information technology - Generic cabling systems. Office premises
- BS EN 50310: Telecommunications bonding networks for building and other structures.
- BS EN 60950-1: Information technology equipment - Safety. General requirements
- BS EN 50174-1: Information technology - cabling installation. Installation specification and quality assurance
- BS EN 50174-2: 2009 +A1:2011 - Information technology – Cabling installations – Installation and planning and practices inside buildings.
- BS EN 50174-3:2013 - Information technology – Cabling installations – Installation and planning and practices outside buildings.

- BS EN 50575: 2014 +A1:2016 - Power, Control and Communication Cables – Cables for general applications in construction works subject to reaction to fire
- BS EN 50600: Information technology - data centre facilities and infrastructures.
- BS EN 5031 - Application of equipotential bonding and earthing in buildings
- BS EN 50267 Common test methods for cables under fire conditions. Tests on gases evolved during combustion of materials from cables
- BS EN 50267-1 Part 1: Apparatus
- BS EN 50267-2.3 Part 2-2: Procedures. Determination of degree of acidity of gases for cables by determination of the weighted average of pH and conductivity
- BS EN 60332: Tests on electric and optical fibre cables under fire conditions
- BS EN 60793: Optical fibres
- BS EN 60794: Optical fibre cables
- BS EN 60794-1.1: Part 1-1: Generic specification - General
- BS EN 60794-1.2 Part 1-2: Generic specification – Basic optical cable test procedures
- BS EN 61034: Measurement of smoke density in cables burning under defined conditions
- ISO/IEC 11801 Information technology – Generic cabling for customer premises
- IEC 60332: Tests on electric and optical fibre cables under fire conditions.
- IEC 60754: Test on gases evolved during combustion of materials from cables.
- IEC 61034: Measurement of smoke density of cables burning under defined conditions.
- BS EN 50346: - Information technology – Cabling installations – Testing of installed cabling.
- BS7671: - IET Electrical Wiring Regulations – current version

1.16.2 System Description

Provide an ICT structured cabling system comprising of RJ45 data outlets, RJ45 CAT 6a cable, patch panel, ICT cabinets, cable containment system as shown on the small power and data layout drawings and as described in this specification.

The ICT structured cabling is a contractors Design Portion item and the contractor is responsible for designing the installation in accordance with the relevant standards and as described below.

The works undertaken as part of this project is limited to the provision of structured cabling and associated data outlets.

The following are the cabling contractor's responsibilities;

- To procure, design and manage the data cabling works.
- To provide patch panels with sufficient provision to terminate all the outgoing CAT 6a cables and provide one spare patch panel of minimum 24 ways.
- To install the horizontal cabling based on CAT 6a cabling from the data outlets to the patch panels in the ICT cabinets.
- To provide RJ45 outlets mounted into back-boxes, dado-trunking and wall outlets as necessary.
- To provide and install a dedicated earth-bar for the cabinet and install 16 sq mm PVC G/Y cable from the earth-bar to each cabinet.
- To provide and install a 25 sq mm PVC G/Y cable from the building earth-bar to the ICT cabinet earth bar.
- To label, test and commission the structured cabling installation
- To provide test certificates, as-built drawings and O&M documentation
- To provide a 12-month warranty covering both parts and labour. The warranty is to allow for the repair or replacement of any component or circuit that is shown to be faulty within 12 months of the date of the site acceptance by the client.
- To develop and coordinate the exact positions of data outlets with the architect and submit co-ordinated architectural and IT layout drawings for review
- To protect the structured cabling installation from dust, water ingress and mechanical damage and maintain a clean and tidy worksite at all times.
- To install fire-barriers and make good any cable penetrations in accordance with supplier's recommendations.
- To review cable containment sizes and provide appropriately sized cable containment system.
- To label each end of the cables according to client's specifications or an agreed method.

Install all cables on basket and adhere to the separation distances to mains power cables.

Supply, install, test and commission BS EN.60309-2/BS4343 industrial socket outlets for cabinets on the cable containment system above the ICT cabinets.

Install the structured cabling system in full compliance with the manufacturer's standards and provide certificate of compliance to that effect.

Provide technical submittals including; installation drawings showing the location of data outlets, patch cabinet layout, comms room layout, equipment schedule / specifications, proposed suppliers, type of cable, and cable containment system.

Submit three copies of the following detailed installation drawings for approval at least three weeks before commencing work on site:

- Face plan of each cabinet and frame showing the location and designation of each termination panel
- Floor plan of each floor at a scale of 1 to 100 @ A1 showing the main cable routes and location of each wall, conduit and floor-box outlets for Cat6a cabling.
- Floor plan co-ordinated with the furniture layout showing the positioning of all desks.
- IT tray and basket cable riser and horizontal stacking desk cable management and distribution
- Containment routes and co-ordination with LV and HV power cable and containment system.

Provide three copies of the test results indicating the test date which must be within two weeks of the completion of the tests.

Provide three hard copies and three CD ROM copies of the following drawings revised to show 'as-built' information:

- Face plan of each cabinet and frame showing the location and designation of each termination panel
- Floor plan of each floor at a scale of 1 to 100 showing the main cable routes and location of each wall outlet, and dado trunking.
- Excel spreadsheet listing each cable or loom installed and the cable length.

Note the following are to be supplied directly by the client:

- Telephone PABX is existing in the plant room. Contractor to provide telecoms connection to fire alarm panel, lift, server room etc
- Wireless access point transmitters are to be supplied by others, however, a WIFI mapping exercise is to be undertaken by the contractor to advise the client on the number of access points required.
- All active hard-ware are to be supplied by others.

The contractor is to employ a domestic sub-contractor to undertake the installation of structured cabling infrastructure, with the contractor providing all, patch panels, cable routes, back boxes, face plates, electrical accessories and power supply.

1.17 Spares

Please find below the required spares as part of the project:

- 1 luminaire (of each type)
- 1 Lighting control module (LCM)
- 1 set of door furniture including magnetic lock and door access control accessories.
- 1 PIR (of each type)
- 1 smoke detector with sounder
- 1 heat detector (fixed temperature) with sounder
- 1 heat detector (rate of rise) with sounder
- 1 sounder with LED beacon
- 1 manual call point
- 1 combination unit for busbar

2.0

Preferred Manufacturers

2.0 Preferred Manufacturers

Note: Equipment is generally to be selected to match existing as far as practicable. Where this is not possible, equipment to be selected from this list of approved electrical manufacturers. Other suppliers equipment will not be accepted.

Service / Product Type	*Manufacturer*	*Telephone Number*	*Website Address*
Cables	AEI Cables Ltd	0191 410 3111	www.aeicables.co.uk
	Prysmian Cables & Systems UK Ltd	023 8060 8760	www.uk.prysmian.com
	Draka	0133 234 5431	www.drakauk.com
Containment	MK Electric now Honeywell UK	0126 856 3000	www.mkelectric.co.uk
	Legrand	0845 605 4333	www.legrand.co.uk
	Schneider Electric Ltd	0870 608 8608	www.schneider.co.uk
	Cableduct	020 8683 1126	www.cableduct.ltd.uk
Distribution Panels & Distribution Boards	Schneider Electric Ltd	0870 608 8608	www.schneider.co.uk
Lighting Control	As per luminaire schedule		
Metering for Electrical Distribution (Building Regulations Part L)	Schneider Electric Ltd	0870 608 8608	www.schneider.co.uk
Miniature Circuit Breakers (Manufacturers to match distribution boards)	Schneider Electric Ltd	0870 608 8608	www.schneider.co.uk
Underfloor Busbar	As per accessories schedule		
Lighting	As per luminaire schedule		

3.0

Tender Summary

3.0 Tender Summary

3.1 Tender Summary

The contractor is required to provide their tender summary in the format identified below. all rates are assumed to include overhead and profit.

This summary is to be completed with costs provided against each element.

TENDER SUMMARY	
Section	**£**
All costs associated with Preliminaries.	
All costs associated with Design (CDP) items	
All costs associated with Materials & Workmanship.	
Electrical Equipment	
Supply and installation of new LV distribution equipment including switchgear, panel boards and distribution boards.	
Supply and installation of all sub-main cabling	
Electrical supplies for mechanical equipment	
Small power	
Supply and installation of small power including, 13A socket outlets, industrial socket outlets, isolators.	
Supply and installation of horizontal power busbar system.	
Lighting	
Supply and installation of general and emergency lighting in the workshop areas, plant room and offices areas including the lighting busbar track system.	
Supply and installation lighting controls	
Containment	
Supply and installation of cable containments system including dado trunking, cable tray and cable trunking systems.	
Fire Alarm	
Supply and installation of fire alarm system including the aspirating system in the workshop areas.	
Security	
Supply and installation of the CCTV system, access control and intruder alarm systems.	
Ancillaries	
Supply and installation of facilities for disabled persons	
Supply and installation of earthing & bonding	
Supply and installation of ICT (Voice & Data)	
Others	
Testing & Commissioning	
As fitted drawings	

Operating and maintenance manuals	
12 months maintenance from date of Practical Completion	
12 months defects liability from date of Practical Completion	
Other	

TOTAL £……

TOTAL including 2.5% MCD £……

Amount in Words ……..

Signed……..

Print Name & Position…....……

On Behalf of…...……

Date……...……...

OPTION SUMMARY	
Section	**£**
The contractor is to provide an option cost for the design, supply, installation and commissioning of combination units as shown on the small power layout	

Cundall Johnston & Partners LLP
4th Floor 15 Colmore Row Birmingham B3 2BH
United Kingdom Tel:+44 (0)121 262 2720

Asia Australia Europe MENA UK and Ireland
www.cundall.com

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Part D1

Standard Materials and Workmanship

Mechanical Services

This Standard Materials and Workmanship Specification covers multiple aspects of mechanical services systems and installation. In doing so it includes details of systems and equipment that may not apply to this particular project.

Refer to project particular documents for details of systems, plant, equipment and other project specific features. Project particular documents include, but may not be limited to, the invitation to tender, specifications, drawings and schedules, and including the main contract documents and formal instructions. Information included in such project specific documentation takes precedence over information contained within this specification.

The inclusion of a feature within this specification does not alone make that feature applicable in all cases. For example, various pipework systems and materials are included and should that system be required, the standards set out in this specification apply. However, to establish what pipework system and/or material is applicable on any project, refer to project specific documentation.

For clarifications or missing information raise a formal query through the Contract Administrator (CA).

Version 0718.1

CUNDALL

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45-55-75 Sealants and glazing compounds

Execution

610 Suitability of joints for sealant application

- **Joint dimensions:** Within limits specified for the sealant.
- **Substrate quality:** Surfaces regular, undamaged and stable.
- **Joints not fit to receive sealant:** Submit proposals for rectification.

620 Joint preparation for sealant application

- **Surfaces to which sealant must adhere:** Remove temporary coatings, tapes, loosely adhering material, dust, oil, grease, surface water and contaminants that may affect bond.
- **Cleaning:** Use materials and methods recommended by sealant manufacturer.
- **Vulnerable surfaces adjacent to joints:** Submit proposals.

630 Applying joint sealants

- **Substrate:** As recommended by sealant manufacturer and Dry and unaffected by frost, ice or snow.
- **Environmental conditions:** Do not dry or raise temperature of joints by heating.
- **Sealant application:** Completely and neatly fill joints. Provide firm adhesion to substrates.
- **Sealant profiles:**
  - **Butt and lap joints:** Slightly concave.
  - **Fillet joints:** Slightly convex.
- **Protection:** Do not contaminate or damage finished joints.

50-10-00 Above ground rainwater drainage systems

System outline

110 External gravity rainwater drainage system

- **Combined fascias soffits and gutters:**
  - **Materials:** .
  - **Supports:**

    Brackets: Not required. Direct fix.

    Fixings: As appropriate to the application;
    Submit proposals
- **Eaves gutters:**
  - **Gutters:**

    Gutter types: 90-05-35/320 Aluminium eaves gutters;
    90-05-35/330 Cast iron eaves gutters;
    ;
    90-05-35/375 Glass reinforced plastics (GRP) eaves gutters;
    90-05-35/385 Hot dip precoated steel eaves gutters;
    90-05-35/415 PVC-U eaves gutters;
    90-05-35/405 Stainless steel eaves gutters;
    and 90-05-35/420 Zinc eaves gutters.

    Jointing: As recommended by gutter manufacturer;
    90-05-35/455 Nylon gutter bolts;
    90-05-35/470 Stainless steel gutter bolts;
    and 45-55-75/345 Silicone construction joint sealants.

    Electrical continuity: Required.
  - **Supports:**

    Brackets: Eaves gutter brackets and clips.

    Fixings: As appropriate to the application;
    Submit proposals
- **Chutes:**
  - **Materials:** 90-05-35/407 Stainless steel rainwater chutes and 90-05-35/425 Zinc rainwater chutes.
  - **Fixings:** Not required. Built in.
    else
    As appropriate to the application;
    Submit proposals
- **External rainwater pipework:**
  - **Rainwater downpipes:**

    Downpipe types: 90-10-20/306 Aluminium external rainwater pipes;
    90-10-20/344 Cast iron above ground drainage pipes;
    90-10-20/308 Cast iron socketed rainwater pipes;
    90-10-20/312 GRP rainwater pipes;
    90-10-20/314 Hot dip precoated steel rainwater pipes;

and 90-10-20/318 Unplasticized polyvinyl chloride (PVC-U) external rainwater pipes.

Jointing: 45-55-75/345 Silicone construction joint sealants.

- **Supports:**

Brackets and clips: 90-10-20/340 Brackets and clips for above ground drainage pipelines type B.

Fixings: As appropriate to the application;
Submit proposals

- **System accessories:** 45-35-84/394 Anti-climb paints;
90-10-60/435 Anti climb pipe covers;
and 90-10-85/310 Electrical resistance surface trace heating.
- **Execution:** 50-10-00/605 Removing rainwater drainage systems;
50-10-00/610 Installation of rainwater drainage generally;
50-10-00/612 Setting out eaves gutters;
50-10-00/614 Fixing and jointing GRP eaves gutters;
50-10-00/616 Fixing and jointing cast and extruded metal eaves gutters;
50-10-00/618 Fixing and jointing pressed and rolled metal eaves gutters;
50-10-00/620 Fixing and jointing PVC-U eaves gutters;
50-10-00/622 Fixing and jointing combined fascia, soffit and gutter system;
50-10-00/632 Installing preformed gutter linings;
50-10-00/638 Fixing and jointing GRP external rainwater pipework;
50-10-00/640 Fixing and jointing cast and extruded metal external gravity rainwater drainage pipework;
50-10-00/642 Fixing and jointing pressed metal external gravity rainwater drainage pipework
;
50-10-00/644 Fixing and jointing plastics external gravity rainwater drainage pipework;
;
and 50-10-00/662 Access for testing and maintenance of rainwater drainage system.
- **System completion:** 50-10-00/810 Testing rainwater drainage generally;
50-10-00/818 Rainwater drainage gutter test;
50-10-00/820 Rainwater drainage system maintenance instructions;
50-10-00/822 Rainwater drainage system pre-handover checks;
and 50-10-00/830 Documentation.

120 Internal gravity rainwater drainage system

- **Roof gutters:**
  - **Gutters:**

Gutter types: 90-05-35/325 Aluminium boundary wall or valley gutters;
90-05-35/380 Glass reinforced plastics (GRP) boundary wall or valley gutters;
90-05-35/465 Site applied gutter linings;
and 90-05-35/365 Galvanized steel boundary wall or valley gutters.

Jointing: 45-55-75/345 Silicone construction joint sealants
else
As recommended by gutter manufacturer.

Electrical continuity: Required.

Insulation: 90-90-40/340 Mineral wool slabs insulation.

- **Rainwater outlets:** 90-10-20/302 Gravity rainwater outlets and Spigot outlets supplied with guttering.
Refer to project specific documentation.

- **Internal rainwater pipework:**
  - **Rainwater downpipes:**

    Downpipe types: 90-10-20/344 Cast iron above ground drainage pipes;
    90-10-20/348 High density polyethylene (HDPE) above ground drainage pipes;
    90-10-20/350 Stainless steel above ground drainage pipes;
    90-10-20/354 Unplasticized polyvinyl chloride (PVC-U) above ground drainage pipes;
    90-10-20/352 Steel above ground drainage pipelines;
    50-10-00/510 Galvanized steel prefabricated drainage pipeline assemblies;
    50-10-00/515 HDPE prefabricated drainage pipeline assemblies;
    and 50-10-00/520 Stainless steel prefabricated drainage pipeline assemblies.

    Jointing: 45-55-75/345 Silicone construction joint sealants.
  - **Supports:**

    Brackets and clips: 90-10-20/340 Brackets and clips for above ground drainage pipelines type A.

    Fixings: Submit proposals.
  - **Insulation:** 90-90-40/330 Mineral wool pipe section insulation type A.
  - **Warning pipes:** Required.
- **System accessories:** Expansion sockets;
  Access fittings;
  Intumescent fire collars;
  90-05-35/465 Site applied gutter linings;
  90-10-85/310 Electrical resistance surface trace heating;
  90-10-60/395 Masking plates;
  and 90-10-60/405 Pipe sleeves.
- **Execution:** 50-10-00/610 Installation of rainwater drainage generally;
  50-10-00/632 Installing preformed gutter linings;
  50-10-00/662 Access for testing and maintenance of rainwater drainage system;
  and 50-10-00/658 Installing rainwater pipe identification.
- **System completion:** 50-10-00/810 Testing rainwater drainage generally;
  50-10-00/812 Rainwater drainage internal pipework test – England, Wales, Ireland and Northern Ireland;
  50-10-00/814 Rainwater drainage internal pipework test – Scotland;
  50-10-00/818 Rainwater drainage gutter test;
  50-10-00/820 Rainwater drainage system maintenance instructions;
  50-10-00/822 Rainwater drainage system pre-handover checks;
  and 50-10-00/830 Documentation.

Custom made products

510 Galvanized steel prefabricated drainage pipeline assemblies

- **Standard:** To BS 3868.
- **Design and fabrication:** To BS EN 12056-1, BS EN 12056-3 and BS EN 12056-5.
- **Shop drawings:** Submit.
- **Damage:** Do not cut pipes to length or otherwise damage coatings.
- **Accessories:** Access fittings and Insulation.

515 HDPE prefabricated drainage pipeline assemblies

- **Standard:** To BS EN 1519-1.
- **Design and fabrication:** To BS EN 12056-1, BS EN 12056-3 and BS EN 12056-5.
- **Shop drawings:** Submit.
- **Accessories:** Expansion sockets.

520 Stainless steel prefabricated drainage pipeline assemblies

- **Standard:** To BS 3868.
- **Design and fabrication:** To BS EN 12056-1, BS EN 12056-3 and BS EN 12056-5.
- **Shop drawings:** Submit.
- **Damage:** Do not cut pipes to length or otherwise damage coatings.
- **Accessories:** Access fittings and Insulation.

Execution

605 Removing rainwater drainage systems

- **Scope:** Refer to project specific documentation

610 Installation of rainwater drainage generally

- **Collection and distribution of rainwater:** Complete, and without leakage or noise nuisance.
- **Electrolytic corrosion:** Avoid contact between dissimilar metals where corrosion may occur.
- **Plastics and galvanized steel pipes:** Do not bend. Plumb and/ or true to line.
- **Allowance for thermal and building movement:** Provide and maintain clearance as fixing and jointing proceeds.
- **Protection:** Fit purpose-made temporary caps to prevent ingress of debris. Fit access covers, cleaning eyes and blanking plates as the work proceeds.

612 Setting out eaves gutters

- **Setting out:** To fall with true line and even gradient. Prevent ponding and backfall. Position high points of gutters as close as practical to the roof. Position low points not more than 50 mm below the roof.
- **Outlets:** Align with connections to below-ground drainage.

614 Fixing and jointing GRP eaves gutters

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

    Stability: Fix securely.

    Fixing centres (nominal): 450 mm.
  - **Additional supports:** At joints in gutters and near angles and outlets.

- **Jointing:**
  - **Method:** Sealed and bolted clip jointing
    and
    Sealed and bolted socket jointing.
  - **Jointing differing gutter systems:** Use adaptors intended for the purpose.
  - **Jointing or mating surfaces:** Clean and, where necessary, lubricate immediately before assembly.
  - **Sealant:** 6 mm continuous bead each side of bolt position.

616 Fixing and jointing cast and extruded metal eaves gutters

- **Fixing:**
  - **Supports:**
    Stability: Fix securely.
    Fixing centres (nominal): 450 mm.
  - **Additional supports:** At joints in gutters and near angles and outlets.
- **Jointing:**
  - **Method:** Sealed and bolted clip jointing
    and
    Sealed and bolted socket jointing.
  - **Jointing differing gutter systems:** Use adaptors intended for the purpose.
  - **Cut ends of gutters:** Clean and square. Remove burrs and swarf.
  - **Jointing or mating surfaces:** Clean and, where necessary, lubricate immediately before assembly.
  - **Sealant:** 6 mm continuous bead each side of bolt position.

618 Fixing and jointing pressed and rolled metal eaves gutters

- **Fixing:**
  - **Supports:**
    Stability: Fix securely.
    Fixing centres (maximum): 450 mm.
  - **Additional supports:** At joints in gutters and near angles and outlets.
- **Jointing:**
  - **Method:** Sealed and bolted clip jointing;
    Sealed and riveted jointing;
    and Sealed clip jointing.
  - **Jointing differing gutter systems:** Use adaptors intended for the purpose.
  - **Cut ends of gutters:** Clean and square. Remove burrs and swarf.
  - **Jointing or mating surfaces:** Clean and, where necessary, lubricate immediately before assembly.
  - **Sealant:** To full contact area.

620 Fixing and jointing PVC-U eaves gutters

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

Stability: Fix securely.

Fixing centres (maximum): 450 mm.

- **Additional supports:** At joints in gutters and near angles and outlets.

- **Jointing:** Clip jointed with integral gaskets.
  - **Method:** Clip jointed with integral gaskets.
  - **Jointing differing gutter systems:** Use adaptors intended for the purpose.
  - **Cut ends of gutters:** Clean and square. Remove burrs and swarf.
  - **Jointing or mating surfaces:** Clean and, where necessary, lubricate immediately before assembly.

638 Fixing and jointing GRP external rainwater pipework

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

    Stability: Fix securely.

    Fixing centres (nominal): Minimum 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 sockets facing upstream.
- **Jointing:**
  - **Method:** Push fit.
  - **Jointing differing pipework systems:** Use adaptors intended for the purpose.
  - **Cut ends of pipes:** Clean and square. Remove burrs and swarf. Chamfer pipe ends before inserting into ring seal sockets.
  - **Jointing or mating surfaces:** Clean and, where necessary, lubricate immediately before assembly.

640 Fixing and jointing cast and extruded metal external gravity rainwater drainage pipework

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

    Stability: Fix securely.

    Fixing centres (nominal): Minimum 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 sockets facing upstream.
- **Jointing:**
  - **Method:** Push fit.
  - **Jointing differing pipework systems:** Use adaptors intended for the purpose.
  - **Cut ends of pipes:** Clean and square. Remove burrs and swarf.

- **Jointing or mating surfaces:** Clean and, where necessary, lubricate immediately before assembly.
- **Unsealed joints:** Wedge joints to cast pipes to prevent rattling.

642 Fixing and jointing pressed metal external gravity rainwater drainage pipework

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

    Stability: Fix securely.

    Fixing centres (nominal): Minimum 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 sockets facing upstream.
- **Jointing:**
  - **Method:** Push fit.
  - **Jointing differing pipework systems:** Use adaptors intended for the purpose.
  - **Cut ends of pipes:** Clean and square. Remove burrs and swarf.
  - **Jointing or mating surfaces:** Clean and, where necessary, lubricate immediately before assembly.

644 Fixing and jointing plastics external gravity rainwater drainage pipework

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

    Stability: Fix securely.

    Fixing centres (nominal): Minimum 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 sockets facing upstream.
- **Jointing:**
  - **Method:** Push fit.
  - **Jointing differing pipework systems:** Use adaptors intended for the purpose.
  - **Cut ends of pipes:** Clean and square. Remove burrs and swarf. Chamfer pipe ends before inserting into ring seal sockets.
  - **Jointing or mating surfaces:** Clean and, where necessary, lubricate immediately before assembly.

658 Installing rainwater pipe identification

- **Position:** Junctions, both sides of slabs, bulkheads and wall penetrations.

662 Access for testing and maintenance of rainwater drainage system

- **Requirement:** Install pipework and gutters with adequate clearance to permit testing, cleaning and maintenance, including painting where necessary.
- **Access fittings and rodding eyes:** Position so that they are not obstructed.

System completion

810 Testing rainwater drainage generally

- **Dates for testing:** Give notice.
- **Period of notice (minimum):** 7 days
- **Pipework:** Complete, and fix securely. Make free from defects, obstruction and debris before testing.
- **Testing:**
  - **Clean water:** Provide.
  - **Testing apparatus:** Provide, including calibration certificates.
  - **Smoke testing:** Do not use.

812 Rainwater drainage internal pipework test – England, Wales, Ireland and Northern Ireland

- **Preparation:** Temporarily seal open ends of pipework with plugs.
- **Test apparatus:** Connect a 'U' tube water gauge and air pump to pipework via a plug.
- **Testing:** Pump air into pipework until gauge registers 38 mm.
- **Required performance:** After a period for temperature stabilization, maintain the pressure of 38 mm without loss for at least 3 minutes.

814 Rainwater drainage internal pipework test – Scotland

- **Testing:**
  - **Standard:** To BS EN 12056-3, National Annex NE.4.2.
  - **Method:** Air pressure test.
- **Required performance:** Pipework to withstand constant pressure of 38 mm water gauge for 3 minutes.

818 Rainwater drainage gutter test

- **Preparation:** Temporarily block all outlets.
- **Testing:** Fill gutters to overflow level and after 5 minutes closely inspect for leakage.
- **Records of tests:** Submit within 5 days.

820 Rainwater drainage system maintenance instructions

- **Printed instructions:** Submit at completion and to form part of project operating and maintenance documentation.
- **Contents:** Recommended procedures for maintenance of the rainwater installation, including full details of recommended inspection, cleaning and repair procedures.

822 Rainwater drainage system pre-handover checks

- **Construction rubbish, debris, swarf, temporary caps and fine dust which may enter the rainwater system:** Remove. Do not sweep or flush into the rainwater system.
- **Access covers, rodding eyes, outlet gratings and the like:** Secure complete with fixings.

830 Documentation

- **Operating and maintenance instructions:**
  - **Scope:** Submit for the system giving optimum settings for controls and refer to the project specific documentation.
  - **Product information:** Include product description, date of purchase, performance characteristics, application (suitability for use), method of operation and control, and cleaning and maintenance requirements.
- **Record drawings:**
  - **Content:** Location and arrangement of plant in plant rooms;
    Location, size and route of drainage services;
    and Location of outlets.
  - **Format:** Refer to the project specific documentation.
- **Submittal date:** Before handover.

50-10-05 Above ground waste water drainage systems

System outline

110 Above ground wastewater drainage system with external stacks

- **Floor drainage:**
  - **Preparation to existing floors:** Cutting out chases in existing concrete;
    Cutting out holes in existing concrete;
    and Cutting out holes in existing timber floors.
    Refer to project specific documentation.
  - **Floor channels and gullies:** 90-05-20/302 Floor channels and 90-05-20/306 Floor gullies.
  - **Supports:**

    Bedding: Submit proposals.

    Backfill: Submit proposals.

    Fixings: Submit proposals.
- **Sanitary pipework:**
  - **Small diameter branch discharge pipework:**

    Traps: 90-10-60/410 Sanitary appliance traps.

    Pipelines and fittings: 90-10-20/326 ABS above ground wastewater branch discharge pipes;
    90-10-20/334 Modified unplasticized polyvinyl chloride (MUPVC) above ground wastewater branch discharge pipes;
    90-10-20/348 High density polyethylene (HDPE) above ground drainage pipes;
    90-10-20/350 Stainless steel above ground drainage pipes;
    90-10-20/354 Unplasticized polyvinyl chloride (PVC-U) above ground drainage pipes;
    and 90-10-65/310 Copper pipelines.
    Refer to project specific documentation.

    Accessories for jointing: 45-75-90/412 PTFE thread sealing tape and Solvent welding cement.

    Supports: Submit proposals.

    Fixings: Submit proposals.

    Insulation: 90-90-40/330 Mineral wool pipe section insulation.
  - **Large diameter branch discharge pipework:**

    Pipelines and fittings: 90-10-20/334 Modified unplasticized polyvinyl chloride (MUPVC) above ground wastewater branch discharge pipes;
    90-10-20/336 Polypropylene above ground wastewater branch discharge pipes;
    90-10-20/344 Cast iron above ground drainage pipes;
    90-10-20/348 High density polyethylene (HDPE) above ground drainage pipes;
    90-10-20/350 Stainless steel above ground drainage pipes;
    and 90-10-20/354 Unplasticized polyvinyl chloride (PVC-U) above ground drainage pipes.
    Refer to project specific documentation.

Accessories for jointing: Cold caulking for traditional cast iron pipework; Solvent welding cement.
Fusion welding.

Supports: Submit proposals.

Fixings: Submit proposals.

Insulation: 90-90-40/330 Mineral wool pipe section insulation type A.

- **Discharge stack pipework:**

  Pipelines and fittings: 90-10-20/344 Cast iron above ground drainage pipes and 90-10-20/348 High density polyethylene (HDPE) above ground drainage pipes.
  Refer to project specific documentation.

  Accessories for jointing: Resin cement caulking for traditional cast iron pipework and Solvent welding cement.

  Supports: Submit proposals.

  Fixings: Submit proposals.

  Insulation: 90-90-40/330 Mineral wool pipe section insulation type A.

- **Ventilating pipework:**
  - **Pipelines and fittings:** 90-10-20/326 ABS above ground wastewater branch discharge pipes;
    90-10-20/334 Modified unplasticized polyvinyl chloride (MUPVC) above ground wastewater branch discharge pipes;
    and 90-10-20/354 Unplasticized polyvinyl chloride (PVC-U) above ground drainage pipes.
    Refer to project specific documentation.
  - **Accessories for jointing:** 45-75-90/412 PTFE thread sealing tape and Solvent welding cement.
  - **Supports:** Submit proposals.
  - **Fixings:** Submit proposals.
- **Prefabricated branch and stack pipework:**
  - **Pipelines and fittings:** 50-10-05/510 Galvanized steel prefabricated drainage pipeline assemblies;
    50-10-05/515 HDPE prefabricated drainage pipeline assemblies;
    and 50-10-05/520 Stainless steel prefabricated drainage pipeline assemblies.
  - **Supports:** Submit proposals.
  - **Fixings:** Submit proposals.
- **Overflow pipework:**
  - **Pipelines and fittings:** 90-10-20/326 ABS above ground wastewater branch discharge pipes;
    90-10-20/334 Modified unplasticized polyvinyl chloride (MUPVC) above ground wastewater branch discharge pipes;
    90-10-20/354 Unplasticized polyvinyl chloride (PVC-U) above ground drainage pipes;
    and 90-10-65/310 Copper pipelines.
  - **Accessories for jointing:** 45-75-90/412 PTFE thread sealing tape and Solvent welding cement.
  - **Supports:**
  - **Fixings:** Submit proposals.

- **Pipework identification:** 90-90-55/430 Identifying pipework.
- **Fire stopping:**
  - **Floor penetrations:** 90-10-60/405 Pipe sleeves;
    45-45-70/433 Flexible intumescent gap sealer;
    and 45-55-75/375 Intumescent foam fillers.
  - **Wall penetrations:** 45-45-70/433 Flexible intumescent gap sealer;
    45-55-75/375 Intumescent foam fillers;
    and 90-10-60/405 Pipe sleeves.
- **System accessories:** 90-10-60/395 Masking plates;
  Access fittings;
  and 90-10-60/437 Discharge and ventilating stack terminations.
- **Execution:** 50-10-05/610 Installing above ground wastewater drainage systems;
  50-10-05/612 Applying above ground wastewater drainage internal pipework identification;
  50-10-05/614 Installing above ground wastewater drainage discharge branch pipework;
  50-10-05/616 Installing above ground wastewater drainage discharge stack pipework generally;
  50-10-05/618 Installing above ground wastewater drainage prefabricated discharge pipework assemblies;
  and 50-10-05/622 Access to above ground wastewater drainage systems for testing and maintenance.
- **System completion:** 50-10-05/810 Testing above ground wastewater drainage systems
  and 50-10-05/860 Documentation.

120 Above ground wastewater drainage system with internal stacks

- **Floor drainage:**
  - **Preparation to existing floors:** Cutting out chases in existing concrete;
    Cutting out holes in existing concrete;
    and Cutting out holes in existing timber floors.
    Refer to project specific documentation.
  - **Floor channels and gullies:** 90-05-20/302 Floor channels and 90-05-20/306 Floor gullies.
  - **Supports:**

    Bedding: Submit proposals.

    Backfill: Submit proposals.

    Fixings: Submit proposals.
- **Sanitary pipework:**
  - **Small diameter branch discharge pipework:**

    Traps: 90-10-60/410 Sanitary appliance traps.

    Pipelines and fittings: 90-10-20/326 ABS above ground wastewater branch discharge pipes;
    90-10-20/334 Modified unplasticized polyvinyl chloride (MUPVC) above ground wastewater branch discharge pipes;
    90-10-20/336 Polypropylene above ground wastewater branch discharge pipes;
    90-10-20/348 High density polyethylene (HDPE) above ground drainage pipes;
    90-10-20/350 Stainless steel above ground drainage pipes;
    and 90-10-20/354 Unplasticized polyvinyl chloride (PVC-U) above ground drainage pipes.
    Refer to project specific documentation.

Accessories for jointing: 45-75-90/412 PTFE thread sealing tape and Solvent welding cement.

Supports: Submit proposals.

Fixings: Submit proposals.

- **Large diameter branch discharge pipework:**

  Pipelines and fittings: 90-10-20/336 Polypropylene above ground wastewater branch discharge pipes;
  90-10-20/344 Cast iron above ground drainage pipes;
  90-10-20/348 High density polyethylene (HDPE) above ground drainage pipes;
  90-10-20/350 Stainless steel above ground drainage pipes;
  and 90-10-20/354 Unplasticized polyvinyl chloride (PVC-U) above ground drainage pipes.

  Accessories for jointing: Solvent welding cement.

  Supports: Submit proposals.

  Fixings: Submit proposals.

  Insulation: 90-90-40/330 Mineral wool pipe section insulation type A.

- **Discharge stack pipework:**

  Pipelines and fittings: 90-10-20/336 Polypropylene above ground wastewater branch discharge pipes;
  90-10-20/344 Cast iron above ground drainage pipes;
  90-10-20/348 High density polyethylene (HDPE) above ground drainage pipes;
  and 90-10-20/350 Stainless steel above ground drainage pipes.
  Refer to project specific documentation.

  Accessories for jointing: Resin cement caulking for traditional cast iron pipework and Solvent welding cement.

  Supports: Submit proposals.

  Fixings: Submit proposals.

  Insulation: 90-90-40/330 Mineral wool pipe section insulation type A.

- **Ventilating pipework:**
  - **Ventilating branch pipework:**

    Pipelines and fittings: 90-10-20/326 ABS above ground wastewater branch discharge pipes;
    90-10-20/334 Modified unplasticized polyvinyl chloride (MUPVC) above ground wastewater branch discharge pipes;
    90-10-20/336 Polypropylene above ground wastewater branch discharge pipes;
    and 90-10-20/354 Unplasticized polyvinyl chloride (PVC-U) above ground drainage pipes.
    Refer to project specific documentation.

    Accessories for jointing: 45-75-90/412 PTFE thread sealing tape and Solvent welding cement.

    Supports:

    Fixings: Submit proposals.

  - **Ventilating stack pipework:**

    Pipelines and fittings: 90-10-20/344 Cast iron above ground drainage pipes and 90-10-20/354 Unplasticized polyvinyl chloride (PVC-U) above ground drainage pipes.

Accessories for jointing: Resin cement caulking for traditional cast iron pipework and Solvent welding cement.

Supports: Submit proposals.

Fixings: Submit proposals.

- **Prefabricated branch and stack pipework:**
  - **Pipelines and fittings:** 50-10-05/510 Galvanized steel prefabricated drainage pipeline assemblies;
    50-10-05/515 HDPE prefabricated drainage pipeline assemblies;
    and 50-10-05/520 Stainless steel prefabricated drainage pipeline assemblies.
  - **Supports:** Submit proposals.
  - **Fixings:** Submit proposals.
  - **Insulation:** 90-90-40/330 Mineral wool pipe section insulation type A.
- **Overflow pipework:**
  - **Pipelines and fittings:** 90-10-20/326 ABS above ground wastewater branch discharge pipes;
    90-10-20/334 Modified unplasticized polyvinyl chloride (MUPVC) above ground wastewater branch discharge pipes;
    90-10-20/354 Unplasticized polyvinyl chloride (PVC-U) above ground drainage pipes;
    and 90-10-65/310 Copper pipelines.
    Refer to project specific documentation.
  - **Accessories for jointing:** 45-75-90/412 PTFE thread sealing tape and Solvent welding cement.
  - **Supports:** Submit proposals.
  - **Fixings:** Submit proposals.
- **Pipework identification:** 90-90-55/430 Identifying pipework.
- **Fire stopping:**
  - **Floor penetrations:** 45-45-70/433 Flexible intumescent gap sealer;
    45-55-75/375 Intumescent foam fillers;
    and 90-10-60/405 Pipe sleeves.
  - **Wall penetrations:** 45-45-70/433 Flexible intumescent gap sealer;
    45-55-75/375 Intumescent foam fillers;
    and 90-10-60/405 Pipe sleeves.
- **System accessories:** 90-10-60/395 Masking plates;
  90-10-60/437 Discharge and ventilating stack terminations;
  and Access fittings.
- **Execution:** 50-10-05/610 Installing above ground wastewater drainage systems;
  50-10-05/612 Applying above ground wastewater drainage internal pipework identification;
  50-10-05/614 Installing above ground wastewater drainage discharge branch pipework;
  50-10-05/616 Installing above ground wastewater drainage discharge stack pipework generally;
  50-10-05/618 Installing above ground wastewater drainage prefabricated discharge pipework assemblies;
  and 50-10-05/622 Access to above ground wastewater drainage systems for testing and maintenance.
- **System completion:** 50-10-05/810 Testing above ground wastewater drainage systems and 50-10-05/860 Documentation.

Custom made products

510 Galvanized steel prefabricated drainage pipeline assemblies

- **Standard:** To BS 3868.
- **Design and fabrication:** To BS EN 12056-1, BS EN 12056-3 and BS EN 12056-5.
- **Shop drawings:** Submit.
- **Damage:** Do not cut pipes to length or otherwise damage coatings.
- **Accessories:** Access fittings and Insulation.

515 HDPE prefabricated drainage pipeline assemblies

- **Standard:** To BS EN 1519-1.
- **Design and fabrication:** To BS EN 12056-1, BS EN 12056-3 and BS EN 12056-5.
- **Shop drawings:** Submit.
- **Accessories:** Expansion sockets.

520 Stainless steel prefabricated drainage pipeline assemblies

- **Standard:** To BS 3868.
- **Design and fabrication:** To BS EN 12056-1, BS EN 12056-3 and BS EN 12056-5.
- **Shop drawings:** Submit.
- **Damage:** Do not cut pipes to length or otherwise damage coatings.
- **Accessories:** Access fittings and Insulation.

Execution

610 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.

612 Applying above ground wastewater drainage internal pipework identification

- **Standard:** To BS 1710.
- **Method:** Integral lettering on pipe wall, self-adhesive bands or identification clips.
- **Form:**
  - **Wastewater system without recycling:**

    Definition: All wastewater from sanitary appliances and sinks.

    Direction of flow: White arrow on black background.

    Wording: White lettering 'FOUL DRAINAGE' on a black background.
  - **Blackwater in system with recycling:**

    Definition: Containing faecal matter or urine.

    Direction of flow: White arrow on black background.

    Wording: White lettering 'FOUL DRAINAGE' on a black background.
  - **Greywater in system with recycling:**

    Definition: As defined in BS EN 12056-1, clause 3.1.

    Direction of flow: Black arrow on light grey background.

    Wording: Black lettering 'GREYWATER' on a light grey background.

614 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.

616 Installing above ground wastewater drainage discharge stack pipework generally

- **Pipework:**
  - **Alignment:** Fix securely plumb and true to line.
  - **Externally socketed pipes and fittings:** Fix with sockets facing upstream.
  - **Vertical pipes:** Provide a loadbearing support not less than every storey level. Locate

at or close below socket collar or coupling. Tighten fixings as work proceeds so that every storey is self-supporting.
  - **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.
- **Expansion joint sockets:** Fix rigidly to the building.
- **Fixings:** Allow the pipe to slide.

618 Installing above ground wastewater drainage prefabricated discharge pipework assemblies

- **Jointing on site:**
  - **Protection:** Provide protection as installation proceeds;
    Do not cut pipes to length;
    Do not damage coatings;
    and Make good damaged coatings as recommended by pipework manufacturer.
  - **Expansion joints (minimum provision):** At every floor level.
  - **Waste pipes:** Connect with compression fittings.

622 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.

System completion

810 Testing above ground wastewater drainage systems

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

860 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:** *Refer to project specific documentation.*

- **Record drawings:**
  - **Format:** *Refer to project specific documentation.*
- **Submittal date:** Before handover.

55-40-40 Hot & cold water supply systems

System outline

110 Incoming water supply

- **Standards:** Water Supply (Water Fitting) Regulations 1999;
  Water Supply (Water Quality) Regulations 2001
- **Codes and Guidance:** HSE L8;
  HSG 374, Parts 2 & 3 - as applicable
- **Valves:** 90-10-90/312 Gate valves for waterworks;
  90-10-90/314 Stop valves for potable water;
  90-10-90/316 Copper alloy underground stop valves;
  and 90-10-90/318 Backflow prevention devices.
- **System completion:** 55-40-40/850 Water quality tests.

120 Cold water supply system

- **Water meters:** 90-65-55/470 Water meters.
- **Storage tank or cistern:** 90-10-95/310 Glass reinforced tanks and cisterns;
  90-10-95/340 Moulded plastics cisterns;
  90-10-95/350 Prefabricated galvanized steel cisterns;
  90-10-95/360 Prefabricated galvanized steel tanks;
  and 90-10-95/390 Sectional steel tank.
- **Pipelines:**
  - **Below ground:** 90-10-65/365 Polyethylene (PE) pipelines for water supply.
  - **Above ground:** 90-10-65/365 Polyethylene (PE) pipelines for water supply;
    90-10-65/310 Copper pipelines;
    90-10-65/355 Polybutylene (PB) pipelines;
    and 90-10-65/395 Stainless steel pipelines.
- **General:** All pipelines, components and fittings for wholesome water must be WRAS approved.
  Do not use flexible connectors except where essential for vibration isolation or the operation of equipment.
- **Pipeline accessories:**
  - **Expansion devices:** 90-10-60/325 Axial expansion compensators and 90-10-60/320 Angular expansion compensators.
  - **Gauges:** 90-10-60/370 Pressure gauges;
    90-10-60/375 Pressure and altitude gauges;
    90-10-60/380 Temperature gauges;
    and 90-10-60/385 Gauge mounting boards.
  - **Accessories:** 90-10-60/395 Masking plates;
    90-10-60/400 Pipeline strainers;
    90-10-60/405 Pipe sleeves;
    90-10-60/420 Tundishes;
    90-10-60/445 Puddle flanges;
    and 90-10-60/450 Pipe flange collars.

- **Valves:**
  - **Schedules:** Allow for suitable valves and submit proposals, based on preferred manufacturers identified, or other project specific documentation.
  - **General requirements:** 90-10-90/300 Valves generally
  - **Float valves:** 90-10-90/320 Float operated valves.
  - **Isolating valves:** 90-10-90/332 Butterfly valves;
    90-10-90/336 Cast iron gate valves;
    and 90-10-90/342 Copper alloy gate valves.
  - **Check valves:** 90-10-90/348 Cast iron check valves;
    90-10-90/350 Carbon steel globe stop and check valves;
    90-10-90/352 Copper alloy check valves;
    and .
  - **Regulating valves:** 90-10-90/356 Double regulating valves;
    90-10-90/358 Flow measuring devices;
    90-10-90/410 Pressure regulating valves;
    and 90-10-90/415 Pressure relief valves.
  - **Draining devices:** 90-10-90/374 Draining taps type A and 90-10-90/374 Draining taps type B.
  - **Accessories:** 90-10-90/318 Backflow prevention devices and 90-10-90/360 Test points.
- **Thermal insulation:**
  - **Pipelines:** 90-90-40/330 Mineral wool pipe section insulation type A and 90-90-40/350 Nitrile rubber insulation type A.
    90-90-40/301 Insulation Generally
  - **Tanks:** 90-90-40/320 Metal mesh faced mineral wool mattresses and .
- **Vibration isolation:** 90-90-95/330 Spring isolators;
  90-90-95/320 Compression isolators;
  90-90-95/370 Isolation hangers;
  90-90-95/360 Inertia bases;
  90-90-95/380 Flexible hoses;
  90-90-95/390 Rubber bellows;
  and 90-90-95/350 Pad mountings.
- **Outlets:** *Generally specified by others (Architect/Contract Administrator) - refer to project specific documentation*
- **Flexible connections to outlets:** Do not use for potable water unless a flexible connection is essential either for the operation of mobile equipment, or to isolate from vibration.
- **Controls:** *Refer to BMS / Controls Specifications.*
- **Plant and equipment identification:** 90-90-55/430 Identifying pipework;
  90-90-55/440 Plastic warning devices for underground cables and pipelines;
  90-90-55/480 Mechanical plant and equipment identification labels type A;
  90-90-55/490 Valve charts and schematics;
  and 90-90-55/495 Valve identification labels.
- **Execution:** 55-40-40/620 Installing hot and cold water systems generally;
  55-40-40/650 Hydraulic pressure testing of hot and cold water supply systems;
  55-40-40/660 Flushing hot and cold water systems;
  and 55-40-40/670 Disinfection of hot and cold water systems.
- **System completion:** 55-40-40/850 Water quality tests;
  55-40-40/810 Commissioning of hot and cold water supply systems;

55-40-40/820 Inspection and test records;
55-40-40/830 Demonstrations;
55-40-40/840 Documentation;
55-40-40/860 Spares;
and 55-40-40/880 Maintenance.

130 Pumped cold water supply system

- **Cold water systems generally:** As cold water supply system (55-40-40/120)
- **Cold water boosting:**
  - **Pressure booster sets:** 90-10-70/390 Pressure booster sets.
  - **Method:** Flooded suction or suction lift to directly pressurize hot and cold water systems and Flooded suction to pressurize cold water system to high level tank. *Refer to project specific documentation*
  - **Surge protection:** Provide surge arrestor at head of each and every rising main; Ensure adequate space allowance for fitting, access and maintenance.

    Provide soft fill function to booster.

140 Instantaneous hot water supply system

- **Instantaneous water heater:** 90-15-35/390 Instantaneous shower units, electric;
  90-15-35/400 Instantaneous water heaters, electric;
  90-15-35/410 Instantaneous water heaters, gas fired;
  and 90-15-35/420 Instantaneous water heaters, packaged plate heat exchangers.
- **Flues:** 90-40-30/310 Metal flues and chimneys and Balanced flues.
- **Pumps:** 90-10-70/340 Canned rotor pumps and 90-10-70/360 Close coupled in line pumps.
- **Pipelines:** 90-10-65/310 Copper pipelines;
  90-10-65/355 Polybutylene (PB) pipelines;
  and 90-10-65/365 Polyethylene (PE) pipelines for water supply.
- **Pipeline accessories:** 90-10-60/395 Masking plates;
  90-10-60/400 Pipeline strainers;
  90-10-60/405 Pipe sleeves;
  and 90-10-60/420 Tundishes.
- **Valves:**
  - **Isolating valves:** 90-10-90/342 Copper alloy gate valves.
  - **Check valves:** 90-10-90/352 Copper alloy check valves.
  - **Draining devices:** 90-10-90/374 Draining taps type A.
  - **Accessories:** 90-10-90/360 Test points.
  - **General requirements:** 90-10-90/300 Valves generally
- **Thermal insulation:** 90-90-40/330 Mineral wool pipe section insulation type A and 90-90-40/350 Nitrile rubber insulation type A.
  90-90-40/301 Insulation Generally
- **Outlets:** Generally specified by others (Architect / Contract Administrator) - refer to project specific documentation
- **Controls:** Automated control and monitoring system as described in the BMS/Controls Specification

- **Plant and equipment identification:** 90-90-55/430 Identifying pipework;
  90-90-55/480 Mechanical plant and equipment identification labels type A;
  90-90-55/490 Valve charts and schematics;
  and 90-90-55/495 Valve identification labels.
- **Connections to outlets:** Do not use for potable water unless a flexible connection is essential either for the operation of mobile equipment, or to isolate from vibration.
- **Execution:** 55-40-40/620 Installing hot and cold water systems generally;
  55-40-40/650 Hydraulic pressure testing of hot and cold water supply systems;
  55-40-40/660 Flushing hot and cold water systems;
  55-40-40/670 Disinfection of hot and cold water systems;
  and 55-40-40/630 Installing unvented hot water storage discharge pipes.
- **System completion:** 55-40-40/810 Commissioning of hot and cold water supply systems;
  55-40-40/820 Inspection and test records;
  55-40-40/830 Demonstrations;
  55-40-40/850 Water quality tests;
  55-40-40/860 Spares;
  and 55-40-40/880 Maintenance.

150 Direct hot water storage supply system

- **Storage unit:** 90-15-35/310 Direct hot water storage cylinders;
  90-15-35/320 Direct insulated combination units;
  90-15-35/440 Storage water heaters, electric;
  and 90-15-35/450 Storage water heaters, gas fired.
  90-15-35/301 Hot water storage cylinders / calorifiers generally
- **Electric immersion heater:** 90-15-35/460 Immersion heaters.
- **Flues:** 90-40-30/310 Metal flues and chimneys and Balanced flues.
- **System:** Vented and Unvented.
- **Pumps:** 90-10-70/340 Canned rotor pumps and 90-10-70/360 Close coupled in line pumps.
- **Pipelines:** 90-10-65/310 Copper pipelines.
- **Pipeline accessories:**
  - **Expansion devices:** Natural fexibility (preferred)
    90-10-60/320 Angular expansion compensators and 90-10-60/325 Axial expansion compensators.
  - **Gauges:** 90-10-60/370 Pressure gauges;
    90-10-60/375 Pressure and altitude gauges;
    90-10-60/380 Temperature gauges;
    and 90-10-60/385 Gauge mounting boards.
  - **Accessories:** 90-10-60/395 Masking plates;
    90-10-60/400 Pipeline strainers;
    90-10-60/405 Pipe sleeves;
    and 90-10-60/420 Tundishes.
- **Valves:**
  - **Schedule:** Allow for suitable valves and submit proposals, based on preferred manufacturers identified, or other project specific documentation.
  - **General requirements:** 90-10-90/300 Valves generally
  - **Isolating valves:** 90-10-90/332 Butterfly valves;

90-10-90/342 Copper alloy gate valves;
and 90-10-90/344 Copper alloy globe valves.
- **Check valves:** 90-10-90/352 Copper alloy check valves and .
- **Regulating valves:** 90-10-90/356 Double regulating valves;
90-10-90/358 Flow measuring devices;
and 90-10-90/410 Pressure regulating valves.
- **Mixing valves:** 90-10-90/366 Low pressure thermostatic mixing valves;
90-10-90/370 Thermostatic mixing valves;
and 90-10-90/372 Thermostatic mixing valves for use in care establishments.
- **Draining devices:** 90-10-90/374 Draining taps type A.
- **Accessories:** 90-10-90/360 Test points.

- **Thermal insulation:**
  - **Pipelines:** 90-90-40/330 Mineral wool pipe section insulation type A;
  90-90-40/350 Nitrile rubber insulation type A;
  and 90-90-40/301 Insulation Generally.
  - **Cylinders:** 90-90-40/320 Metal mesh faced mineral wool mattresses;
  90-90-40/340 Mineral wool slabs insulation;
  and 90-90-40/301 Insulation Generally.
- **Vibration isolation:** 90-90-95/320 Compression isolators;
90-90-95/330 Spring isolators;
90-90-95/350 Pad mountings;
90-90-95/360 Inertia bases;
90-90-95/370 Isolation hangers;
90-90-95/380 Flexible hoses;
and 90-90-95/390 Rubber bellows.
- **Outlets:** Generally specified by others (Architect/Contract Administrator)
- refer to project specific documentation
- **Connections to outlets:** Do not use flexible hoses for potable water unless a flexible connection is essential either for the operation of mobile equipment, or to isolate from vibration.
- **Controls:** Automated control and monitoring system as described in the BMS/Controls Specification;
- **Accessories:** 90-10-85/310 Electrical resistance surface trace heating;
90-90-60/380 Roof equipment supports;
and 90-90-60/390 Channel supports type A.
- **Plant and equipment identification:** 90-90-55/430 Identifying pipework;
90-90-55/440 Plastic warning devices for underground cables and pipelines;
90-90-55/480 Mechanical plant and equipment identification labels type A;
90-90-55/490 Valve charts and schematics;
and 90-90-55/495 Valve identification labels.
- **Execution:** 55-40-40/620 Installing hot and cold water systems generally;
55-40-40/630 Installing unvented hot water storage discharge pipes;
55-40-40/650 Hydraulic pressure testing of hot and cold water supply systems;
55-40-40/660 Flushing hot and cold water systems;
and 55-40-40/670 Disinfection of hot and cold water systems.
- **System completion:** 55-40-40/810 Commissioning of hot and cold water supply systems;
55-40-40/820 Inspection and test records;
55-40-40/830 Demonstrations;

55-40-40/850 Water quality tests;
55-40-40/860 Spares;
and 55-40-40/880 Maintenance.

160 Indirect hot water storage supply system

- **Primary heat source:** 90-40-05/330 Gas fired boilers;
  90-40-05/340 Gas fired condensing boilers;
  90-40-05/350 Gas fired cast iron boilers;
  and 90-40-05/360 Gas fired steel shell boilers.
- **Primary:** Sealed.
- **Storage unit:** 90-15-35/330 Multi-coil hot water storage cylinders;
  90-15-35/340 Indirectly heated unvented hot water storage;
  90-15-35/350 Indirect hot water storage cylinders, double feed;
  90-15-35/360 Indirect hot water storage cylinders, single feed;
  90-15-35/370 Double feed indirect insulated combination units;
  and 90-15-35/380 Single feed indirect insulated combination units.90-15-35/301 Hot water storage cylinders / calorifiers generally
- **Electric immersion heater:** Required, unless otherwise specified
- **Pumps:**
  - **Primary hot water supply:** 90-10-70/340 Canned rotor pumps;
    90-10-70/350 Close coupled end suction pumps;
    and 90-10-70/360 Close coupled in line pumps.
  - **Secondary hot water supply:** 90-10-70/340 Canned rotor pumps;
    90-10-70/350 Close coupled end suction pumps;
    and 90-10-70/360 Close coupled in line pumps.
- **Pipelines:** 90-10-65/310 Copper pipelines and 90-10-65/395 Stainless steel pipelines.
- **Pipeline accessories:**
  - **Expansion devices:** Natural Flexibility (Preferred);
    90-10-60/320 Angular expansion compensators and 90-10-60/325 Axial expansion compensators.
  - **Gauges:** 90-10-60/370 Pressure gauges;
    90-10-60/375 Pressure and altitude gauges;
    90-10-60/380 Temperature gauges;
    and 90-10-60/385 Gauge mounting boards.
  - **Accessories:** 90-10-60/395 Masking plates;
    90-10-60/400 Pipeline strainers;
    90-10-60/405 Pipe sleeves;
    and 90-10-60/420 Tundishes.
- **Valves:**
  - **Schedules:** Allow for suitable valves and submit proposals, based on preferred manufacturers identified, or other project specific documentation.
  - **General:** 90-10-90/300 Valves generally
  - **Isolating valves:** 90-10-90/332 Butterfly valves;
    90-10-90/336 Cast iron gate valves;
    90-10-90/342 Copper alloy gate valves;
    and 90-10-90/344 Copper alloy globe valves.
  - **Check valves:** 90-10-90/352 Copper alloy check valves and .

- **Regulating valves:** 90-10-90/356 Double regulating valves;
  90-10-90/358 Flow measuring devices;
  and 90-10-90/410 Pressure regulating valves.
- **Mixing valves:** 90-10-90/366 Low pressure thermostatic mixing valves;
  90-10-90/370 Thermostatic mixing valves;
  and 90-10-90/372 Thermostatic mixing valves for use in care establishments.
- **Draining devices:** 90-10-90/374 Draining taps type A.
- **Accessories:** 90-10-90/360 Test points.

- **Thermal insulation:**
  - **Pipelines:** 90-90-40/330 Mineral wool pipe section insulation type A and 90-90-40/350 Nitrile rubber insulation type A.
    90-90-40/301 Insulation Generally
  - **Cylinders:** 90-90-40/320 Metal mesh faced mineral wool mattresses and 90-90-40/340 Mineral wool slabs insulation.
    90-90-40/301 Insulation Generally
- **Vibration isolation:** 90-90-95/320 Compression isolators;
  90-90-95/330 Spring isolators;
  90-90-95/350 Pad mountings;
  90-90-95/360 Inertia bases;
  90-90-95/370 Isolation hangers;
  90-90-95/380 Flexible hoses;
  and 90-90-95/390 Rubber bellows.
- **Controls:** Refer to Controls/BMS specification
- **Outlets:** Generally specified by others (Architect/Contract Administrator) - refer to project specific documentation
- **Connections to outlets:** Do not use for potable water unless a flexible connection is essential either for the operation of mobile equipment, or to isolate from vibration.
- **Accessories:** 90-10-85/310 Electrical resistance surface trace heating;
  90-90-60/380 Roof equipment supports;
  90-90-60/390 Channel supports type A;
  and 90-10-60/455 Expansion vessels.
- **Plant and equipment identification:** 90-90-55/430 Identifying pipework;
  90-90-55/440 Plastic warning devices for underground cables and pipelines;
  90-90-55/480 Mechanical plant and equipment identification labels type A;
  90-90-55/490 Valve charts and schematics;
  and 90-90-55/495 Valve identification labels.
- **Execution:** 55-40-40/620 Installing hot and cold water systems generally;
  55-40-40/650 Hydraulic pressure testing of hot and cold water supply systems;
  55-40-40/660 Flushing hot and cold water systems;
  and 55-40-40/670 Disinfection of hot and cold water systems.
- **System completion:** 55-40-40/810 Commissioning of hot and cold water supply systems;
  55-40-40/820 Inspection and test records;
  55-40-40/830 Demonstrations;
  55-40-40/850 Water quality tests;
  55-40-40/860 Spares;
  and 55-40-40/880 Maintenance.

Execution

620 Installing hot and cold water systems generally

- **Standard:** To BS 8558 and BS EN 806-4.
- **Applicable content:** BESA TR/20 standards are wide ranging and include some material options not listed within this specification. Do NOT use such options.
  However, where, within allowable options, the BESA standards include requirements that are not detailed or referred to in this specification, such requirements apply.
  In addition, where requirements of this specification are in addition to those within the BESA standards, comply with the requirements of this specification.
- **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.

630 Installing unvented hot water storage discharge pipes

- **Fall (minimum):** 1 in 80.
- **Discharge:**
  - **Method:** Via an air break and tundish.
  - **Size:** At least the diameter of the outlet of the safety device.
  - **Tundish discharge:** At least one diameter larger than the outlet of the safety device.

650 Hydraulic pressure testing of hot and cold water supply systems

- **Standard:** To BS 8558 and BS EN 806-4.
- **Test equipment:** Provide certified pressure gauge;
  Disconnect pressure pump and ancillaries during test period.
- **Notice (minimum):** 5 working days
- **Pressure:** 1.5 times working pressure.
  minimum 5 bar.
- **Duration of test:** 2 h.
  Note: where systems fail the initial test, increase the test period to 4 hours for subsequent testing.

660 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.

670 Disinfection of hot and cold water systems

- **Standard:** To BS EN 806-4.
- **Requirements:** Carry out on all hot and cold water pipework and equipment including feed tanks and cisterns and draw-off pipework;
  Complete prior to any water being drawn off for use.
- **Samples for analysis:** Provide after flushing, taken from representative sampling points at draw-off and storage positions with the systems at working temperatures.

System completion

810 Commissioning of hot and cold water supply systems

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

820 Inspection and test records

- **Construction phase reports:** System design is commissionable;
  Post-installation;
  System cleanliness;
  and System commissionable.
- **Records for water systems:** In accordance with BSRIABG 2/2010.
- **Record sheets:**
  - **Submission:** On completion, before handover.

830 Demonstrations

- **Instruction:** Instruct and demonstrate the purpose, function and operation of the installations.

840 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:** As set out in Part A
  - **Number of copies:** As set out in Part A
- **Record drawings:**
  - **Content:** As set out in Part A

- **Format:** As set out in Part A
- **Number of copies:** As set out in Part A

- **Submittal date:** Before handover.
- **Wholesome water consumption notice:** Submit within five days.

850 Water quality tests

- **Standard:** To BS EN 806-4.
- **Samples:**
  - **Sample points:** Main supply to site;
    Hot water storage cylinder;
    Cold water storage cistern;
    and selection of outlets across the system.
  - **Samples for analysis:** Submit samples for bacteriological analysis.
    For the main supply use three samples taken over a period of seven days at different times of day and additionally confirm size and quantity of undissolved solids.
- **Water temperature:** Record at each sampling point at the time of taking the sample.
- **Test results:**
  - **Record:** Details of all analyses.
  - **Submit:** Within 5 days of completion of the tests.
  - **Number of copies:** Three paper and one electronic.

860 Spares

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

880 Maintenance

- **Servicing and maintenance:** Undertake for 12 months after completion, unless identified otherwise within project specific documentation.

55-45-30 Fuel oil supply systems

System outline

110 Fuel oil supply system

- **Supply arrangement:** Gravity supply;
  Sub-gravity supply;
  and Pumped supply.
- **Class of oil:** D to BS 2869;
  E to BS 2869;
  F to BS 2869;
  G to BS 2869;
  and H to BS 2869.
- **Service tanks:** and .
  - **Tank type:** 90-25-50/360 Carbon steel oil tanks and 90-25-50/365 Plastics oil tanks.
  - **Tank accessories:** 90-25-50/310 Contents gauges.
- **Storage tanks:**
  - **Tank type:** 90-25-50/360 Carbon steel oil tanks and 90-25-50/365 Plastics oil tanks.
  - **Tank accessories:** 90-25-50/310 Contents gauges and 90-25-50/380 Overfill alarms and overfill prevention devices.
- **Secondary containment:** Drip Tray or Bund to contain 110% of total storage capacity.
- **Oil heating methods:** 90-25-50/385 Outflow heaters;
  90-25-50/420 Tank heaters;
  and 90-10-85/320 Electrical resistance surface heating for hazardous environments.
- **Supply pipelines:** 90-10-65/310 Copper pipelines and 90-10-65/415 Steel pipelines.
- **Vent pipes:** Copper pipelines and Steel pipelines.
- **Pipeline accessories:** 90-25-45/310 Anti-syphon valves;
  90-25-45/320 De-aeration devices;
  90-25-45/330 Filters;
  90-25-45/340 Remote acting fire safety valves;
  90-25-45/350 Strainers;
  90-25-45/360 Water separators;
  90-65-55/420 Oil meters;
  and 90-25-50/320 Fill points.
- **Oil pump:** Burner pump and 90-10-70/370 Fuel transfer pumps.
- **Outlets:** Dual fuel fired cast iron boilers;
  Dual fuel fired steel shell boilers;
  Oil fired cast iron boilers;
  Oil fired steel shell boilers;
  Oil fired steam boilers;
  Generator set;
  and Packaged CHP units.
- **Plant and equipment identification:** 90-90-55/430 Identifying pipework;
  90-90-55/480 Mechanical plant and equipment identification labels type A;

90-90-55/490 Valve charts and schematics;
and 90-90-55/495 Valve identification labels.

- **Execution:** 55-45-30/630 Installing oil supply pipelines.
- **System completion:** 55-45-30/820 Commissioning and performance testing;
55-45-30/840 Inspection and test records;
and 55-45-30/810 Documentation.

Execution

630 Installing oil supply pipelines

- **Installation:** In accordance with BS 5410-2 and OFTEC Technical Book 3.

System completion

810 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 copy.
  - **Number of copies:** As set out in General Clauses / Preliminaries
- **Record drawings:**
  - **Content:** Location, size and route of mechanical services and Location, size, route and depth of underground services.
  - **Format:** As set out in General Clauses / Preliminaries
  - **Number of copies:** As set out in General Clauses / Preliminaries
- **Commissioning certificates:**
  - **Format:** Electronic copy.
- **Submittal date:** Before handover.

820 Commissioning and performance testing

- **Commissioning:** In accordance with OFTEC Technical Book 2 and OFTEC Technical Book 5.
- **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.
- **Results:** Include within commissioning certificates and O&M manuals.

55-60-55 Natural gas supply systems

System outline

110 Incoming gas supply

- **Requirements:** Refer to project specific documentation, Part B, for requirements for the incoming gas supply.
- **Gas meter:** Ensure gas meter is supplied and installed complete with a pulsed output suitable for connection to a BMS system. (Often referred to as a "Chatterbox")

120 Natural gas supply system

- **Metering:** 90-65-55/400 Secondary gas meters.
- **Pipeline material:** 90-10-65/310 Copper pipelines;
  90-10-65/360 Polyethylene (PE) pipelines for gaseous fuels;
  90-10-65/410 Corrugated stainless steel for gaseous fuels;
  and 90-10-65/415 Steel pipelines.
- **Support:** 90-90-60/380 Roof equipment supports and 90-90-60/390 Channel supports type A.
- **Gas valves:** 90-10-90/380 Ball valves, manually operated;
  90-10-90/382 Plug valves, cast iron;
  90-10-90/384 Plug valves, steel;
  90-10-90/386 Plug valves, taper;
  90-30-35/320 Gas solenoid valves;
  and 90-30-35/330 Mechanical gas safety valves.
- **Gas equipment:** 90-30-35/340 Gas boosters;
  90-30-35/350 Gas filters;
  90-30-35/360 Gas pressure switches;
  and 90-30-35/370 Safety and control devices.
- **Plant and equipment identification:** 90-90-55/430 Identifying pipework;
  90-90-55/480 Mechanical plant and equipment identification labels type A;
  90-90-55/490 Valve charts and schematics;
  and 90-90-55/495 Valve identification labels.
- **Execution:** 55-60-55/630 Gas Safe registration requirements;
  55-60-55/650 Installing gas pipelines;
  and 55-60-55/670 Connection to gas outlets.
- **System completion:** 55-60-55/810 Testing gas pipeline installations;
  55-60-55/840 Commercial and industrial gas installations;
  55-60-55/850 Pressure testing of natural gas supply systems;
  55-60-55/870 Inspection and test records;
  and 55-60-55/880 Maintenance.

Execution

630 Gas Safe registration requirements

- **Type of service:** All services;
  Domestic;
  and Non-domestic.
- **Type of gas:** Natural gas.
- **Application:** 1) All gas systems are to be inspected by an approved "Gas Safe" technician and a certificate issued.

  2) All gas fired equipment must be connected, tested and adjusted as necessary by an approved "Gas Safe" registered technician who must issue a certificate confirming this has been carried out satisfactorily.
- **Area of work:** All areas.

650 Installing gas pipelines

- **Standards:**
  - **General:** To IGEMStandard UP/10.
  - **Gas pipelines:** To BS 6891 and BS EN 1775;
    To BS EN 15001-1;
    and In accordance with TR/20 Part 9.
- **Confined spaces:** Where gas pipework is routed via a confined space with limited ventilation, including ceiling voids, risers and the like, ensure adequate natural ventilation is provided to prevent a build up of gas in the event of a leak.
- **Burried pipelines:**
  - **Standards:** IM/16 - December: 1988;
    BGC/PS/PL2 - Part 1: Pipework;
    BGC/PS/PL2 - Part 2 or PL3: Fittings;
    BGC/PS/V7 - Part 7: Pipe markings and valves;
  - **Excavation and Fill:** Cover 600mm min;
    Bed 150mm;
    Pipe surrounded by: 150mm sand or sifted pea gravel;
  - **Marker tape:** Yellow metal mesh tape, 150mm wide, 200mm above pipe along entire length;
  - **Routing:** Minimum 600mm from any potable water pipe;

670 Connection to gas outlets

- **Equipment:** As provided under the project and any retained existing;
- **Connection:** Connect to installed equipment.
  Fit local isolating valve.

System completion

810 Testing gas pipeline installations

- **Standards:**
  - **Testing, purging and commissioning:** To BS 6891 and BS EN 1775.
  - **Soundness testing and purging:** To IGEM/UP/1A.
  - **Tightness testing and direct purging:** To IGEM/UP/1B

840 Commercial and industrial gas installations

- **Soundness testing and purging:** To IGEM/UP/1.
- **Testing, purging and commissioning pipelines:** To BS EN 15001-2.
- **Commissioning gas fired plant:** To IGEM/UP/4.

850 Pressure testing of natural gas supply systems

- **Notice (minimum):** 1 week.
- **Pressure:** 2 times working pressure.
- **Duration of test:** 2 h

870 Inspection and test records

- **Record sheets:**
  - **Submission:** On completion.

880 Maintenance

- **Servicing and maintenance:** Generally 12 months. Refer to project specific documentation for possible alternative requirements.

60-45-10 Chilled water systems

System outline

110 Chilled water system

- **Cooling source:** 90-40-10/330 Air cooled liquid chillers and 90-40-10/360 Water cooled liquid chillers.
- **Condensers:** 90-40-10/320 Air cooled condensing units;
  90-40-10/380 Closed circuit cooling towers;
  90-40-10/390 Open circuit cooling towers;
  and 90-40-10/400 Dry air coolers.
- **Pressurization units:** 90-10-70/400 Pressurization units.
- **Pumps:** 90-10-70/340 Canned rotor pumps;
  90-10-70/360 Close coupled in line pumps;
  and 90-10-70/350 Close coupled end suction pumps.

  90-10-70/320 Pumps generally
- **Plate heat exchangers:** 90-40-45/330 Plate heat exchangers
- **Water treatment:**
  - **Plant:** 90-15-95/350 Dosing pots;
    90-15-95/370 Filtration units;
    90-15-95/390 Ion exchange softening units;
    and 90-15-95/430 Ultra-violet light disinfection units.
  - **Chemicals for closed circuit systems:** 90-15-95/317 Corrosion inhibitors for closed circuit systems and 90-15-95/335 Bacteria and biofouling inhibitors for closed circuit systems.
  - **Chemicals for open circuit systems:** 90-15-95/310 Biodispersant chemicals for open circuit systems;
    90-15-95/315 Corrosion inhibitor chemicals for open circuit systems;
    90-15-95/320 Dispersant chemicals for open circuit systems;
    90-15-95/325 Non-oxidizing biocides for open circuit systems;
    90-15-95/330 Oxidizing biocides for open circuit systems;
    and 90-15-95/340 Scale inhibitor chemicals for open circuit systems.
- **Pipelines:** 90-10-65/310 Copper pipelines and 90-10-65/415 Steel pipelines.
  90-10-65/350 Cross-linked polyethylene (PE-X) pipelines
  Where stainless steel is proposed, clauses 90-10-65/395, 400 and 405 apply, subject to full technical submission.
  Note:- Thin wall carbon steel tube is NOT acceptable
- **Pipelines accessories:**
  - **Venting devices:** 90-10-60/610 Air bottles and 90-10-60/310 Automatic air vents.
  - **Expansion devices:** Natural flexibility (Preferred);
    90-10-60/320 Angular expansion compensators and 90-10-60/325 Axial expansion compensators.

Where possible take up movement by natural flexibility of the pipework installation with compensators only utilised where this is not practicable.

- **De-aerators:** 90-10-60/340 Pressure differential de-aerators and 90-10-60/345 Temperature differential de-aerators.
- **Separators:** 90-10-60/350 Centrifugal air separators; 90-10-60/355 Combined air and dirt separators; and 90-10-60/360 Dirt separators type A.
- **Gauges:** 90-10-60/370 Pressure gauges; 90-10-60/375 Pressure and altitude gauges; 90-10-60/380 Temperature gauges; and 90-10-60/385 Gauge mounting boards.
- **Accessories:** 90-10-60/400 Pipeline strainers 90-10-60/405 Pipe sleeves.

- **Energy meters:** 90-65-55/300 Energy meters generally
- **Valves:**
  - **General:** 90-10-90/300 Valves generally
  - **Schedule:** Allow for suitable valves and submit proposals, based on preferred manufacturers identified, or other project specific documentation.
  - **Isolating valves:** 90-10-90/332 Butterfly valves; 90-10-90/336 Cast iron gate valves; 90-10-90/338 Carbon steel globe valves; 90-10-90/342 Copper alloy gate valves; 90-10-90/344 Copper alloy globe valves.
  - **Check valves:** 90-10-90/348 Cast iron check valves; 90-10-90/352 Copper alloy check valves
  - **Regulating valves:** 90-10-90/356 Double regulating valves; 90-10-90/358 Flow measuring devices; 90-10-90/420 Pressure independent control valves (PICV)
  - **Draining and venting devices:** 90-10-90/374 Draining taps type A
  - **Accessories:** 90-10-90/360 Test points
- **Thermal insulation:** 90-90-40/330 Mineral wool pipe section insulation type A and 90-90-40/350 Nitrile rubber insulation type A; 90-90-40/301 Insulation Generally
- **Vibration isolation:** 90-90-95/320 Compression isolators; 90-90-95/330 Spring isolators; 90-90-95/350 Pad mountings; 90-90-95/360 Inertia bases; 90-90-95/370 Isolation hangers; 90-90-95/380 Flexible hoses; and 90-90-95/390 Rubber bellows.
- **Emitters:** 90-40-15/310 Active climatic beams; 90-40-15/320 Passive climatic beams; 90-40-15/340 Climatic ceiling panels; 90-45-50/310 Chilled water cooling coils; and 90-45-05/320 Fan coil units.
- **Controls:** Automated control and monitoring system as described in the BMS/Controls Specification;

- **System accessories:** 90-10-85/310 Electrical resistance surface trace heating;
  90-90-60/380 Roof equipment supports;
  90-90-60/390 Channel supports type A;
  and 90-90-60/390 Services supports type B.
- **Plant and equipment identification:** 90-90-55/430 Identifying pipework;
  90-90-55/440 Plastic warning devices for underground cables and pipelines;
  90-90-55/480 Mechanical plant and equipment identification labels type A;
  90-90-55/490 Valve charts and schematics;
  and 90-90-55/495 Valve identification labels.
- **Execution:** 60-45-10/615 Installing water based cooling systems;
  60-45-10/620 Filling and pressure testing of chilled water systems;
  60-45-10/630 Flushing and pre-commission cleaning of chilled water systems;
  and 60-45-10/640 Installing water treatment for chilled water and condenser water systems.
  60-45-10/635 Water Treatment
- **System completion:** 60-45-10/810 Commissioning chilled water systems;
  60-45-10/830 Performance testing chilled water systems;
  60-45-10/840 Inspection and test records for chilled water systems;
  60-45-10/850 Demonstrations;
  60-45-10/860 Documentation;
  60-45-10/870 Operating tools;
  60-45-10/880 Servicing and maintenance;
  and 60-45-10/820 Commissioning refrigerating systems.

Execution

615 Installing water based cooling systems

- **Standard:** To BS EN 1264-4;
  BESA TR/20 part 6 - Chilled water systems;
  BESA TR/20 part 7 - Condenser and cooling water.
- **Applicable content:** BESA TR/20 standards are wide ranging and include some material options not listed within this specification. Do NOT use such options.
  However, where, within allowable options, the BESA standards include requirements that are not detailed or referred to in this specification, such requirements apply.
  In addition, where any requirements of this specification are in addition to those within the BESA standards, comply with the requirements of this specification.

620 Filling and pressure testing of chilled water systems

- **Testing:** In accordance with BSRIABG 29/2012.
- **Notice (minimum):** 5 working days.
- **Pressure:** 1.5 times working pressure.
- **Inspection and witnessing:** In accordance with the procedure in BSRIABG 29/2012.
- **Duration of test:** 2 hrs.

630 Flushing and pre-commission cleaning of chilled water systems

- **Preliminary checks:** Thoroughly inspect pipework. Complete pressure tests before cleaning or chemical treatment.

- **Flushing:** In accordance with BSRIABG 29/2012.
- **Cleaning:** In accordance with BSRIABG 29/2012 and BG 50/2013.
- **Waste products:** Neutralize, and dispose of to drain. Preferably direct to manhole: Obtain approval of drainage authority.

635 Water Treatment

- **Function:** To prevent system degradation and/or blockages due to sediment build up.
- **Guidance:** In accordance with BSRIA BG 50/2013;
- **Pseudonomads:** Take particular care to combat the effect of pseudonomads within the system water;
- **Execution:** Employ specialist to advise

640 Installing water treatment for chilled water and condenser water systems

- **Treatment:**
  - **Closed circuit systems:** In accordance with BSRIABG 50/2013.
  - **Open circuit systems:** In accordance with BSRIAAG 2/93.
- **Water sampling:** In accordance with BS 8552.

System completion

810 Commissioning chilled water systems

- **Pre-commissioning:** In accordance with BSRIABG 2/2010 and CIBSECommissioning Code W.
- **Commissioning:** In accordance with BSRIA BG 2/2010 and CIBSECommissioning Code W .
- **Seasonal commissioning:** In accordance with BSRIABG 44/2013.
- **Variable flow systems:** In accordance with CIBSEKS09 Commissioning variable flow pipework systems.
- **Notice (minimum):** One Week

820 Commissioning refrigerating systems

- **Precommissioning:** In accordance with CIBSE Commissioning code R.
- **Commissioning:** In accordance with CIBSE Commissioning code R.
- **Notice (minimum):** One week.

830 Performance testing chilled water systems

- **General:** Operate the plant as intended in normal use;
  Repeat operation for each system using each item of standby plant & equipment (e.g.. boilers, chillers, pumps, fans, etc), in turn;
  Additional operation with all standby plant in simultaneous operation;
  Refer to project specific specification for further details.
- **Environmental tests:** Where indicated carry out environmental testing. Where 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:** Four (minimum);
    Number to be as necessary to cover all areas served.
  - **Duration of loan:** Time period as necessary to demonstrate satisfactory performance.
- **Reports:** Submit weekly and on completion.

840 Inspection and test records for chilled water systems

- **Pre-construction phase reports:** Confirmation system design is commissionable (submit prior to commencement on site)
- **Construction phase reports:** Post-installation;
  System cleanliness;
  System commissionable.
- **Records for water systems:** In accordance with BSRIABG 2/2010 Commissioning water systems.
- **Record sheets:**
  - **Submission:** Weekly as commissioning progresses and full set before Practical Completion.
  - **Number of copies:** Three.

850 Demonstrations

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

860 Documentation

- **Operating and maintenance instructions:**
  - **Requirements:** Provide in accordance with project specific documentation
- **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;
    Location and identification of regulating, fire and smoke dampers;
    and Location of grilles, diffusers, terminal units, radiators and heat emitters.
  - **Requirements:** Provide in accordance with project specific documentation
- **Submittal date:** Prior to Practical Completion. Refer to project specific documentation for details.

870 Operating tools

- **Requirements:** Provide
- **Tools:** Supply tools for operation, maintenance and cleaning purposes.
- **Keys:** Supply keys for valves and vents
- **Quantity:** Two complete sets

880 Servicing and maintenance

- **Requirement:** Generally for 12 months - Refer to project specific documentation for possible variations from this.

60-45-35 Heat pump systems

System outline

110 Air source heat pump system

- **Heat pump type:** 90-40-40/310 Air to air heat pumps;
  90-40-40/320 Air to water heat pumps;
  90-40-40/330 Gas engine driven heat pumps;
  and 90-40-40/340 Gas fired absorption heat pumps.
- **Pipelines:** 90-10-65/390 Refrigerant pipelines and fittings.
- **Thermal insulation:** 90-90-40/350 Nitrile rubber insulation type A.
- **Outlets:**
  - **Radiator circuit:**
  - **System details:** Refer to LTHW Heating section (60-45-40/110)
  - **Underfloor:** 60-45-90/110 Low temperature hot water underfloor heating.
  - **Variable refrigerant unit:** 90-40-95/330 Indoor units.
- **Controls:** Refer to BMS/Controls Specification.
- **System accessories:** 90-90-60/380 Roof equipment supports;
  90-90-60/390 Channel supports type A;
  and 75-65-35/110 Fixed gas detection and alarm system.
- **Plant and equipment identification:** 90-90-55/430 Identifying pipework;
  90-90-55/480 Mechanical plant and equipment identification labels type A;
  90-90-55/490 Valve charts and schematics;
  and 90-90-55/495 Valve identification labels.
- **Execution:** 60-45-35/620 Installing heat pump systems generally.
- **System completion:** 60-45-35/810 Commissioning of refrigerating systems;
  60-45-35/820 Performance testing;
  60-45-35/830 Inspection and test records;
  60-45-35/840 Demonstrations;
  60-45-35/850 Documentation;
  and 60-45-35/860 Servicing and maintenance.

Execution

620 Installing heat pump systems generally

- **Standards:** To 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 from blocking air flow.
- **Access:** Provide for inspection and servicing of heat pumps and ancillary equipment.
- **Refrigerant lines:** Short and straight.

System completion

810 Commissioning of refrigerating systems

- **Pre-commissioning:** In accordance with CIBSE Commissioning code R.
- **Commissioning:** In accordance with CIBSE Commissioning code R.
- **Seasonal Commissioning:** In accordance with BSRIA BG44/2013; refer to project specific documentation for requirements.
- **Notice (minimum):** 1 week.

820 Performance testing

- **General:** Demonstrate the performance of the installations.
- **Guaranteed efficiency:** As specified
- **Environmental tests:** Carry out environmental testing. If necessary, use artificial loads to simulate operating conditions.
- **Reports:** Submit on completion.

830 Inspection and test records

- **Reports:**
  - **Pre-construction phase:** Confirmation system design is commissionable (submit prior to commencement on site)
  - **Construction phase:** Post-installation;
    System cleanliness;
    and System commissionable.
- **Records for water systems:** In accordance with BSRIA BG 2/2010.
- **Records for air systems:** In accordance with BSRIA BG 49/2015.

840 Demonstrations

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

850 Documentation

- **Operating and maintenance instructions:**
  - **Requirements:** Provide in accordance with project specific documentation.
  - **Product information:** Include product description, date of purchase, performance characteristics, application (suitability for use), method of operation and control, and cleaning and maintenance requirements.
- **Record drawings:**
  - **Requirements:** Provide in accordance with project specific documentation.

- **Submittal date:** In advance of Practical Completion. Refer to project specific documentation for details.

860 Servicing and maintenance

- **Requirement:** Generally 12 months;
  Refer to project specific documentation for details and possible alternative requirements.

60-45-40 Heating systems

System outline

110 Low temperature hot water heating system

- **Distribution:** Constant flow;
  Constant temperature;
  Variable flow;
  and Variable temperature.
- **Heat source:**
  90-40-05/310 Dual fuel fired cast iron boilers;
  90-40-05/320 Dual fuel fired steel shell boilers;
  90-40-05/330 Gas fired boilers;
  90-40-05/340 Gas fired condensing boilers;
  90-40-05/350 Gas fired cast iron boilers;
  90-40-05/360 Gas fired steel shell boilers;
  90-40-45/310 Hot water non-storage calorifiers;
  90-40-05/380 Oil fired cast iron boilers;
  90-40-05/390 Oil fired steel shell boilers;
  90-50-35/490 Packaged CHP units;
  90-40-45/330 Plate heat exchangers;
  90-40-05/410 Solid fuel fired cast iron boilers;
  90-40-05/420 Solid fuel fired steel shell boilers;
  90-40-45/350 Steam non-storage calorifiers.
  90-40-05/300 Boilers Generally
- **Burner:**
  - **Arrangement:** Integral to boiler;
    Supplied with boiler;
    and Supplied separately to boiler.
  - **Type:** Atmospheric;
    90-40-05/460 Forced draught dual fuel burners;
    90-40-05/470 Forced draught gas burners;
    90-40-05/480 Forced draught oil burners;
    and Premix.
- **Fuel:** Fuel oil and Natural gas.
- **Flues and chimneys:** 90-40-30/310 Metal flues and chimneys and 90-40-30/320 Liners.
- **Solid fuel equipment:**
  - **Solid fuel handling equipment:** 90-40-80/310 Fuel handling equipment;
    90-40-80/320 Ash handling equipment;
    90-40-80/340 Above ground storage containers for solid fuel;
    and 90-40-80/350 Below ground storage containers for solid fuel.
  - **Accumulators:** 90-40-80/330 Accumulators.
  - **Accumulator accessories:** 90-10-60/370 Pressure gauges;
    90-10-60/380 Temperature gauges;
    90-10-90/376 Safety valves;
    and Charging pump.

- **Pressurization units:** 90-10-70/400 Pressurization units.
- **Feed and expansion tanks:** 90-10-95/340 Moulded plastics cisterns and 90-10-95/350 Prefabricated galvanized steel cisterns.
  Not usually required although may be applicable on modification work on existing projects;
- **Pumps:** 90-10-70/340 Canned rotor pumps;
  90-10-70/350 Close coupled end suction pumps;
  and 90-10-70/360 Close coupled in line pumps.
- **Water treatment plant:**
  - **Equipment:** 90-15-95/350 Dosing pots;
    90-15-95/370 Filtration units;
    90-15-95/390 Ion exchange softening units;
    90-15-95/430 Ultra-violet light disinfection units;
    and 90-15-95/355 Dosing pump units.
  - **Chemicals:** 90-15-95/335 Bacteria and biofouling inhibitors for closed circuit systems.
- **Pipelines:** 90-10-65/310 Copper pipelines;
  90-10-65/350 Cross-linked polyethylene (PE-X) pipelines;
  90-10-65/415 Steel pipelines;
  and 90-10-65/385 Pre-insulated pipelines.
  Where stainless steel is proposed, clauses 90-10-65/395, 400 and 405 apply, subject to full technical submission.

  Thin wall carbon steel is NOT acceptable
- **Energy meters:** 90-65-55/300 Energy meters generally
- **Pipelines accessories:**
  - **Venting devices:** 90-10-60/310 Automatic air vents and 90-10-60/610 Air bottles.
  - **Expansion devices:** Natural flexibility (preferred);
    90-10-60/320 Angular expansion compensators and 90-10-60/325 Axial expansion compensators.

    Where possible take up movement by natural flexibility of the pipework installation; Compensators used where this is not possible
  - **De-aerators:** 90-10-60/340 Pressure differential de-aerators.
  - **Separators:** 90-10-60/350 Centrifugal air separators;
    90-10-60/355 Combined air and dirt separators;
    and 90-10-60/360 Dirt separators type A.
  - **Gauges:** 90-10-60/370 Pressure gauges;
    90-10-60/375 Pressure and altitude gauges;
    90-10-60/380 Temperature gauges;
    and 90-10-60/385 Gauge mounting boards.
  - **Accessories:** 90-10-60/400 Pipeline strainers and 90-10-60/405 Pipe sleeves.
- **Valves:**
  - **Isolating valves:** 90-10-90/332 Butterfly valves;
    90-10-90/336 Cast iron gate valves;
    90-10-90/338 Carbon steel globe valves;
    90-10-90/342 Copper alloy gate valves;
    90-10-90/344 Copper alloy globe valves;
    and 90-10-90/300 Valves generally.

- **Check valves:** 90-10-90/348 Cast iron check valves;
  90-10-90/352 Copper alloy check valves;
  and .
- **Regulating valves:** 90-10-90/356 Double regulating valves;
  90-10-90/358 Flow measuring devices;
  and 90-10-90/420 Pressure independent control valves (PICV).
- **Radiator valves:** Lockshield Valves on return connections and TRV on flow connections.
- **Draining devices:** 90-10-90/374 Draining taps type A.
- **Accessories:** 90-10-90/360 Test points and 90-10-90/376 Safety valves.
- **Schedule:** Allow for suitable valves and submit proposals, based on preferred manufacturers identified, or other project specific documentation.

- **Thermal insulation:** 90-90-40/330 Mineral wool pipe section insulation type A and 90-90-40/350 Nitrile rubber insulation type A.;
  90-90-40/301 Insulation Generally
- **Vibration isolation:** 90-90-95/320 Compression isolators;
  90-90-95/330 Spring isolators;
  90-90-95/350 Pad mountings;
  90-90-95/360 Inertia bases;
  90-90-95/370 Isolation hangers;
  90-90-95/380 Flexible hoses;
  and 90-90-95/390 Rubber bellows.
- **Heat emitters:** 90-45-05/320 Fan coil units;
  90-40-35/310 Air curtains;
  90-40-35/335 Fan convectors;
  90-40-35/380 Low temperature hot water heated towel rails;
  90-45-50/340 Low temperature hot water heating coils;
  90-40-35/395 Natural convectors;
  90-40-35/425 Radiant panels;
  90-40-35/405 Radiators;
  90-40-35/475 Trench convectors;
  and 90-40-35/485 Unit heaters.
- **Controls:** Automated control and monitoring system as described in the BMS/Controls Specification.
- **System accessories:** 90-90-60/380 Roof equipment supports and 90-90-60/390 Channel supports type A.
- **Plant and equipment identification:** 90-90-55/430 Identifying pipework;
  90-90-55/440 Plastic warning devices for underground cables and pipelines;
  90-90-55/480 Mechanical plant and equipment identification labels type A;
  90-90-55/490 Valve charts and schematics;
  and 90-90-55/495 Valve identification labels.
- **Execution:** 60-45-40/620 Installing water based heating systems;
  60-45-40/670 Installing water treatment for heating systems;
  60-45-40/650 Filling and pressure testing of water based heating systems;
  and 60-45-40/660 Flushing and pre-commission cleaning of heating systems.
- **System completion:** 60-45-40/830 Commissioning boiler plant;
  60-45-40/810 Commissioning water heating systems;
  60-45-40/840 Performance testing;
  60-45-40/845 Demonstrations;

60-45-40/850 Inspection and test records;
60-45-40/860 Documentation;
60-45-40/870 Operating tools;
and 60-45-40/880 Servicing and maintenance.

Execution

620 Installing water based heating systems

- **Standard:** To BS EN 14336.
  BESA TR/20 part1 - Low temperature hot water heating;
- **Applicable Standards:** BESA TR/20 standards are wide ranging and include some material options not listed within this specification. Do NOT use such options.
  However, where, within allowable options, the BESA standards include requirements that are not detailed or referred to in this specification such requirements apply.
  In addition, where any requirements of this specification are in addition to those within the BESA standards, comply with the requirements of this specification.
- **Installation Generally:** Fixing: Securely and parallel or perpendicular to the structure of the building.
  • Pipelines to be free to move under expansion & contraction
  • Fixing to walls & soffits: Submit proposed fixing method for approval by Architect
  • Fixing to Structural Steel: Non-destructive fixings only allowed; submit proposals for approval by Structural Engineer

650 Filling and pressure testing of water based heating systems

- **Testing:** Pressure testing in accordance with BS EN 14336, Annex B and Procedure for filling and pressure testing in accordance with BSRIABG 29/2012.
- **Notice (minimum):** 5 working days.
- **Pressure:** 1.5 times working pressure.
- **Inspection and witnessing:** In accordance with the procedure in BSRIABG 29/2012.
- **Duration of test:** 2 h.
  Should any witnessed test fail, subsequent test period to be 4hr minimum.

660 Flushing and pre-commission cleaning of heating systems

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

670 Installing water treatment for heating systems

- **Treatment:** Closed circuit systems in accordance with BSRIABG 50/2013.
- **Water sampling:** In accordance with BS 8552.

System completion

810 Commissioning water heating systems

- **Pre-commissioning:** In accordance with BSRIABG 2/2010 and CIBSECommissioning Code W.
- **Commissioning:** In accordance with BSRIABG 2/2010 and CIBSECommissioning Code W.
- **Seasonal commissioning:** In accordance with BSRIABG 44/2013.
- **Variable flow systems:** In accordance with CIBSEKnowledge Series KS09.
- **Notice (minimum):** One week.

830 Commissioning boiler plant

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

840 Performance testing

- **General:** Demonstrate the performance of the installations.
- **Environmental tests:** Carry out environmental testing. If necessary, use artificial loads to simulate operating conditions.
- **Recorders:**
  - **Requirements:** Refer to project specific documentation for additional details.
  - **Type:** Supply and maintain portable seven day space temperature and relative humidity recorders, complete with charts.
  - **Number:** Four.
    On large projects provide additional units as necessary to cover the whole area served.
  - **Duration of loan:** Minimum two weeks unless specified otherwise;
    additional time as necessary should systems fail to meet design performance.
- **Reports:** Submit on completion.

845 Demonstrations

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

850 Inspection and test records

- **Pre-construction phase reports:** Confirmation system design is commissionable (submit prior to commencement on site)

- **Construction phase reports:** Post-installation;
  System cleanliness;
  System commissionable.
- **Records for water systems:** In accordance with BSRIABG 2/2010.
- **Record sheets:**
  - **Submission:** Submit weekly

860 Documentation

- **Operating and maintenance instructions:**
  - **Requirements:** Provide in accordance with project specific documentation;
- **Record drawings:**
  - **Requirements:** Provide in accordance with project specific documentation;
- **Submittal date:** Prior to Practical Completion. Refer to project specific documentation for details;

870 Operating tools

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

880 Servicing and maintenance

- **Requirement:** Generally for 12 months from Practical Completion- Refer to project specific documentation for any possible variation to this.

60-45-90 Underfloor heating and cooling systems

System outline

110 Low temperature hot water underfloor heating

- **System performance:** .
- **See also general heating: This section of the specification covers those elements applicable to underfloor heating only. Refer to the general LTHW heating specification (60-45-40) for additional information on other elements making up the complete installation.**
- **Standards:** To BS EN 1264-1 and BSRIA Guide BG 4/2011.
- **Pumps:** 90-10-70/340 Canned rotor pumps.
  Integral with manifold.
- **Pipes:**
  - **Distribution:** 90-10-65/310 Copper pipelines and 90-10-65/415 Steel pipelines.
    refer to project specific documentation.
  - **Underfloor:** 90-10-65/350 Cross-linked polyethylene (PE-X) pipelines and 90-10-65/355 Polybutylene (PB) pipelines.
    refer to project specific documentation.
  - **Insulation:** 90-90-40/330 Mineral wool pipe section insulation type A and 90-90-40/350 Nitrile rubber insulation type A.
- **Pipeline accessories:** Flow control valves;
  Regulation valves.
- **Valves:** 90-10-60/390 Manifold for underfloor heating and cooling;
  90-10-90/342 Copper alloy gate valves;
  90-10-90/358 Flow measuring devices;
  90-10-90/360 Test points;
  90-10-90/366 Low pressure thermostatic mixing valves;
  and 90-10-90/374 Draining taps type A.
- **Water treatment:** 90-15-95/317 Corrosion inhibitors for closed circuit systems and 90-15-95/335 Bacteria and biofouling inhibitors for closed circuit systems.
- **Accessories:** Flow control valves;
- **Controls:**
  - **Controllers:** refer to Controls/BMS specification
  - **Control valves:** Part of manifold;
    90-65-50/310 Valve actuators
    90-65-50/350 Motorized valves.
    refer to Controls/BMS specification
  - **Sensors:** 90-65-50/380 Air temperature sensors;
    90-65-50/400 Flow in pipe sensors;
    Underfloor temperature sensors;
    90-65-50/430 Water temperature sensors.
    refer to Controls/BMS specification
- **Floor components:** Insulation.

- **Execution:** 60-45-90/620 Installing underfloor systems;
  60-45-90/640 Hydraulic pressure testing of underfloor systems;
  and 60-45-90/650 Flushing underfloor systems.
- **System completion:** 60-45-90/810 Commissioning water systems;
  60-45-90/820 Commissioning boiler plant;
  60-45-90/830 Performance testing;
  60-45-90/840 Demonstrations;
  60-45-90/850 Inspection and test records;
  60-45-90/860 Documentation;
  60-45-90/870 Operating tools;
  and 60-45-90/880 Servicing and maintenance.

120 Chilled water underfloor cooling

- **Standards:** To BS EN 1264-1 and BSRIA Guide BG 4/2011
  All installation must follow the manufacturer's guidance
- **Cooling source:** Chilled water system.
- **Pumps:** 90-10-70/340 Canned rotor pumps and Integral with manifold.
- **Pipes:**
  - **Distribution:** 90-10-65/310 Copper pipelines and 90-10-65/350 Cross-linked polyethylene (PE-X) pipelines.
  - **Underfloor:** 90-10-65/350 Cross-linked polyethylene (PE-X) pipelines.
  - **Insulation:** 90-90-40/330 Mineral wool pipe section insulation type A;
    90-90-40/350 Nitrile rubber insulation type A;
    and .
- **Pipeline accessories:** 90-10-60/310 Automatic air vents;
  90-10-60/370 Pressure gauges;
  90-10-60/375 Pressure and altitude gauges;
  90-10-60/380 Temperature gauges;
  90-10-60/385 Gauge mounting boards;
  90-10-60/400 Pipeline strainers;
  and 90-10-60/405 Pipe sleeves.
- **Valves:** 90-10-90/342 Copper alloy gate valves;
  90-10-90/344 Copper alloy globe valves;
  90-10-90/356 Double regulating valves;
  90-10-90/358 Flow measuring devices;
  90-10-90/360 Test points;
  90-10-90/366 Low pressure thermostatic mixing valves;
  90-10-90/330 Ball valves;
  and 90-10-60/390 Manifold for underfloor heating and cooling.
- **Water treatment:** 90-15-95/317 Corrosion inhibitors for closed circuit systems and 90-15-95/335 Bacteria and biofouling inhibitors for closed circuit systems.
- **Floor components:** Insulation and Spreader plates.
- **Execution:** 60-45-90/620 Installing underfloor systems;
  60-45-90/640 Hydraulic pressure testing of underfloor systems;
  and 60-45-90/650 Flushing underfloor systems.
- **System completion:**

130 Combined underfloor heating and cooling

- **Standards:** To BS EN 1264-1 and BSRIA Guide BG 4/2011.
- **Heat source:** Low temperature hot water heating system.
- **Cooling source:** Chilled water system.
- **Pumps:** 90-10-70/340 Canned rotor pumps and Integral with manifold.
- **Pipes:**
  - **Distribution:** 90-10-65/310 Copper pipelines and 90-10-65/350 Cross-linked polyethylene (PE-X) pipelines.
  - **Underfloor:** 90-10-65/350 Cross-linked polyethylene (PE-X) pipelines.
  - **Insulation:** 90-90-40/330 Mineral wool pipe section insulation type A and 90-90-40/350 Nitrile rubber insulation type A.
- **Pipeline accessories:** 90-10-60/310 Automatic air vents;
  90-10-60/370 Pressure gauges;
  90-10-60/375 Pressure and altitude gauges;
  90-10-60/380 Temperature gauges;
  90-10-60/385 Gauge mounting boards;
  and 90-10-60/400 Pipeline strainers.
- **Valves:** 90-10-60/390 Manifold for underfloor heating and cooling;
  90-10-90/330 Ball valves;
  90-10-90/342 Copper alloy gate valves;
  90-10-90/344 Copper alloy globe valves;
  90-10-90/356 Double regulating valves;
  90-10-90/358 Flow measuring devices;
  90-10-90/360 Test points;
  and 90-10-90/366 Low pressure thermostatic mixing valves.
- **Water treatment:** 90-15-95/317 Corrosion inhibitors for closed circuit systems;
  90-15-95/335 Bacteria and biofouling inhibitors for closed circuit systems;
  and 90-15-95/350 Dosing pots.
- **Execution:** 60-45-90/620 Installing underfloor systems;
  60-45-90/640 Hydraulic pressure testing of underfloor systems;
  and 60-45-90/650 Flushing underfloor systems.
- **System completion:** 60-45-90/810 Commissioning water systems;
  60-45-90/830 Performance testing;
  60-45-90/840 Demonstrations;
  60-45-90/850 Inspection and test records;
  60-45-90/860 Documentation;
  60-45-90/870 Operating tools;
  and 60-45-90/880 Servicing and maintenance.

Execution

620 Installing underfloor systems

- **Standard:** To BS EN 1264-4.
- **Fixing of manifold:** Locate with access for regulation and maintenance and away from areas sensitive to noise.

- **Fixing of pipes:**
  - **Solid floors:** Rail with clips in required pattern;
    Fixed to insulation with staples;
    Tied to a steel mesh;
    refer to project specific documentation.
  - **Floating floors:** Lay pipe in a preformed high-density polystyrene profiled panel;
    Spreader plates.;
    refer to project specific documentation.
  - **Timber suspended floors:** Install pipes between joists on insulation;
    Install pipes on top of joists on insulation;
    Spreader plates;
    refer to project specific documentation.
  - **Raised access floors:** Mount pipes with spreader plates between pedestals and floor tiles.
    refer to project specific documentation

640 Hydraulic pressure testing of underfloor systems

- **Testing:** In accordance with BESA TR/6 and Hydraulic testing in accordance with BS EN 14336, Appendix B.
- **Notice (minimum):** 5 working days.
- **Pressure:** 1.5 times working pressure.
- **Duration of test:** 2 h.

650 Flushing underfloor systems

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

System completion

810 Commissioning water systems

- **Pre-commissioning:** In accordance with BSRIABG 2/2010 and CIBSECommissioning Code: Water distribution systems.
- **Commissioning:** In accordance with BSRIABG 2/2010 and CIBSECommissioning Code: Water distribution systems.
- **Seasonal Commissioning:** In accordance with BSRIA BG44/2013;
  refer to project specific documentation for requirements.
- **Variable flow systems:** In accordance with CIBSEKS09 Commissioning variable flow pipework systems.
- **Notice (minimum):** One week.

820 Commissioning boiler plant

- **Pre-commissioning:** In accordance with CIBSECommissioning code B.

- **Commissioning:** In accordance with CIBSECommissioning code B.

830 Performance testing

- **General:** Demonstrate the performance of the installations.
- **Environmental tests:** Carry out environmental testing. If necessary, use artificial loads to simulate operating conditions.
- **Reports:** Submit weekly

840 Demonstrations

- **Running of plant:**
  - **Operation:** Run, maintain and supervise the installations under normal working conditions.
  - **Duration:** As necessary to demonstrate satisfactory performance of the installation. A minimum period of 2 weeks.
- **Instruction:** Instruct and demonstrate the purpose, function and operation of the installations.

850 Inspection and test records

- **Pre-construction phase report:** Confirmation system design is commissionable (submit prior to commencement on site)
- **Construction phase reports:** Post-installation;
  System cleanliness;
  and System commissionable.
- **Records for water systems:** In accordance with BSRIABG 2/2010.

860 Documentation

- **Operating and maintenance instructions:**
  - **Requirements:** As for general heating installation
- **Record drawings:**
  - **Requirements:** As for general heating installation

870 Operating tools

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

880 Servicing and maintenance

- **Requirement:** Generally for12 months- Refer to project specific documentation for possible variation on this.

60-45-95 Variable refrigerant flow systems

System outline

110 Variable refrigerant flow system

- **Compressor:** 90-40-95/310 Electric driven compressors and 90-40-95/320 Gas engine driven compressors.
- **System:** Two pipe cooling only;
  Two pipe cooling and heating;
  and Three pipe heat recovery.
- **Pipelines:** 90-10-65/390 Refrigerant pipelines and fittings.
- **Thermal insulation:** 90-90-40/350 Nitrile rubber insulation type A.
- **Outlets:** 90-40-95/330 Indoor units.
- **Controls:** Refer to BMS/Controls specifications.
- **System accessories:** 75-65-35/110 Fixed gas detection and alarm system.
- **Plant and equipment identification:** 90-90-55/430 Identifying pipework;
  90-90-55/480 Mechanical plant and equipment identification labels type A;
  90-90-55/490 Valve charts and schematics;
  and 90-90-55/495 Valve identification labels.
- **Execution:** 60-45-95/620 Installing variable refrigerant flow systems generally.
- **System completion:** 60-45-95/810 Commissioning of refrigerating systems;
  60-45-95/820 Performance testing;
  60-45-95/830 Inspection and test records;
  60-45-95/840 Demonstrations;
  60-45-95/850 Documentation;
  and 60-45-95/860 Servicing and maintenance.

Execution

620 Installing variable refrigerant flow systems generally

- **Standards:** To 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:** Protect from high winds. Prevent snow, leaves and debris from blocking air flow.
  Ensure that manufacturer's recommendations for access and clear space are maintained.
- **Access:** Provide for inspection and servicing of heat pumps and ancillary equipment.
- **Refrigerant lines:** Maintain as short and straight as practicable.
- **Location of outdoor units:** Away from windows and adjacent buildings.

System completion

810 Commissioning of refrigerating systems

- **Pre-commissioning:** In accordance with CIBSE Commissioning Code R.
- **Commissioning:** In accordance with CIBSE Commissioning Code R.
- **Seasonal Commissioning:** In accordance with BSRIA BG44/2013;
- **Notice (minimum):** 1 week.

820 Performance testing

- **General:** Demonstrate the performance of the installations.
- **Environmental tests:** Carry out environmental testing. If necessary, use artificial loads to simulate operating conditions.
- **Recorders:**
  - **Requirements:** Generally as for heating and cooling systems
- **Reports:** Submit weekly and on completion.

830 Inspection and test records

- **Pre-construction phase reports:** Confirmation system design is commissionable (submit prior to commencement on site)
- **Construction phase reports:** Post-installation;
  System cleanliness;
  System commissionable
- **Records for air systems:** In accordance with BSRIA BG 49/2015.
- **Record sheets:**
  - **Submission:** On completion of inspection/test
  - **Number of copies:** Three.

840 Demonstrations

- **Running of plant:**
  - **Operation:** In accordance with proposed usage
- **Instruction:** Instruct and demonstrate the purpose, function and operation of the installations.

850 Documentation

- **Operating and maintenance instructions:**
  - **Requirements:** As for heating and chilled water systems
  - **Product information:** Include product description, date of purchase, performance characteristics, application (suitability for use), method of operation and control, and cleaning and maintenance requirements.
- **Record drawings:**
  - **Requirements:** As for heating and chilled water systems

- **Submittal date:** At handover.

860 Servicing and maintenance

- **Requirement:** Generallyfor 12 months after completion; refer to project specific documentation for any possible variation on this.
- **Extended warranty:** Provide an extended warranty (parts & labour) direct to the client.

  - Duration: Until 5 years after Practical Completion

65-10-10 Car park ventilation systems

System outline

110 Car park extract system

- **Air ductwork and accessories:**
  - **Ductwork:** Galvanised metal ductwork in accordance with DW/144 90-45-25/322 Fire resisting ductwork and fittings;
    90-45-25/370 Smoke extract ductwork;
    Refer to project specific documentation concerning need for fire / smoke rated ductwork.
  - **Accessories:** 90-45-25/420 Fire and smoke dampers type A.
- **Accessories:** 90-90-60/380 Roof equipment supports and 90-90-60/390 Channel supports type A.
- **Controls:**
  - **Central control and building management:** Refer to BMS/Controls specifications.
  - **Local control:** Refer to BMS/Controls specifications.
- **Identification of ductwork and equipment:** 90-90-55/420 Identifying ductwork and 90-90-55/480 Mechanical plant and equipment identification labels type A.
- **Execution:** 65-10-10/620 Installing smoke control fans.
- **System completion:** 65-10-10/810 Commissioning car park ventilation systems;
  65-10-10/820 Inspection and test records;
  65-10-10/830 Demonstrations;
  65-10-10/840 Documentation;
  65-10-10/850 Spares and consumables;
  and 65-10-10/860 Maintenance.

Execution

620 Installing smoke control fans

- **Standard:** To BS 7346-7.
- **Protection:** Where fans are installed in the building but outside the fire compartment, enclose in a protection equivalent to the fire compartment.
- **Jet fans:** Refer to project specific documentation

System completion

810 Commissioning car park ventilation systems

- **Standard:** In accordance with BS 7346-7, clause 17.

General requirements in accordance with BSRIABG 49/2015 and CIBSECommissioning code A.

820 Inspection and test records

- **Reports:** Submit details of inspections and tests in accordance with BS 7346-7, Table 2.
  - **Pre-construction phase:** Confirmation system design is commissionable (submit prior to commencement on site)
  - **Construction phase:** Post-installation;
    System cleanliness;
    System commissionable;
- **Records for air systems:** In accordance with BSRIA BG 49/2013
- **Record sheets:**
  - **Submission:** Weekly during final inspections and testing, and on completion.

830 Demonstrations

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

840 Documentation

- **Operating and maintenance instructions:**
  - **Requirements:** Provide in accordance with project specific documentation
- **Record drawings:**
  - **Requirements:** Provide in accordance with project specific documentation
- **Submittal date:** Generally prior to Practical Completion. Refer to project specific documentation for details.

850 Spares and consumables

- **Filters:**
  - **Filter media:** Supply and install a complete set of replacement filters immediately prior to practical completion;
    and
    Supply one additional replacement for every filter.
  - **Retaining clips and rubber gaskets:** Minimum of two sets for each type of filter, or as project specific documentation, if more.
  - **Cleaning solution:** Supply coating solution for one complete cleaning of metal plate filters.
- **Detectors:** Supply minimum two of each type or as project specific documentation, if more.
- **Air terminal device keys:** Supply a set for adjusting each type of grille and diffuser damper.

860 Maintenance

- **Servicing and maintenance:** Generally for 12 months after completion. - Refer to project specific documentation for any possible variation to this.

65-10-95 Ventilation systems

System outline

110 Natural ventilation system

- **Ventilation inlet openings:** Windows;
  Rooflights;
  Doors;
  Dampers and louvres;
  and Trickle ventilators.
- **Actuators:** 90-65-50/312 Chain actuators;
  90-65-50/314 Linear actuators;
  90-65-50/316 Damper actuators;
  Lever arm;
  and Gas struts with cables.
- **Supply points:**
  90-45-20/320 Diffusers type A;
  and 90-45-20/380 Grilles type A.
- **Exhaust path:** 90-45-25/322 Fire resisting ductwork and fittings;
  90-45-25/310 Circular plastics ductwork and fittings;
  90-45-25/315 Circular sheet metal ductwork and fittings;
  90-45-25/325 Flat oval sheet metal ductwork and fittings;
  90-45-25/350 Pre-insulated ductwork and fittings;
  90-45-25/360 Rectangular plastics ductwork and fittings;
  and 90-45-25/365 Rectangular sheet metal ductwork and fittings.
- **Ventilation outlet openings:**
  External louvres;
  Rooflights;
  and Windows.

  Some options generally specified by others (Architect/Contract Administrator) - Refer to project specific documentation.
- **Accessories:** 90-90-60/390 Channel supports type A
- **Controls:** Refer to controls specification
- **Ventilation opening control:** On/ off;
  Bank control;
  Sensor controlled;
  and Key switch.
- **Identification of ductwork and equipment:** 90-90-55/420 Identifying ductwork and 90-90-55/480 Mechanical plant and equipment identification labels type A.
- **Execution:** 65-10-95/620 Installing natural ventilation systems.
- **System completion:** 65-10-95/830 Inspection and test records;
  65-10-95/840 Demonstrations;
  65-10-95/850 Documentation for ventilation systems;
  65-10-95/860 Spares and consumables;
  and 65-10-95/870 Maintenance.

130 Mechanical supply ventilation system

- **Air filters:** 90-45-10/310 Activated carbon filters;
  90-45-10/320 Efficient particulate arrestor (EPA) filters;
  90-45-10/330 Electrostatic precipitators;
  90-45-10/340 High efficiency particle arrestor (HEPA) filters;
  90-45-10/360 Panel filters;
  90-45-10/380 Bag filters type A;
  and 90-45-10/400 Ultra low particle arrestor (ULPA) filters.
- **Heat recovery:** 90-45-45/310 Heat pipes;
  90-45-45/320 Plate recuperators;
  90-45-45/330 Regenerators;
  90-45-45/340 Run-around coils;
  and 90-45-45/350 Thermal wheels.
- **Air handling units:** 90-45-15/310 Air handling unit.
  Arrangement as project specific documentation with components to the standards in this specification
- **Supply fans:** 90-45-30/310 Axial flow fans;
  90-45-30/320 Centrifugal fans type A;
  90-45-30/340 Mixed flow fans;
  and 90-45-30/360 Roof mounted fans.
- **Acoustic treatment:** 90-45-75/310 Air transfer and cross talk attenuators;
  90-45-75/320 Circular silencers;
  90-45-75/330 Rectangular silencers;
  and 90-45-75/350 Acoustic linings.
- **Air ductwork and accessories:**
  - **Ductwork:** 90-45-25/310 Circular plastics ductwork and fittings;
    90-45-25/315 Circular sheet metal ductwork and fittings;
    90-45-25/322 Fire resisting ductwork and fittings;
    90-45-25/325 Flat oval sheet metal ductwork and fittings;
    90-45-25/350 Pre-insulated ductwork and fittings;
    90-45-25/360 Rectangular plastics ductwork and fittings;
    and 90-45-25/365 Rectangular sheet metal ductwork and fittings.
  - **Accessories:** 90-45-25/400 Access doors;
    90-45-25/410 Bird guards;
    90-45-25/420 Fire and smoke dampers type A;
    90-45-25/430 Flexible ductwork;
    90-45-25/440 Insect guards;
    90-45-25/445 Intumescent fire and smoke dampers;
    90-45-25/460 Non-return dampers;
    90-45-25/465 Pressure control flaps;
    90-45-25/470 Pressure relief dampers;
    90-45-25/480 Shut off dampers;
    and 90-45-25/482 Smoke dampers.
- **Thermal insulation on supply air ductwork:** 90-90-40/320 Metal mesh faced mineral wool mattresses;
  90-90-40/340 Mineral wool slabs insulation;
  90-90-40/350 Nitrile rubber insulation type A;
  and 90-90-40/301 Insulation Generally.

- **Vibration isolation mountings:** 90-90-95/320 Compression isolators;
  90-90-95/330 Spring isolators;
  and 90-90-95/370 Isolation hangers.
- **Reheat batteries:** 90-45-50/340 Low temperature hot water heating coils and 90-45-50/320 Electric heater batteries.
- **Room supply air terminal devices:** ;
  90-45-20/320 Diffusers type A;
  90-45-20/380 Grilles type A;
  90-45-20/330 Displacement ventilation diffusers;
  90-45-20/350 Linear diffusers;
  90-45-20/360 Swirl diffusers;
  90-45-20/390 Laminar flow panels;
  90-45-20/450 Specialist air terminal devices;
  and 90-45-20/460 Ventilated ceilings.
- **Accessories:** 90-90-60/380 Roof equipment supports and 90-90-60/390 Channel supports type A.
- **Identification of ductwork and equipment:** 90-90-55/420 Identifying ductwork and 90-90-55/480 Mechanical plant and equipment identification labels type A.
- **Testing:** 90-45-25/780 Air leakage testing of high pressure ductwork;
  90-45-25/785 Air leakage testing of medium pressure ductwork;
  and 90-45-25/790 Air leakage testing of plant items.
- **Execution:** 65-10-95/630 Installing ductwork on air handling units and 65-10-95/640 Ductwork systems cleaning.
- **System completion:** 65-10-95/830 Inspection and test records;
  65-10-95/840 Demonstrations;
  65-10-95/850 Documentation for ventilation systems;
  65-10-95/860 Spares and consumables;
  65-10-95/870 Maintenance;
  65-10-95/810 Commissioning of air distribution systems;
  and 65-10-95/820 Performance testing.

140 Mechanical extract ventilation system

- **Room extract air terminal devices:** 90-45-20/380 Grilles type A;
  90-45-20/450 Specialist air terminal devices;
  and 90-45-20/460 Ventilated ceilings.
- **Air ductwork and accessories:**
  - **Ductwork:** 90-45-25/310 Circular plastics ductwork and fittings;
    90-45-25/315 Circular sheet metal ductwork and fittings;
    90-45-25/322 Fire resisting ductwork and fittings;
    90-45-25/325 Flat oval sheet metal ductwork and fittings;
    90-45-25/350 Pre-insulated ductwork and fittings;
    90-45-25/360 Rectangular plastics ductwork and fittings;
    90-45-25/365 Rectangular sheet metal ductwork and fittings;
    and 90-45-25/370 Smoke extract ductwork.
  - **Accessories:** 90-45-25/400 Access doors;
    90-45-25/410 Bird guards;
    90-45-25/420 Fire and smoke dampers type A;
    90-45-25/430 Flexible ductwork;
    90-45-25/440 Insect guards;

90-45-25/445 Intumescent fire and smoke dampers;
90-45-25/460 Non-return dampers;
90-45-25/465 Pressure control flaps;
90-45-25/470 Pressure relief dampers;
90-45-25/480 Shut off dampers;
and 90-45-25/482 Smoke dampers.

- **Thermal insulation on extract air ductwork:** 90-90-40/320 Metal mesh faced mineral wool mattresses;
  90-90-40/340 Mineral wool slabs insulation;
  and 90-90-40/350 Nitrile rubber insulation type A.
  90-90-40/301 Insulation Generally
- **Vibration isolation mountings:** 90-90-95/320 Compression isolators;
  90-90-95/330 Spring isolators;
  and 90-90-95/370 Isolation hangers.
- **Heat recovery:** 90-45-15/310 Air handling unit;
  90-45-45/310 Heat pipes;
  90-45-45/320 Plate recuperators;
  90-45-45/330 Regenerators;
  90-45-45/340 Run-around coils;
  and 90-45-45/350 Thermal wheels.
- **Acoustic treatment:** 90-45-75/310 Air transfer and cross talk attenuators;
  90-45-75/320 Circular silencers;
  90-45-75/330 Rectangular silencers;
  and 90-45-75/350 Acoustic linings.
- **Extract fans:** 90-45-30/310 Axial flow fans;
  90-45-30/320 Centrifugal fans type A;
  90-45-30/340 Mixed flow fans;
  and 90-45-30/360 Roof mounted fans.
- **External exhaust air terminals:** 45-25-50/305 Aluminium louvre panel units.

  Where fitted within the building structure louvres are generally specified by others (Architect/Contract Adminsitrator) -
  Refer to project specific documentation.
- **Accessories:** 90-90-60/380 Roof equipment supports and 90-90-60/390 Channel supports type A.
- **Controls:** Refer to BMS/Controls specification
- **Identification of ductwork and equipment:** 90-90-55/420 Identifying ductwork and 90-90-55/480 Mechanical plant and equipment identification labels type A.
- **Testing:** 90-45-25/780 Air leakage testing of high pressure ductwork;
  90-45-25/785 Air leakage testing of medium pressure ductwork;
  and 90-45-25/790 Air leakage testing of plant items.
- **Execution:** 65-10-95/630 Installing ductwork on air handling units and 65-10-95/640 Ductwork systems cleaning.
- **System completion:** 65-10-95/810 Commissioning of air distribution systems;
  65-10-95/820 Performance testing;
  65-10-95/830 Inspection and test records;
  65-10-95/840 Demonstrations;
  65-10-95/850 Documentation for ventilation systems;

65-10-95/860 Spares and consumables;
and 65-10-95/870 Maintenance.

150 Toilet extract ventilation system

- **Room extract air terminal devices:** and 90-45-20/380 Grilles type A.
- **Air ductwork and accessories:**
  - **Ductwork:** 90-45-25/315 Circular sheet metal ductwork and fittings and 90-45-25/365 Rectangular sheet metal ductwork and fittings.
  - **Accessories:** 90-45-25/400 Access doors;
    90-45-25/410 Bird guards;
    90-45-25/420 Fire and smoke dampers type A;
    90-45-25/430 Flexible ductwork;
    90-45-25/445 Intumescent fire and smoke dampers;
    90-45-25/460 Non-return dampers;
    and 90-45-25/480 Shut off dampers.
- **Thermal insulation on extract air ductwork:** 90-90-40/340 Mineral wool slabs insulation.
  90-90-40/301 Insulation Generally
- **Vibration isolation mountings:** 90-90-95/320 Compression isolators;
  90-90-95/330 Spring isolators;
  and 90-90-95/370 Isolation hangers.
- **Acoustic treatment:** 90-45-75/310 Air transfer and cross talk attenuators;
  90-45-75/320 Circular silencers;
  90-45-75/330 Rectangular silencers;
  and 90-45-75/350 Acoustic linings.
- **Extract fans:** 90-45-30/380 Toilet extract fans.
- **External exhaust air terminals:** 45-25-50/305 Aluminium louvre panel units.

  Where fitted within the building structure louvres are generally specified by others (Architect/Contract Adminsitrator) -
  Refer to project specific documentation.
- **Accessories:** 90-90-60/380 Roof equipment supports and 90-90-60/390 Channel supports type A.
- **Controls:** Refer to BMS/Controls Specification
- **Identification of ductwork and equipment:** 90-90-55/420 Identifying ductwork and 90-90-55/480 Mechanical plant and equipment identification labels type A.
- **Testing:** 90-45-25/785 Air leakage testing of medium pressure ductwork and 90-45-25/790 Air leakage testing of plant items.
- **Execution:** 65-10-95/630 Installing ductwork on air handling units.
- **System completion:** 65-10-95/810 Commissioning of air distribution systems;
  65-10-95/820 Performance testing;
  65-10-95/830 Inspection and test records;
  65-10-95/840 Demonstrations;
  65-10-95/850 Documentation for ventilation systems;
  65-10-95/860 Spares and consumables;
  and 65-10-95/870 Maintenance.

160 Kitchen extract ventilation system

- **General:** All kitchen ductwork installation must be installed in accordance with DW172
- **Room extract air terminal devices:** 90-45-25/340 Kitchen canopies;
  90-45-20/470 Ventilated ceilings for kitchens;
  90-45-10/350 Mesh filters;
  90-45-10/370 Primary grease filters;
  and 90-45-10/390 Secondary grease filters.
- **Air ductwork and accessories:**
  - **Ductwork:** 90-45-25/322 Fire resisting ductwork and fittings;
    90-45-25/370 Smoke extract ductwork;
    90-45-25/365 Rectangular sheet metal ductwork and fittings;
    90-45-25/315 Circular sheet metal ductwork and fittings
  - **Accessories:** 90-45-25/400 Access doors;
    90-45-25/410 Bird guards;
    90-45-25/460 Non-return dampers;
    and 90-45-25/480 Shut off dampers.
- **Thermal insulation on extract air ductwork:** 90-90-40/340 Mineral wool slabs insulation.
  90-90-40/301 Insulation Generally
- **Vibration isolation mountings:** 90-90-95/320 Compression isolators;
  90-90-95/330 Spring isolators;
  and 90-90-95/370 Isolation hangers.
- **Acoustic treatment:** 90-45-75/310 Air transfer and cross talk attenuators;
  90-45-75/320 Circular silencers;
  and 90-45-75/330 Rectangular silencers.
- **Extract fans:** 90-45-30/310 Axial flow fans;
  90-45-30/320 Centrifugal fans type A;
  90-45-30/340 Mixed flow fans;
  and 90-45-30/360 Roof mounted fans.
- **External exhaust air terminals:** Vertical discharge from kitchen extract by Swedish cowel, or as project specific documentation
- **Accessories:** 90-90-60/380 Roof equipment supports and 90-90-60/390 Channel supports type A.
- **Controls:**
  Refer to BMS/Controls specification.
- **Identification of ductwork and equipment:** 90-90-55/420 Identifying ductwork
  90-90-55/480 Mechanical plant and equipment identification labels type A.
- **Testing:** 90-45-25/780 Air leakage testing of high pressure ductwork;
  90-45-25/785 Air leakage testing of medium pressure ductwork;
  and 90-45-25/790 Air leakage testing of plant items.
- **Execution:** 65-10-95/630 Installing ductwork on air handling units and 65-10-95/650 Cleaning of kitchen extract ductwork systems.
- **System completion:** 65-10-95/810 Commissioning of air distribution systems;
  65-10-95/820 Performance testing;
  65-10-95/830 Inspection and test records;
  65-10-95/840 Demonstrations;
  65-10-95/850 Documentation for ventilation systems;

65-10-95/860 Spares and consumables;
and 65-10-95/870 Maintenance.

Execution

620 Installing natural ventilation systems

- **Installation:** Install ductwork in runs that are as short and straight as possible, with smooth curvature to offsets.
- **Arrangement:** Do not install ducts at more than 45° from vertical.
- **Air leakage:** Prevent leakage where ducts enter rooms and around inlet grilles.
- **Sealing material:** Submit proposals.

630 Installing ductwork on air handling units

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

640 Ductwork systems cleaning

- **Standards:** In accordance with BESATechnical Report TR/19 and to BS EN 15780.
- **Cleaning methods:**
  - **General:** To cleaning specialist's recommendation
- **Verification:**
  - **Method:** Visual inspection.
  - **Completion report:**

    Information: System cleaned;
    Cleaning method used;
    Verification tests;
    COSHH data on chemicals used where applicable;
    and Recommendations for future testing and cleaning.

    Submit: On completion.

650 Cleaning of kitchen extract ductwork systems

- **Cleaning:** In accordance with BESATechnical Report TR/19.
- **Specialist:** B&ES approved
- **Method of test:** Deposit thickness test (DTT)
  Wet film thickness test (WFTT).
  Refer to project specific documentation.
- **Method of cleaning:** Chemical and Steam cleaning.
- **Post clean verification of cleanliness report:**
  - **Information:** System cleaned;
    Pre- and post-clean measurements;
    Pre- and post-clean photographic records;
    Additional works carried out;
    COSHH data on chemicals used, where applicable;
    Recommendations for future testing and cleaning;
    Details of system showing access panels and test locations;

Details of uncleaned or inaccessible areas;
and Cleaning works completed certificate.
- **Format:** Electronic and Paper copy.
- **Submit:** On completion.
- **Number of copies:** Two

System completion

810 Commissioning of air distribution systems

- **Pre-commissioning:** In accordance with BSRIABG 49/2015 and CIBSECommissioning code A.
- **Commissioning:** In accordance with BSRIABG 49/2015 and CIBSECommissioning code A.
- **Notice (minimum):** As set out in the preliminaries / general clauses, else 10 days

820 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:** Four minimum.
  - **Duration of loan:** To successfully demonstrate satisfactory performance of the systems.
- **Reports:** Submit weekly.

830 Inspection and test records

- **Records for air systems:** In accordance with BSRIABG 49/2015.
- **Record sheets:**
  - **Submission:**
    Weekly during final inspections and testing
  - **Number of copies:** As identified in the preliminary and general clauses, else two plus a digital copy

840 Demonstrations

- **Running of plant:**
  - **Operation:** Run, maintain and supervise the installations under normal working conditions.
  - **Duration:** Sufficient time period to fully demonstrate satisfactory operation. Minimum period 2 weeks.
    Refer to project specific documentation for any particular requirements.

- **Instruction:** Instruct and demonstrate the purpose, function and operation of the installations.

850 Documentation for ventilation systems

- **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 and as set out in the preliminary / general clauses
  - **Format:** Paper copy.
  - **Number of copies:** As identified in the preliminary and general clauses, else two plus a digital copy
- **Record drawings:**
  - **Requirement and number:** As identified in the preliminary and general clauses, else two plus a digital copy
- **Submittal date:** Before handover or practical completion.

860 Spares and consumables

- **Filters:**
  - **Filter media:** As set out in the project specific documentation and as a minimum: Supply and install one complete set of filters immediately prior to handover; and supply one full set for handing to client. (Including all washable filters)
  - **Retaining clips and rubber gaskets:** Minimum two sets for each type of filter or as project specific documentation, if more.
  - **Cleaning solution:** Supply coating solution for one complete cleaning of metal plate filters.
- **Detectors:**
  Supply minimum two of each type or as project specific documentation, if more.
- **Air terminal device keys:** Supply a set for adjusting each size and type of grille and diffuser.

870 Maintenance

- **Servicing and maintenance:** Generally for 12 months;
  Refer to project specific documentation for possible variations to this.

65-70-05 Air conditioning systems

System outline

110 Centralized all-air conditioning system

- **Legionella codes and guidance:** Follow the relevant guidance in:

  HSE Acop L8
  HSG 274 Part 1 - Control of Legionella in Evaporative Cooling Systems
  HSG 274 Part 3 - Control of Legionella in Other Risk Systems

  Some of the content of these documents concerns maintenance regimes. Incorporate facilities into the installation to ensure an appropriate regime can be established.
- **External air intake terminals:** 45-25-50/305 Aluminium louvre panel units.

  External louvres;
  Generally specified by others (Architect/Contract Adminsitrator) -
  Refer to project specific documentation.
- **Air filters:** 90-45-10/310 Activated carbon filters;
  90-45-10/320 Efficient particulate arrestor (EPA) filters;
  90-45-10/330 Electrostatic precipitators;
  90-45-10/340 High efficiency particle arrestor (HEPA) filters;
  90-45-10/360 Panel filters;
  90-45-10/380 Bag filters type A;
  90-45-10/400 Ultra low particle arrestor (ULPA) filters;
  90-45-15/310 Air handling unit.
- **Heat recovery:** 90-45-15/310 Air handling unit;
  90-45-45/310 Heat pipes;
  90-45-45/320 Plate recuperators;
  90-45-45/330 Regenerators;
  90-45-45/340 Run-around coils;
  90-45-45/350 Thermal wheels.
- **Humidifiers:** 90-45-55/310 Evaporative humidifiers;
  90-45-55/320 Steam humidifiers;
  90-45-55/330 Water atomizing humidifiers.
- **De-humidifiers:** 90-45-55/340 Desiccant dehumidifiers.
- **Air handling units:** 90-45-15/310 Air handling unit.
- **Silencers and acoustic treatment:** 90-45-75/310 Air transfer and cross talk attenuators;
  90-45-75/320 Circular silencers;
  90-45-75/330 Rectangular silencers;
  and 90-45-75/350 Acoustic linings.
- **Air ductwork and accessories:**
  - **Ductwork:** 90-45-25/310 Circular plastics ductwork and fittings;
    90-45-25/315 Circular sheet metal ductwork and fittings;
    90-45-25/322 Fire resisting ductwork and fittings;
    90-45-25/325 Flat oval sheet metal ductwork and fittings;

90-45-25/350 Pre-insulated ductwork and fittings;
90-45-25/360 Rectangular plastics ductwork and fittings;
90-45-25/365 Rectangular sheet metal ductwork and fittings;
90-45-25/370 Smoke extract ductwork.

- **Accessories:** 90-45-25/400 Access doors;
90-45-25/410 Bird guards;
90-45-25/420 Fire and smoke dampers type A;
90-45-25/430 Flexible ductwork;
90-45-25/440 Insect guards;
90-45-25/445 Intumescent fire and smoke dampers;
90-45-25/460 Non-return dampers;
90-45-25/465 Pressure control flaps;
90-45-25/470 Pressure relief dampers;
90-45-25/480 Shut off dampers;
90-45-25/482 Smoke dampers.

- **Thermal insulation on supply air ductwork:** 90-90-40/320 Metal mesh faced mineral wool mattresses
90-90-40/340 Mineral wool slabs insulation.
- **Vibration isolation mountings:** 90-90-95/320 Compression isolators;
90-90-95/330 Spring isolators;
90-90-95/370 Isolation hangers.
- **Reheaters:** 90-45-50/320 Electric heater batteries;
90-45-50/340 Low temperature hot water heating coils;
90-45-50/330 Gas fired heater batteries.
- **Cooling coils:** 90-45-50/310 Chilled water cooling coils
90-45-50/350 Refrigerant cooling coils.
- **VAV terminal units:** 90-45-25/490 VAV terminal units.
- **Room supply air terminal devices:** 90-40-15/310 Active climatic beams;
90-40-15/320 Passive climatic beams;
90-40-15/340 Climatic ceiling panels;
90-45-20/320 Diffusers type A;
90-45-20/330 Displacement ventilation diffusers;
90-45-20/350 Linear diffusers;
90-45-20/360 Swirl diffusers;
90-45-20/380 Grilles type A;
90-45-20/390 Laminar flow panels;
90-45-20/450 Specialist air terminal devices;
90-45-20/460 Ventilated ceilings.
- **Accessories:** 90-90-60/380 Roof equipment supports
90-90-60/390 Channel supports type A.
- **Condensate pipelines:** 90-10-65/310 Copper pipelines and 90-10-65/375 Unplasticized polyvinylchloride (PVC-U) pipelines.
- **Controls:**
Refer to BMS/Controls specification
- **Identification of ductwork and equipment:** 90-90-55/420 Identifying ductwork
90-90-55/480 Mechanical plant and equipment identification labels type A.
- **Testing:** 90-45-25/780 Air leakage testing of high pressure ductwork;
90-45-25/785 Air leakage testing of medium pressure ductwork;
90-45-25/790 Air leakage testing of plant items.

- **Execution:** 65-70-05/620 Installing ductwork on air handling units and 65-70-05/640 Ductwork systems cleaning.
- **System completion:** 65-10-95/810 Commissioning of air distribution systems
  65-10-95/820 Performance testing
  65-10-95/830 Inspection and test records
  65-10-95/840 Demonstrations
  65-10-95/850 Documentation for ventilation systems
  65-10-95/860 Spares and consumables
  65-10-95/870 Maintenance

130 Fan coil unit air conditioning system

- **Type of system:** Four-pipe;
  Two-pipe changeover;
  and Two-pipe non-changeover.
- **External air intake terminals:** 45-25-50/305 Aluminium louvre panel units.

  Where fitted within the building structure louvres are generally specified by others (Architect/Contract Administrator) -
  Refer to project specific documentation.
- **Air filters:** 90-45-10/310 Activated carbon filters;
  90-45-10/320 Efficient particulate arrestor (EPA) filters;
  90-45-10/330 Electrostatic precipitators;
  90-45-10/360 Panel filters;
  90-45-10/380 Bag filters type A;
  90-45-10/400 Ultra low particle arrestor (ULPA) filters;
  90-45-15/310 Air handling unit;
  and 90-45-10/301 Fan coil filters.
- **Heat recovery:** 90-45-15/310 Air handling unit;
  90-45-45/310 Heat pipes;
  90-45-45/320 Plate recuperators;
  90-45-45/340 Run-around coils;
  90-45-45/350 Thermal wheels.
- **Humidifiers:** 90-45-15/310 Air handling unit;
  90-45-55/310 Evaporative humidifiers;
  90-45-55/320 Steam humidifiers;
  90-45-55/330 Water atomizing humidifiers.
- **De-humidifiers:** 90-45-15/310 Air handling unit
  90-45-55/340 Desiccant dehumidifiers.
- **Air handling units:** 90-45-15/310 Air handling unit.
- **Silencers and acoustic treatment:** 90-45-75/310 Air transfer and cross talk attenuators;
  90-45-75/320 Circular silencers;
  90-45-75/330 Rectangular silencers;
  and 90-45-75/350 Acoustic linings.
- **Air ductwork and accessories:**
  - **Ductwork:** 90-45-25/315 Circular sheet metal ductwork and fittings;
    90-45-25/322 Fire resisting ductwork and fittings;
    90-45-25/325 Flat oval sheet metal ductwork and fittings;
    90-45-25/350 Pre-insulated ductwork and fittings;
    90-45-25/365 Rectangular sheet metal ductwork and fittings.

- **Accessories:** 90-45-25/400 Access doors;
  90-45-25/410 Bird guards;
  90-45-25/420 Fire and smoke dampers type A;
  90-45-25/430 Flexible ductwork;
  90-45-25/440 Insect guards;
  90-45-25/445 Intumescent fire and smoke dampers;
  90-45-25/460 Non-return dampers;
  90-45-25/465 Pressure control flaps;
  90-45-25/470 Pressure relief dampers;
  90-45-25/480 Shut off dampers;
  90-45-25/482 Smoke dampers.

- **Thermal insulation on supply air ductwork:** 90-90-40/320 Metal mesh faced mineral wool mattresses and 90-90-40/340 Mineral wool slabs insulation.
- **Vibration isolation mountings:** 90-90-95/320 Compression isolators;
  90-90-95/330 Spring isolators;
  90-90-95/370 Isolation hangers.
- **Reheaters:** 90-45-50/320 Electric heater batteries
  90-45-50/340 Low temperature hot water heating coils.
- **Cooling coils:** 90-45-15/310 Air handling unit;
  90-45-50/310 Chilled water cooling coils;
  90-45-50/350 Refrigerant cooling coils.
- **Room supply air terminals:** 90-45-05/320 Fan coil units;
  90-45-20/320 Diffusers type A;
  90-45-20/330 Displacement ventilation diffusers;
  90-45-20/350 Linear diffusers;
  90-45-20/360 Swirl diffusers;
  90-45-20/380 Grilles type A;
  90-45-20/450 Specialist air terminal devices.
- **Accessories:** 90-90-60/390 Channel supports type A.
- **Condensate pipelines:** 90-10-65/310 Copper pipelines and 90-10-65/375 Unplasticized polyvinylchloride (PVC-U) pipelines.
- **Controls:** *Refer to BMS/Controls specifications.*
- **Identification of ductwork and equipment:** 90-90-55/420 Identifying ductwork
  90-90-55/480 Mechanical plant and equipment identification labels type A.
- **Testing:** 90-45-25/780 Air leakage testing of high pressure ductwork;
  90-45-25/785 Air leakage testing of medium pressure ductwork;
  90-45-25/790 Air leakage testing of plant items.
- **Execution:** 65-70-05/620 Installing ductwork on air handling units
  65-70-05/640 Ductwork systems cleaning.
- **System completion:** 65-70-05/810 Commissioning of air distribution systems;
  65-70-05/820 Performance testing;
  65-70-05/830 Inspection and test records;
  65-70-05/840 Demonstrations;
  65-70-05/850 Documentation;
  65-70-05/860 Spares and consumables;
  and 65-70-05/870 Maintenance.

Execution

620 Installing ductwork on air handling units

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

640 Ductwork systems cleaning

- **Standards:** In accordance with BESATR/19 and to BS EN 15780.
- **Specialist:** Contractor's choice. B&ES approved
- **Verification:**
  - **Method:**
  - **Completion report:**

    Information: Verification tests;
    Faults identified that may impact future hygiene;
    Additional works carried out;
    COSHH data on chemicals used where applicable;
    and Recommendations for future testing and cleaning.

    Format: Electronic and Paper copy.

    Submit: On completion.

    Number of copies: Two

System completion

810 Commissioning of air distribution systems

- **Pre-commissioning:** In accordance with BSRIABG 49/2015 and CIBSECommissioning Code A.
- **Commissioning:** In accordance with BSRIABG 49/2015 and CIBSECommissioning Code A .
- **Notice (minimum):** As set out in the preliminaries / general clauses, else 10 days

820 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:** Four minimum.
  - **Duration of loan:** To successfully demonstrate satisfactory performance of the systems.
- **Reports:** Submit weekly.

830 Inspection and test records

- **Construction phase reports:** System design is commissionable (submit before commencement on site);
  Post-installation;
  System cleanliness;
  and System commissionable.
- **Records for air systems:** In accordance with BSRIABG 49/2015.
- **Record sheets:**
  - **Submission:** On completion.
  - **Number of copies:** As identified in the preliminary and general clauses, else two plus a digital copy

840 Demonstrations

- **Running of plant:**
  - **Operation:** As in normal operational use.
  - **Duration:** Sufficient time to demonstrate satisfactory performance of the systems. Minimum time period 2 weeks. Refer to project specific documentation for any particular requirement.
- **Instruction:** Instruct and demonstrate the purpose, function and operation of the installations.

850 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 and as identified in the project preliminaries / general clauses.
- **Record drawings:**
  - **Content:** Generally as BSRIA BG 6.
    Refer to project specific documentation
  - **Format:** Paper copy and as identified in theproject preliminaries / general clauses.
  - **Number of copies:** As identified in theproject preliminaries / general clauses.
- **Submittal date:** Before handover.

860 Spares and consumables

- **Filters:**
  - **Filter media:** Supply three complete sets of clean filters,
    install first set for use before commissioning;
    install a second after final commissioning; prior to handover.
    the third set to be handed to the client on handover. (Note, for fan coil unit washable filters provide 1 filter per 10 fan coil units)
  - **Retaining clips and rubber gaskets:** Two sets for each type of filter.

- **Cleaning solution:** Supply coating solution for one complete cleaning of metal plate filters.

- **Detectors:** Supply two of each type.
- **Air terminal device keys:** Supply a set for adjusting each size and type of grille and diffuser;
  plus a set for adjusting each type of grille and diffuserdamper.

870 Maintenance

- **Servicing and maintenance:** Generally 12 months - Refer to project specific documentation for variations from that.

65-70-45 Local air conditioning systems

System outline

110 Room air conditioning system

- **Air conditioning units:** 90-45-05/350 Room air conditioning units;
  90-45-05/360 Split coil room air conditioning units;
  and 90-45-05/370 Split coil remote air cooled condensing units.
- **Refrigerant pipeline:** 90-10-65/390 Refrigerant pipelines and fittings.
- **Pipeline insulation:** 90-90-40/350 Nitrile rubber insulation type A.
- **External louvres:** Where fitted within the building structure louvres are generally specified by others (Architect/Contract Adminsitrator) -
  Refer to project specific documentation.
- **Air ductwork and accessories:**
  - **Ductwork:** 90-45-25/310 Circular plastics ductwork and fittings;
    90-45-25/315 Circular sheet metal ductwork and fittings;
    90-45-25/350 Pre-insulated ductwork and fittings;
    90-45-25/360 Rectangular plastics ductwork and fittings;
    and 90-45-25/365 Rectangular sheet metal ductwork and fittings.
  - **Accessories:** 90-45-25/400 Access doors;
    90-45-25/420 Fire and smoke dampers type A;
    90-45-25/430 Flexible ductwork;
    90-45-25/460 Non-return dampers;
    90-45-25/480 Shut off dampers;
    90-45-25/482 Smoke dampers;
    90-45-25/410 Bird guards;
    and 90-45-25/440 Insect guards.
- **Thermal insulation on supply air ductwork:** 90-90-40/320 Metal mesh faced mineral wool mattresses and 90-90-40/340 Mineral wool slabs insulation.
- **Controls:** Refer to BMS/Controls specification.
- **Condensate pipelines:** 90-10-65/310 Copper pipelines and 90-10-65/375 Unplasticized polyvinylchloride (PVC-U) pipelines.
- **Accessories:** 75-65-35/110 Fixed gas detection and alarm system;
  90-90-60/380 Roof equipment supports;
  and 90-90-60/390 Channel supports type A.
- **Identification of ductwork and equipment:** 90-90-55/420 Identifying ductwork and 90-90-55/480 Mechanical plant and equipment identification labels type A.
- **Testing:** Minimum to manufacturers recommendations;
  Refer to project specific documentation for additional requirements.
- **Execution:** 65-70-45/620 Installing local air conditioning refrigeration.
- **System completion:** 65-70-45/810 Commissioning of air distribution systems;
  65-70-45/815 Commissioning of refrigeration systems;
  65-70-45/820 Performance testing;
  65-70-45/830 Inspection and test records;

65-70-45/840 Demonstrations;
65-70-45/850 Documentation;
65-70-45/860 Spares and consumables;
and 65-70-45/870 Maintenance.

120 Local extract system

- **Air ductwork and accessories:**
  - **Ductwork:** 90-45-25/310 Circular plastics ductwork and fittings;
    90-45-25/315 Circular sheet metal ductwork and fittings;
    and 90-45-25/365 Rectangular sheet metal ductwork and fittings.
  - **Accessories:** 90-45-25/400 Access doors;
    90-45-25/430 Flexible ductwork;
    90-45-25/460 Non-return dampers;
    90-45-25/480 Shut off dampers;
    and 90-45-25/482 Smoke dampers.
- **Thermal insulation on extract air ductwork:** 90-90-40/340 Mineral wool slabs insulation.
- **Vibration isolation mountings:** 90-90-95/320 Compression isolators.
  Refer to project specific documentation.
- **Silencers and acoustic treatment:** 90-45-75/310 Air transfer and cross talk attenuators;
  90-45-75/320 Circular silencers;
  and 90-45-75/330 Rectangular silencers.
- **Extract fans:** 90-45-30/310 Axial flow fans;
  90-45-30/320 Centrifugal fans type A;
  and 90-45-30/360 Roof mounted fans.
- **External louvres:** Where fitted within the building structure louvres are generally specified by others (Architect/Contract Adminsitrator) -
  Refer to project specific documentation
- **Controls:**
  Refer to equipment schedules and BMS/Controls specification
- **Identification of ductwork and equipment:** 90-90-55/420 Identifying ductwork
  90-90-55/480 Mechanical plant and equipment identification labels type A.
- **Execution:** 65-70-45/620 Installing local air conditioning refrigeration.
- **System completion:** 65-70-45/810 Commissioning of air distribution systems;
  65-70-45/820 Performance testing;
  65-70-45/830 Inspection and test records;
  65-70-45/840 Demonstrations;
  65-70-45/850 Documentation;
  65-70-45/860 Spares and consumables;
  and 65-70-45/870 Maintenance.

Execution

620 Installing local air conditioning refrigeration

- **Standard:** To BS EN 378-3.

System completion

810 Commissioning of air distribution systems

- **Pre-commissioning:** In accordance with BSRIABG 49/2015 and CIBSECommissioning Code A.
- **Commissioning:** In accordance with BSRIABG 49/2015 and CIBSECommissioning Code A .
- **Seasonal commisioning:** In accordance with BSRIA BG44/2013;
- **Notice (minimum):** One week.

815 Commissioning of refrigeration systems

- **Pre-commissioning:** In accordance with CIBSECommissioning Code R.
- **Commissioning:** In accordance with CIBSECommissioning Code R.
- **Seasonal commissioning:** In accordance with BSRIA BG44/2013;
- **Notice (minimum):** One week.

820 Performance testing

- **General:** Demonstrate the performance of the installations.
- **Environmental tests:** Carry out environmental testing. If necessary, use artificial loads to simulate operating conditions.
- **Recorders:**
  - **Type:** Requirements may be graded to suit the size and complexity of systems under test. Refer to project specific documentation.
  - **Number:** Sufficient to demonstrate conditions in all areas.
  - **Duration of loan:** Timescale required to satisfactorally demonstrate system performance
- **Reports:** Submit on completion.

830 Inspection and test records

- **Pre-construction phase:** Confirmation system design is commissionable (submit prior to commencement on site)
- **Construction phase reports:** Post-installation;
  System cleanliness;
  and System commissionable.
- **Records for water systems:** In accordance with BSRIABG 2/2010.
- **Records for air systems:** In accordance with BSRIABG 49/2015.
- **Record sheets:**
  - **Submission:** Before completion.
  - **Number of copies:** Three.
  - **Requirement:** Refer to project specific documentation, else:

840 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.

850 Documentation

- **Operating and maintenance instructions:**
  - **Scope:** Submit for the system as a whole giving optimum settings for controls. Provide as project specific documentation, else:
  - **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 and electronic copy.
  - **Number of copies:** Two.
- **Record drawings:**
  - **Content:** Provide as project specific documentation, else BG 6
  - **Format:** A1 paper print and Electronic.
  - **Number of copies:** Two.
- **Submittal date:** Before handover.

860 Spares and consumables

- **Filter:**
  - **Filter media:** A minimum of two sets for each type of filter.
  - **Retaining clips and rubber gaskets:** A minimum of two sets for each type of filter.
  - **Cleaning solution:** Supply coating solution for one complete cleaning of metal plate filters.
- **Detectors:** Supply two of each type.
- **Air terminal device keys:** Supply a set for adjusting each size and type of grille and diffuser, and Supply a set for adjusting each type of grille and diffuser damper.

870 Maintenance

- **Servicing and maintenance:** Generally 12 months - Refer to project specific documentation.

75-65-35 Gas detection and alarm systems

System outline

110 Fixed gas detection and alarm system

- **Type of protection:** Personnel
  Plant and equipment.
- **Connection cable to sensors:**
  - **Cable type:** Refer to electrical specifications.
  - **Containment:** Refer to electrical specifications.
  - **Containment accessories:** Submit proposals.
- **Rewireable installation:** Required.
- **Concealed installation:** Required.
- **Detectors:** 90-75-45/450 Fixed gas detectors.
- **Alarm indication:** 90-70-95/310 Electronic sounders and 90-70-95/320 Visual alarm signal devices.
- **System accessories:** Automatic shut-off valves and BMS monitoring/alarm handling
- **Execution:** 75-65-35/630 Installation generally;
  75-65-35/640 Installing gas leak detectors sensors;
  75-65-35/675 Installing fixed gas detector control panels;
  and 75-65-35/690 Labelling.
- **System completion:** 75-65-35/810 Testing and commissioning gas detection and alarm systems;
  ;
  75-65-35/820 Documentation;
  75-65-35/830 Spares and consumables;
  and 75-65-35/840 Maintenance.

Execution

630 Installation generally

- **Standard:** To BS EN 60079-29-2.
- **Equipment to be connected:** Building Management and Controls System
- **Power supplies:** As project specific documetation, else:
  Derive from local low voltage distribution system, via dedicated circuit.

640 Installing gas leak detectors sensors

- **Position:** Adjacent to likely sources of hazard, at the perimeter of plant and away from mechanical or water damage.
- **Mounting heights:**
  - **Sensors for gases lighter than air:** Above area of potential leak.

  - **Sensors for gases heavier than air:** At floor level, in inspection pits or in ducts into which heavy gas may flow.
- **Sampling line length:** Minimize.
- **Cable connections:** Minimize cable length between control panel and sensor.
- **Access:** Install equipment in accessible locations to allow for regular calibration, maintenance and electrical safety inspection.

675 Installing fixed gas detector control panels

- **Position:** Submit proposals.
- **Connection to BMMS:** Required.
- **Connection to automatic isolation valve:** Required.
- **Access:** Install equipment in accessible locations to allow for regular calibration, maintenance and electrical safety inspection.

690 Labelling

- **Sensor identification:** Label with a unique reference.
- **Alarm devices:** Label with function.

System completion

810 Testing and commissioning gas detection and alarm systems

- **Standard:** To BS EN 60079-29-2.
- **Notice before commencing tests (minimum):** 7 days.
- **Sensor list:** Before commissioning submit proposed sensor and zone names.
- **Schedule of tests and method statement:** Submit.
- **Sensor calibration:** As manufacturers' instructions.
- **Sensor testing:** Verify the operation of each device.
- **Alarm signalling:** Verify operation
- **Connections with other systems and equipment:** Verify and demonstrate operation of the systems and equipment under pre-alarm and alarm conditions.
- **Audible signal sound level:** Measure.
- **Battery back up testing:**
  - **Mains power supply:** Isolate.
  - **Quiescent mode:** Measure current supplied by standby source when gas detection and alarm system is operating in the quiescent mode.
- **Results:** Submit.
- **Certificates of calibration for meters and instruments:** Submit.

820 Documentation

- **Operating and maintenance instructions:**
  - **General:** Refer to project specific documentation, else:
  - **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:** Locations of all equipment;
    Location and routes of all cables;
    and Schematic diagram of wiring and pipework connections.
  - **Format:** A1 paper print drawing and Electronic drawing.
  - **Number of copies:** Two.
- **Submittal date:** Before handover.
- **Modifications to existing gas detection and alarm systems:**
  - **Modification certificate:** Submit.
  - **Existing operation and maintenance manuals and record drawings:** Update.

830 Spares and consumables

- **Supply the following spares:** One sensor per 20 installed of each type with a minimum of 2 sensors of each type.
- **Supply the following consumables:** Submit proposals.

840 Maintenance

- **Duration:** Generally 12 months from Practical Completion; refer to project specific documentation for possible variations from this.

90-05-20 Drainage access chambers and gullies

Products

302 Floor channels

- **Standard:** To BS EN 1433.
- **Floor finish:** *Refer to project specific documentation.*
- **Body:**
  - **Material:** Ductile iron and Stainless steel.
  - **Configuration:** Built in fall.
- **Cover or grating:**
  - **Cover or grating type:** Lockable gratings;
    Lockable solid covers;
    and Solid covers.
    Refer to project specific documentation.
  - **Material:** Galvanized cast iron;
    Stainless steel.
  - **Outlet:** Type and direction to suit pipelines
- **Load class (minimum):** A 15;
  B 125;
  C 250;
  and D 400.
  To suit project application / location.
- **Integral accessories:** Manufacturer's standard.
- **Execution:** 90-05-20/610 Installing channels.

306 Floor gullies

- **Standard:** To BS EN 1253-1 and To BS EN 1253-2.
  As appropriate to the application
- **Body:**
  - **Configuration:** P-trapped.
  - **Material:** Ductile iron, stainless steel, and PVC-U.
- **Cover or grating:**
  - **Cover or grating type:** Lockable gratings;
    Lockable solid covers;
    and Solid covers.
  - **Material:** Epoxy coated cast iron;
    Galvanized cast iron;
    PVC-U;
    and Stainless steel.
- **Outlet:** Type and direction to suit pipelines.
- **Load class (minimum):** Heavy wheeled traffic;
  Light wheeled traffic;

and Pedestrian.
To suit application

- **Integral accessories:** Manufacturer's standard.
- **Execution:** 90-05-20/620 Installing gullies.

Execution

610 Installing channels

- **Alignment:** Grating flush with finished floor.
- **Bedding:**
  - **Material:** concrete
  - **Thickness (minimum):** 100mm, or greater to suit application.

620 Installing gullies

- **Alignment:** Grating flush with finished floor.
- **Bedding:**
  - **Material:** concrete
  - **Thickness (minimum):** 100mm, or greater to suit application.

90-05-35 Gutters

Products

320 Aluminium eaves gutters

- **Form:** Cast to BS 8530;
  Extruded to BS 8530;
  Extruded with cast fittings to BS 8530;
  Pressed to BS EN 612;
  and Rolled to BS EN 612.
- **Third party product certification:** BBA Agrément certificate.
- **Profile:** submit proposals
- **Thickness or gauge:** 2 mm.
- **Finish:** Powder coating to BS 6496;
  Powder coating to BS EN 12206-1;
  and Self colour plastics coating.
- **Colour:** RAL colour to be agreed.
- **Film thickness (minimum):** 40 micrometres.
- **Integral accessories:** Adapters;
  Electrical continuity connectors;
  Preformed gutter angles;
  and Stop ends.

325 Aluminium boundary wall or valley gutters

- **Profile:** Box;
  Boundary;
  and Trapezoidal.
- **Size (nominal):** Manufacturer's standard.
- **Construction:**
  - **Material:** *As project specific documentation else*
    Manufacturer's standard.
- **Factory applied membrane:** Manufacturer's standard.
- **Integral accessories:** Manufacturer's standard.

330 Cast iron eaves gutters

- **Standard:** To BS 460, except for shape.
- **Profile:** Submit proposals.
- **Integral accessories:** Electrical continuity connectors;
  Jointing clips;
  Preformed gutter angles;
  and Stop ends.

365 Galvanized steel boundary wall or valley gutters

- **Details:** Generally as 90-05-35/325 Aluminium Gutters
- **Thickness:** 3.0 mm.
- **Finish:** Hot dip galvanized to BS EN ISO 1461 after manufacture.

375 Glass reinforced plastics (GRP) eaves gutters

- **Form:** Submit proposals.
- **Integral accessories:** Preformed gutter angles and Stop ends.

380 Glass reinforced plastics (GRP) boundary wall or valley gutters

- **Details:** Generally as 90-05-35/325 Aluminium Gutters

385 Hot dip precoated steel eaves gutters

- **Material:** Steel to BS EN 10346, grade S220GD+ZA255.
- **Finish:** Self coloured plastics and Self finish.
- **Colour:** Submit proposals.
- **Integral accessories:** Electrical continuity connectors;
  Preformed gutter angles;
  and Stop ends.
- **Form:** Submit proposals.

405 Stainless steel eaves gutters

- **Standard:** To BS EN 612.
- **Profile:** Beaded half round;
  Box;
  Half round;
  and Ogee.
  Refer to project specific documentation
- **Size (nominal):** 125 mm and 150 mm.
- **Thickness or gauge:** 0.7 mm.
- **Finish:** Natural.
- **Integral accessories:** Electrical continuity connectors;
  Preformed gutter angles;
  and Stop ends.

407 Stainless steel rainwater chutes

- **Materials:**
  - **Standard:** Austenitic stainless steel to BS EN 10088-2.
  - **Grade:** 1.4404 (316L).
  - **Finish:** Low reflective;
    PVDF coated;
    and Tern coated.
- **Form:** Stainless steel rainwater chute. Fully supported, to discharge into hopper.

- **Integral accessories:** Stainless steel brackets.

415 PVC-U eaves gutters

- **Standards:** To relevant parts of BS EN 607 and BS EN 1462.
- **Third party product certification:** BSI Kitemark.
- **Recycled content:** 10% (minimum) to BS EN ISO 14021.
- **Profile:** Box;
  Half round;
  Ogee;
  and Rectilinear.
- **Size (nominal):** 100 mm;
  125 mm;
  and 150 mm.
- **Colour:** Black.
- **Integral accessories:** Preformed gutter angles and Stop ends.

420 Zinc eaves gutters

- **Standard:** To BS EN 612.
- **Profile:** Beaded half round;
  Box;
  Half round;
  and Ogee.
- **Size (nominal):** 125 mm and 150 mm.
- **Finish:** Natural.
- **Integral accessories:** Electrical continuity connectors;
  Preformed gutter angles;
  and Stop ends.

425 Zinc rainwater chutes

- **Materials:**
  - **Standard:** To BS EN 988.
  - **Temper:** Standard.
  - **Finish:** Natural.
- **Form:** Zinc rainwater chute. Fully supported, to discharge into hopper.
- **Integral accessories:** Zinc brackets.

465 Site applied gutter linings

- **Material:** Aluminium;
  Aluminium foil and rubberised bitumen;
  and GRP.
  Refer to project specific documentation.

90-10-20 Drainage and rainwater pipelines

Products

302 Gravity rainwater outlets

- **Material:** Gunmetal and Stainless steel.
  Refer to project specific documentation.
- **Grating:** Angled;
  Domed;
  and Flat.
  Refer to project specific documentation.
- **Spigots:** Type and direction to suit pipelines with suitable adaptors and connections.
- **Integral accessories:** Flange and clamping collar for roof membrane;
  Gravel guards;
  Insulation jackets;
  Raising pieces to suit insulation thicknesses;
  Sediment buckets;
  Support plates;
  and Underdeck clamps.
- **Execution:** 90-10-20/610 Installing rainwater drainage outlets.

306 Aluminium external rainwater pipes

- **Standard:** To BS 8530.
- **Third party product certification:** BBA Agrément certificate.
- **Form:** Manufacturer's standard.
- **Section:** Rectangular;
  Round;
  and Square.
- **Size (nominal):** Manufacturer's standard.
- **Finish and colour:**
  - **Finish:** Mill finish;
    Factory applied epoxy primer and top coat;
    Powder coating to BS EN 12206-1;
    and Self-colour plastics coating.
  - **Colour:** RAL colour to be agreed.
  - **Film thickness (minimum):** As appropriate to the application. Coating applicator to determine
- **Integral accessories:** Access fittings;
  Rainwater heads;
  and Rainwater shoes.

308 Cast iron socketed rainwater pipes

- **Standard:** To BS 460.

- **Section:** Rectangular;
  Round;
  and Square.
- **Form:** Manufacturer's standard.
- **Size (nominal):** Manufacturer's standard.
- **Finish and colour:**
  - **Finish:** Prepainted semigloss.
  - **Colour:** Black.
- **Integral accessories:** Access fittings and Rainwater shoes.

312 GRP rainwater pipes

- **Section:** Rectangular;
  Round;
  and Square.
- **Size (nominal):** Manufacturer's standard.
- **Finish and colour:**
  - **Finish:** High gloss paint.
  - **Colour:** RAL colour to be agreed.
- **Integral accessories:** Access fittings;
  Rainwater heads;
  and Rainwater shoes.

314 Hot dip precoated steel rainwater pipes

- **Material:** Steel to BS EN 10346, grade S220GD+ZA255.
- **Section:** Round and Square.
- **Size (nominal):** Manufacturer's standard.
- **Finish and colour:**
  - **Finish:** Polyvinyl chloride (Plastisol), 200 micrometres.
  - **Colour:** *Refer to project specific documentation.*
- **Integral accessories:** Access fittings;
  Rainwater heads;
  and Rainwater shoes.

318 Unplasticized polyvinyl chloride (PVC-U) external rainwater pipes

- **Standard:** To BS EN 12200-1.
- **Third party product certification:** BSI Kitemark.
- **Recycled content:** 10% (minimum) to BS EN ISO 14021.
- **Section:** Rectangular;
  Round;
  and Square.
- **Size (nominal):** DN 75 and DN 110.
- **Colour:** Manufacturer's standard.
- **Integral accessories:** Access fittings;

Rainwater heads;
and Rainwater shoes.

326 ABS above ground wastewater branch discharge pipes

- **Standard:** To BS EN 1455-1, application area code B.
- **Third party product certification:** BSI Kitemark.
- **Jointing type:** Solvent weld.
- **Nominal sizes:** DN 32;
  DN 40;
  and DN 50.
- **Colour:** Grey and White where exposed to view.
- **Integral accessories:** Access fittings.

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

- **Material and standard:** To BS 5255.
- **Third party product certification:** Manufacturer's standard.
- **Jointing type:** Push fit ring seal and Solvent weld.
- **Nominal sizes:** DN 32;
  DN 40;
  and DN 50.
- **Colour:** Grey and White where exposed to view.
- **Integral accessories:** Access fittings.

336 Polypropylene above ground wastewater branch discharge pipes

- **Standard:** To BS 5255 and To BS EN 1451-1, application area code B.
- **Third party product certification:** BBA
- **Jointing type:** Electrofusion or compression to suit location
- **Colour:** Manufacturer's standard.
- **Integral accessories:** Access fittings.

344 Cast iron above ground drainage pipes

- **Standard:** To BS EN 877.
- **Jointing type:** Push fit couplings
  and
  Socketed.
- **Size (nominal):** Manufacturer's standard.
- **Finish:**
  - **External:** Anti rust primer
    plus Semigloss- black.
  - **Internal:** Two part epoxy.
- **Integral accessories:** Access fittings;
  Noise reducing gaskets for brackets;
  Rainwater heads;

Rainwater shoes;
Weathering collars;
and Wire balloons.

348 High density polyethylene (HDPE) above ground drainage pipes

- **Standard:** To BS EN 1519-1.
- **Third party product certification:** BBA Agrément certificate.
- **Recycled content:** 20% (minimum) to BS EN ISO 14021.
- **Colour:** Black.
- **Size (nominal):** DN 110 and DN 160.
- **Integral accessories:** Access fittings.
  Expansion sockets;
  Intumescent fire collars
- **Execution:** 90-10-20/630 Fixing and jointing rainwater and above ground drainage pipes.

350 Stainless steel above ground drainage pipes

- **Standards:** BS EN 1124-1 and BS EN 1124-3.
- **Grade:** 1.4304 (316) to BS EN 10088-1.
- **Jointing:** Push fit with elastomeric sealing rings to BS 7874 and BS EN 681-1.
- **Nominal sizes:** DN 100 and DN 150.
- **Finish:** Unpolished.
- **Integral accessories:** Access fittings;
  Rainwater heads;
  and Rainwater shoes;
  Expansion sockets;
  Intumescent fire collars.

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

- **Standard:** To BS EN 1329-1 and the weathering resistance requirements of BS 4514.
- **Third party product certification:** BSI Kitemark or Agrément certified.
- **Nominal sizes:** DN 110 and DN 160.
- **Colour:** Black and Grey.
- **Integral accessories:** Access fittings;
  Plastics cages;
  Rainwater heads;
  Rainwater shoes;
  Trace heating;
  Weathering collars;
  Expansion sockets.
- **Execution:** 90-10-20/630 Fixing and jointing rainwater and above ground drainage pipes.

Execution

610 Installing rainwater drainage outlets

- **Fixing:** Secure. Fix before connecting pipework.
- **Method:** Grout into preformed holes;
  Screw to timber spacing blocks;
  Support plates and clamps;
  and Welded to gutter sol,
  as appropriate to the application.
- **Junctions between outlets and pipework:** Watertight. Accommodate movement in structure and pipework.

630 Fixing and jointing rainwater and above ground drainage pipes

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

    Stability: Fix securely.

    Fixing centres (nominal): To suit the installation 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.
- **Spacing (maximum):**
- **Wall and floor penetrations:**

90-10-60 Pipeline accessories

Products

310 Automatic air vents

- **Arrangement:** Vertical inlet with integral lockshield isolating valve and check valve. Discharge pipe taken to visible location to act as warning.
- **Material:** Gunmetal.
  Working parts in stainless steel;
- **Connections:** Threaded.

320 Angular expansion compensators

- **Standard:** In accordance with BS 6129-1.
- **Format:** Contractor to submit proposals.
- **Material:**
  - **Bellows:** Stainless steel 1.4571 (316 Ti).
  - **Inner sleeve:** Stainless steel 1.4541 (321).
- **Connections:** Flanged or screwed as appropriate to the pipe size and system pressure/temperature.
- **Execution:** 90-10-60/620 Installing expansion compensators.

325 Axial expansion compensators

- **Standard:** In accordance with BS 6129-1.
- **Arrangement:** Contractor to submit proposals.
- **Material:**
  - **Bellows:** Stainless steel 1.4571 (316 Ti).
  - **Inner sleeve:** Stainless steel.
- **Connections:** Flanged or screwed as appropriate to the pipe size and system pressure/temperature.
- **Execution:** 90-10-60/620 Installing expansion compensators.

340 Pressure differential de-aerators

- **Arrangement:** Self-circulating unit.
- **Material:** Carbon steel.
- **Connections:** Flanged or Threaded. As appropriate to the pipe size and system pressure/temperature.

345 Temperature differential de-aerators

- **Arrangement:** Vertical housing with internal large surface area mechanism to remove microbubbles via coalescence effect.
- **Material:** Carbon steel.

- **Connections:** Flanged or Threaded. As appropriate to the pipe size and system pressure/temperature.

350 Centrifugal air separators

- **Arrangement:** Vertical steel housing with offset inlet and outlet ports to remove bubbles via centrifugal force.
- **Material:** Carbon steel.
- **Connections:** Flanged or Threaded. As appropriate to the pipe size and system pressure/temperature.

355 Combined air and dirt separators

- **Arrangement:** Vertical housing with internal large surface area mechanism to remove microbubbles via coalescence effect.
- **Material:** Carbon steel.
- **Connections:** Flanged or Threaded. As appropriate to the pipe size and system pressure/temperature.
- **Execution:** 90-10-60/640 Installing combined air and dirt separators.

360 Dirt separators type A

- **Arrangement:** Vertical mild steel housing with internal reservoir, sludge pipe, perforation plate and automatic air release mechanism.
- **Material:** Carbon steel.
- **Connections:** Flanged or Threaded. As appropriate to the pipe size and system pressure/temperature.

370 Pressure gauges

- **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) and 50 kPa (0.5 bar) for a scale value greater than 1000 kPa (10 bar).
  Select gauges with scale range extending from 10% below normal expected readings to between 10%(min) & 25% (max) above normal expected readings.
  Incorporate manually adjustable red index pointers to indicate normal expected setting.
- **Material:** Brass case.
- **Connections:** 'U' pattern siphon and gauge cock.
- **Execution:** 90-10-60/630 Installing pressure gauges.

375 Pressure and altitude gauges

- **Standard:**
  - **Bourdon:** To BS EN 837-1.
  - **Diaphragm:** To BS EN 837-3.
- **Diameter:** 100 mm.
- **Scale subdivisions:** 20 kPa (0.2 bar) for a maximum scale value of 1000 kPa (10 bar); 50 kPa (0.5 bar) for a scale value greater than 1000 kPa (10 bar).
  Altitude gauges to have equivalent scale showing metres head. Both scales to be provided

on dual use gauges.
Select gauges with scale range extending from 10% below normal expected readings to between 10%(min) & 25% (max) above normal expected readings.
Incorporate manually adjustable red index pointers to indicate normal expected setting.

- **Case:** Brass.
- **Connections:** 'U' pattern siphon and gauge cock.
- **Execution:** 90-10-60/630 Installing pressure gauges.

380 Temperature gauges

- **Standard:** To BS EN 13190.
- **Format:** Manufacturer's standard.
- **Diameter:** 100.
- **General:** Select gauges with scale range extending from 10% below normal expected readings to between 10%(min) & 25% (max) above normal expected readings.
  Incorporate manually adjustable red index pointers to indicate normal expected setting.
- **Case:** Brass.
- **Connections:** Angle or vertical stem as appropriate to ensure gauge is displayed vertically.
- **Integral accessories:** 100 mm immersion length pocket.

385 Gauge mounting boards

- **Arrangement:** Mount temperature, pressure and altitude gaugesdirectly on the pipeline or vessel. Where this is not possible, or it would be difficult to read a gauge in such a location, mount remotely on wall fixed hardwood boards. Interconnecting pipeline to be in small bore copper tube supported on cable tray.
- **Material:** 12 mm thick hardwood polished.

390 Manifold for underfloor heating and cooling

- **Accessories:** Manifold elbow connector;
  Manifold extension kit;
  and Pump pack:
  As required for a complete installation.

395 Masking plates

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

400 Pipeline strainers

- **Pattern:** Angle pattern;
  Duplex basket;
  Simplex basket;
  and Y pattern.
  and as indicated on drawings.
  Where not indicated, submit proposals.

- **Baskets:**
  - **Perforation size:** Submit proposals to suit application
  - **Mesh size:** Submit proposals to suit application
- **Material:** Bronze;
  Cast iron;
  Cast steel;
  and Dezincification resistant brass (DZR).
  As appropriate to the pipeline material, size and system parameters.
- **Connections:** Compression;
  Flanged;
  Grooved;
  and Threaded.
  As appropriate to the pipeline material, size and system parameters.
- **Integral accessories:** Manufacturer's standard.
- **Execution:** 90-10-60/650 Installing strainers.

405 Pipe sleeves

- **Material:** As pipeline material.
- **Fire barrier:** Where pipes pass through fire barriers, pack the space between the sleeve and the pipe with fire resisting material.

420 Tundishes

- **Material:** Copper sheet and Mild steel sheet, hot dip galvanized.
- **Connections:** Diameter to suit drain line.

435 Anti climb pipe covers

- **Material:** Aluminium;
  Galvanized steel;
  and GRP.
- **Section:** Manufacturer's standard.
- **Size:** Minimum, 2000 mm long x 200 mm wide.
- **Finish and colour:**
  - **Factory finish:** Polyester powder coating;
    Plastics coating;
    and Smooth, high gloss paint.
  - **Colour:** Manufacturer's standard.

455 Expansion vessels

- **Standard:** To BS EN 13831.
- **Accessories:** Vessel connecting kit.

Execution

610 Air bottles

- **Construction:** A vertical extension from pipe.
- **Size:** Bore of pipe.
- **Length:** 200 mm.
- **Extension pipe:** Copper with a manual vent cock located in an easily accessible position.
- **Discharge pipes:** Terminate with air cock or needle valve in an accessible position.

620 Installing expansion compensators

- **Position:** Submit proposals.
- **Anchors and guides:** Locate to contain movement and resist maximum imposed loads.

630 Installing pressure gauges

- **Position:** Install in locations indicated on drawings, or as otherwise specified.

640 Installing combined air and dirt separators

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

650 Installing strainers

- **Angle type:** Install with strainer cap at the bottom. Inlet at the top or side.
- **Y-type:** Install in direction of flow with the pocket in the horizontal plane.

90-10-65 Pipelines

Products

310 Copper pipelines

- **General requirements:** 90-10-65/320 Copper pipeline jointing materials and 90-10-65/315 Copper pipeline fittings.
- **Standard:** To BS EN 1057.
- **Grade:** R250.
  Tube thickness to be strictly in accordance with BS 2871 Table X.
- **Finish:** Plain, except where indicated as chrome plated.
  Chrome-plated to BS EN ISO 1456
  Generally exposed tube to be chrome plated
- **Execution:** 90-10-65/630 Installing copper pipelines;
  90-10-65/635 Brazed joints in copper and copper alloy pipes;
  90-10-65/700 Installing buried pipelines;
  and 90-10-65/705 Protection of buried pipelines.

315 Copper pipeline fittings

- **Manufacturer:** Kitemarked
- **Standards:**
  - **Capillary:** To BS EN 1254-1, solder ring and To BS EN 1254-1, end feed.
  - **Compression:** To BS EN 1254-2, type A and To BS EN 1254-2, type B.
  - **Flanges:** To BS EN 1092-3
  - **Press fittings:** Generally NOT preferred;
    Submit detailed proposals to CA for consideration where considered a possible appropriate option.

320 Copper pipeline jointing materials

- **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.
  - **Screwed joints:** Screwed jointing is not normally required or approved for use with copper pipework and fittings. However, where necessary to connect to equipment and ancillaries etc., PFTE tape is to be utilised. Do not use jointing compounds and/or hemp.
  - **Compression joints:** Compression joints are designed to be used without jointing compound. In accordance with TR/20 WRAS approved lubricants may be used on sizes over 22mm OD.

350 Cross-linked polyethylene (PE-X) pipelines

- **General requirements:** 90-10-65/380 Jointing materials for plastics tubes.
  Install in accordance with manufacturer's recommendations.
- **Standards:**
  - **Pipe:** To BS 7291-3, class S;
    To BS EN ISO 15875-2, class 2;
    To BS EN ISO 15875-2, class 4;
    and To BS EN ISO 15875-2, class 5.
  - **Fittings:** BS 7291-3, class S;
    BS EN ISO 15875-3, class 2;
    BS EN ISO 15875-3, class 4;
    and BS EN ISO 15875-3, class 5.
- **Execution:** 90-10-65/645 Installing plastics pipelines.

355 Polybutylene (PB) pipelines

- **General requirements:** 90-10-65/380 Jointing materials for plastics tubes.
- **Standards:**
  - **Pipe:** To BS 7291-2, class S;
    To BS EN ISO 15876-2, class 1;
    To BS EN ISO 15876-2, class 2;
    To BS EN ISO 15876-2, class 4;
    and To BS EN ISO 15876-2, class 5.
  - **Fittings:** To BS 7291-2, class S;
    To BS EN ISO 15876-3, class 1;
    To BS EN ISO 15876-3, class 2;
    To BS EN ISO 15876-3, class 4;
    and To BS EN ISO 15876-3, class 5.
- **Colour:** As appropriate to the installation.
- **Execution:** 90-10-65/645 Installing plastics pipelines.

360 Polyethylene (PE) pipelines for gaseous fuels

- **General requirements:** 90-10-65/380 Jointing materials for plastics tubes.
- **Standards:**
  - **Pipes:**

    For gaseous fuels (PE): To BS EN 1555-2.

    For buried gaseous fuels (PE): To BS ISO 4437-2, PE 80 and To BS ISO 4437-2, PE 100.
  - **Fittings:**

    For gaseous fuels (PE): To BS EN 1555-3.

    For buried gaseous fuels (PE): To BS ISO 4437-3, PE 80 and To BS ISO 4437-3, PE 100.
- **Colour:** Yellow.
- **Execution:** 90-10-65/645 Installing plastics pipelines;
  90-10-65/700 Installing buried pipelines;
  and 90-10-65/705 Protection of buried pipelines.

365 Polyethylene (PE) pipelines for water supply

- **General requirements:** 90-10-65/380 Jointing materials for plastics tubes.
  HDPE piping required
- **Manufacturer:** George Fischer PE100 (HDPE) - or equivalent
  Provide a detailed technical submission on proposed product for consideration .
- **Standards:**
  - **Pipes:** To BS EN 12201-2;
    To BS ISO 4427-2, PE 40;
    To BS ISO 4427-2, PE 63;
    To BS ISO 4427-2, PE 80;
    and TO BS ISO 4427-2, PE 100.
  - **Fittings:** To BS EN 12201-3;
    To BS ISO 4427-3, PE 40;
    To BS ISO 4427-3, PE 63;
    To BS ISO 4427-3, PE 80;
    and To BS ISO 4427-3, PE 100.
- **Colour:** Blue.
- **Execution:** 90-10-65/645 Installing plastics pipelines;
  90-10-65/700 Installing buried pipelines;
  and 90-10-65/705 Protection of buried pipelines.

375 Unplasticized polyvinylchloride (PVC-U) pipelines

- **General requirements:** 90-10-65/380 Jointing materials for plastics tubes.
- **Standards:**
  - **Pipe:** To BS EN ISO 1452-2.
  - **Fittings:** To BS EN ISO 1452-3.
- **Execution:** 90-10-65/645 Installing plastics pipelines.

380 Jointing materials for plastics tubes

- **Standards:**
  - **Compression:** To BS EN 1254-3.
  - **Electrofusion:** To BS EN 12201-3.
  - **Socket and spigot:** To BS EN 12201-3.
  - **Solvent cement:** To BS EN 14814.
  - **Elastomeric ring seal:** To BS EN 681-1.

385 Pre-insulated pipelines

- **Pipes:** Pipe assembly of steel service pipes, polyurethane thermal insulation and outer casing of polyethylene, to BS EN 253.
- **Fittings:** Fitting assemblies of steel service pipes, polyurethane thermal insulation and outer casing of polyethylene, to BS EN 448.
- **Joint assembly:** Joint assembly for steel service pipes, polyurethane thermal insulation and outer casing of polyethylene, to BS EN 489.

- **Valve assembly:** Steel valve assembly for steel service pipes, polyurethane thermal insulation and outer casing of polyethylene, to BS EN 488.
- **Execution:** 90-10-65/700 Installing buried pipelines;
  90-10-65/705 Protection of buried pipelines;
  and 90-10-65/660 Installing pre-insulated pipelines.

390 Refrigerant pipelines and fittings

- **Standard:** To BS EN 378-2.
- **Pipelines:** To BS EN 12735-1.
- **Execution:** 90-10-65/665 Installing refrigerant pipework.

395 Stainless steel pipelines

- **General requirements:** 90-10-65/400 Stainless steel pipeline fittings and 90-10-65/405 Stainless steel pipeline jointing materials.
- **Standards:** To EN 10217-7, PED approved

  Stainless steel to be a minimum grade of 304L, subject to the nature and chloride content of the carried water.
- **Minimum wall thickness:** Up to 50mm: 1.5mm (if alternative thickness required for jointing method, submit proposals) and to suit pressure rating

  Above 50mm: 2.0mm and to suit pressure rating.
- **Finish:** Pickled and descaled, unpolished.
  Polished where exposed to view.

  Wrap in aluminium foil prior to applying insuation
- **Execution:** 90-10-65/670 Installing stainless steel pipelines and 90-10-65/675 Brazed joints in stainless steel pipes.

400 Stainless steel pipeline fittings

- **Standards:**
  - **General:** Fittings PED but welded to EN 10253-4.
    Bend radius 1.5 x diameter.
    Reducers from parent metric bore and to EN 10253-3

    Joints welded to EN 13480. Welding to be fully penetrative TIG but welding with inert gas purging.
    Compatible flanges to use composite backing plates.
  - **Capillary:** To BS 4825-2.
  - **Clamp type couplings:** To BS 4825-3.
    Not preferred
  - **Compression:** To BS EN 1254-2.
  - **Press fittings:** Manufacturer's standard. By pipeline supplier
  - **Recessed ring joint type (RJT) couplings:** To BS 4825-5.
  - **Threaded (IDF type) couplings:** To BS 4825-4.

405 Stainless steel pipeline jointing materials

- **Standards:**
  - **Brazing alloy:** To BS EN ISO 17672.
  - **Flux:** Phosphoric acid-based, to BS 5245
  - **Filler metals:** Nickel bearing zinc free.

410 Corrugated stainless steel for gaseous fuels

- **Manufacturer:** Submit proposals.
- **Standard:** Pipe and fittings to BS 7838.
- **Finish:** Coated.
- **Execution:** 90-10-65/700 Installing buried pipelines and 90-10-65/705 Protection of buried pipelines.

415 Steel pipelines

- **General requirements:** 90-10-65/425 Steel pipeline jointing materials and 90-10-65/420 Steel pipeline fittings.
- **Standard:**
  - **Up to 150mm:** To BS EN 10255, medium weight and To BS EN 10255, heavy weight.
    medium weight (gas & oil services only)
    heavy weight for all other services;
    Thin Wall tubing is NOT acceptable.
  - **150mm and above:** To BS EN 10216-1, designation TR1.
    Nominal Bore : Wall thickness;
    150 : 5.4;
    200 : 6.3;
    250 : 7.1;
    300 : 8.0;
    and 350-600 : 9.5.
- **Finish:** Varnish.
- **Execution:** 90-10-65/680 Installing steel pipelines and 90-10-65/685 Welding steel pipelines
  .

420 Steel pipeline fittings

- **Standards:**
  - **Malleable:** To BS 143 and 1256.
    Screwed jointing generally acceptable on sizes up to 50mm, except where concealed.
  - **Flanged:** To BS EN 1092-1.
  - **Welded:** To BS EN 10253-1 and BS EN 10253-2.
    Preferred jointing method on all sizes over 50mm.
  - **Wrought:** To BS EN 10241.
  - **Press fit fittings:** Do not use
  - **Mechanical couplings:** Manufacturer's standard.
    Provide a detailed Technical Submission to the CA for consideration, setting out suitability for the fluid and the operating temperature & pressure;
    Use only in full accordance with manufacturer's recommendations.

425 Steel pipeline jointing materials

- **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.

Execution

610 Pipelines installation generally

- **Standard:** BESA Technical Report TR/20/ 1 - 10 appropriate to the service
- **General:** 1) Cut pipe lengths cleanly cut at right angles to the pipe axis and reamered to remove surplus material;
  2)Install pipework to accommodate movement and expansion, utilising loops and changes in direction wherever possible. Where expansion compensators are required, comply with appropriate clauses of this specification;
  3) Use long radius bends are to be used in preference to elbows. The latter only to be utilised on smaller sizes (up to 50mm) where pipework is running close to walls, etc.;
  4) Use swept tees ;
  5) Other than in vertical pipes, use eccentric fittings for changes in pipe size , correctly installed to allow free venting and draining of the pipeline.
  6) Install maintenance joints at intervals and at connections to equipment, utilising unions or flanged joints as appropriate to the pipe size;
  (i) adjacent to plant and equipment ;
  (ii) at regular intervals not exceeding 25min distribution pipe runs.
  (iii) Where pipes run through rooms unions to be fitted in pipework within each room.
  7) Where necessary, use "navy" type unions with bronze faces.
- **Dissimilar metals:** Prevent electrolytic corrosion.

615 Installing pipeline fittings

- **Bushes:** Use only at radiators.
- **Fabricated junctions and fittings:** Same material as the main pipeline.
- **Demountable joints:** Regularly spaced along pipeline runs and at items of equipment.

620 Installing anchors generally

- **Purpose:** To resist axial stress transmitted by flexure of horizontal and vertical pipe runs, and loading on vertical pipes.
- **Fixings:** Provide associated backing plates, nuts, washers and bolts for attachment to, or building into building structure.
- **Fixing to building structure:** Submit proposals for Contract Administrator Approval.
- **Building structure:** Suitable for transmitted stress.

625 Installing slide guides

- **Expansion and contraction:** Direct movement from pipe anchor points towards loops, bellows or flexible inserts.
- **Thrust:** Linear relative to the axis of pipe.
- **Friction:** Apply a friction reducing material between metal faces subjected to movement.

630 Installing copper pipelines

- **General requirements:** 90-10-65/690 Spacing of pipelines;
  90-10-65/625 Installing slide guides;
  90-10-65/615 Installing pipeline fittings;
  90-10-65/610 Pipelines installation generally;
  90-10-65/710 General inspection and testing;
  and 90-10-65/620 Installing anchors generally.
- **Standard:** In accordance with CDA publications 88 Copper tube in buildings and
  In accordance with CDA publications 149 Large diameter copper tubes.
- **Jointing method:**
  - **Permanently concealed joints:** Brazed.
  - **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 Compression, up to 54 mm.
- **Expansion loops:** Formed bends from single pipe length.
- **Anchor:**
  - **Method:** Two flanges fixed to copper female adaptors.
  - **Pipe restraints:** Saddle clamps.

635 Brazed joints in copper and copper alloy pipes

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

645 Installing plastics pipelines

- **General requirements:** 90-10-65/690 Spacing of pipelines ;
  90-10-65/615 Installing pipeline fittings;
  90-10-65/610 Pipelines installation generally;
  90-10-65/710 General inspection and testing;
  and 90-10-65/620 Installing anchors generally.
- **Pipeline material:** Polybutylene;
  Polyethylene;
  Cross linked polyethylene;
  Polypropylene;
  and Unplasticized polyvinylchloride.
- **Jointing method:** Butt fusion;
  Compression;
  Electrofusion;
  Flanged;
  Push-fit;
  Socket fusion;
  Solvent;

Threaded;
and To suit tube.

- **Anchor:** PVC coated overstraps or clamps, with polypropylene strip between pipe and carbon steel section.

660 Installing pre-insulated pipelines

- **General requirements:** 90-10-65/690 Spacing of pipelines;
90-10-65/615 Installing pipeline fittings;
90-10-65/610 Pipelines installation generally;
and 90-10-65/710 General inspection and testing.
- **Standard:**

665 Installing refrigerant pipework

- **General requirements:** 90-10-65/690 Spacing of pipelines and 90-10-65/710 General inspection and testing.
- **Standards:** To BS EN 378-3 and BS EN 378-4.
- **Refrigerant lines:** Short and straight.

670 Installing stainless steel pipelines

- **General requirements:** 90-10-65/690 Spacing of pipelines;
90-10-65/615 Installing pipeline fittings;
90-10-65/610 Pipelines installation generally;
and 90-10-65/710 General inspection and testing.
- **Jointing method:** Capillary.

675 Brazed joints in stainless steel pipes

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

680 Installing steel pipelines

- **General requirements:** 90-10-65/690 Spacing of pipelines;
90-10-65/625 Installing slide guides;
90-10-65/615 Installing pipeline fittings;
90-10-65/610 Pipelines installation generally;
90-10-65/710 General inspection and testing;
and 90-10-65/620 Installing anchors generally.
- **Permanently concealed joints:** Welded.
- **Accessible joints:** Screwed, up to and including 50 mm;
Mechanical grooved, 50–300 mm (Provide detailed Technical Submission for consideration);
and Welded and flanged, 65 mm and over.
- **Expansion loops:** Formed bends from single pipe length.
- **Anchor:**
  - **Method:** Two slip on flanges welded to pipes, bolted together through a carbon steel channel section.
  - **Pipe restraints:** Carbon steel overstraps or heavy U-bolts welded to pipes.

685 Welding steel pipelines

- **Standard:** In accordance with BESATechnical Report TR/5.
- **Welder identification:** Mark each weld to identify operative.
- **Non-destructive examination:** Visual examination, to BS EN ISO 17637.
- **Completed welds:** Wire brush and protect from corrosion.

690 Spacing of pipelines

- **Minimum clearance between insulated pipelines and:**
  - **Wall finish:** 25 mm.
  - **Ceiling finish or soffit:** 100 mm.
  - **Floor:** 150 mm.
  - **Electrical services:** 150 mm.
  - **Adjacent services:** 100 mm.
  - **Uninsulated pipeline:** 75 mm.
  - **Another insulated pipeline:** Where the service is at approximately the same temperature: 25 mm.
    between hot or heating pipe runs and domestic cold water pipe runs: 750mm or as far as practicable.
- **Minimum clearance between uninsulated pipelines and:**
  - **Wall finish:** 25 mm.
  - **Ceiling finish or soffit:** 100 mm.
  - **Floor:** 150 mm.
  - **Electrical services:** 150 mm.
  - **Adjacent services:** 150 mm.
  - **Another uninsulated pipeline:** 25 mm.

700 Installing buried pipelines

- **Depth of cover:** 90-10-65/705 Protection of buried pipelines
- **Set out:** Lay in straight lines.
- **Concealment:** Do not lay under surfaced footpaths or drives.
- **Trench excavations:** Carefully prepare to a firm even base. Remove sharp objects and replace with pea gravel to give 100 mm (minimum) cover above and below the pipe.
- **Installation:** Thoroughly clean lengths of pipe internally before laying. Temporarily cap until jointing takes place. After laying and jointing keep leading end capped.
- **Thrust blocks:** Install at changes of direction and blank ends.
  May not be appropriate for propriatory pipe-in pipe and similar systems, seek advice from the system specialist.
- **Backfilling:** Excavated material free from large stones and sharp objects. Leave joints exposed until after pipeline pressure test. Lay and compact in 300 mm maximum layers. Do not use heavy compactors before backfill is 600 mm deep.

705 Protection of buried pipelines

- **Earth cover (minimum):**

- **NJUG:** Set out all services at depths not less than those recommended by the latest publications of the National Joint Utilities Council (NJUG) - Volume 1 - NJUG Guidelines on the Positioning and Colour Coding of Underground Utilities' Apparatus. (Issue 8: 29th October 2013 or as subsequently revised)

- **Protection:** Apply an anticorrosive, non- cracking, non-hardening, waterproof sealing tape.
- **Application:** After cleaning pipework wrap two layers contrawise spirally around the pipe, with 50% minimum overlap.
- **Marker tape:** Required.

710 General inspection and testing

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

90-10-70 Pumps and pressurisation units

Products

320 Pumps generally

- **General safety standard:** To BS EN 809.
- **Electrical safety:** To BS EN 60335-1 and BS EN 60335-2-51.
- **Dynamic balance:** To BS ISO 21940-21.
- **Test standards:** To BS EN ISO 9906 and in accordance with BS EN ISO 5198.
- **Belts and pulleys:** To BS 3790.
- **Rotodynamic pumps:** To BS EN 16297-1 and BS EN 16644.
- **Selection:** Select pump at or near the most efficient part of the performance curve for required duty.
- **Hot water service pumps:** Gunmetal or bronze construction unless otherwise specified
- **Connections:**
  - **Flanged, copper alloy and composite:** To BS EN 1092-3.
  - **Flanged, cast iron:** To BS EN 1092-2.
  - **Threaded:** To BS EN 10226-1.

340 Canned rotor pumps

- **General requirements:** 90-10-70/320 Pumps generally.
- **Material:**
  - **Impeller:** Bronze and Stainless steel to suit service
  - **Housing:** Bronze and Cast iron to suit service.
- **Accessories:** Anti-vibration mountings and
  Flexible connections on pump suction and discharge.
- **Execution:** 90-10-70/610 Installation of pumps generally and 90-10-70/640 Commissioning preparation.

350 Close coupled end suction pumps

- **General requirements:** 90-10-70/320 Pumps generally.
- **Standard:** To BS EN ISO 2858.
- **Casing material:** Copper and copper alloy to BS EN 1982 and Grey cast iron to BS EN 1561. to suit application
- **Accessories:** Anti-vibration mountings and
  Flexible connections on pump suction and discharge.
- **Execution:** 90-10-70/610 Installation of pumps generally and 90-10-70/640 Commissioning preparation.

360 Close coupled in line pumps

- **General requirements:** 90-10-70/320 Pumps generally.

- **Casing material:** Copper and copper alloy to BS EN 1982 and Grey cast iron to BS EN 1561. To suit system
- **Accessories:** Anti-vibration mountings and
  Flexible connections on pump suction and discharge.
- **Execution:** 90-10-70/610 Installation of pumps generally and 90-10-70/640 Commissioning preparation.

370 Fuel transfer pumps

- **General requirements:** 90-10-70/320 Pumps generally.
- **Connections:** Threaded.
- **Accessories:** Anti-vibration mountings;
  Flexible connections;
  Auto-changeover starter panel;
  and Duplex filters.
- **Execution:** 90-10-70/610 Installation of pumps generally and 90-10-70/615 Installing fuel transfer pumps.

390 Pressure booster sets

- **General requirements:** 90-10-70/320 Pumps generally.
- **Controlled start up:** Incorporate soft start in pump control to prevent pressure surges on system start-up;
  In the event of power loss, or following a drain down (full or partial), the pump control system is to revert to zero load condition to ensure start up is at a low load condition;
  Subsequent increase to actual load condition to be at a controlled rate to prevent pressure surge within the distribution pipework;
- **Accessories:** Anti-vibration mountings and
  Flexible connections on pump suction and discharge.
- **Execution:** 90-10-70/610 Installation of pumps generally and 90-10-70/640 Commissioning preparation.

400 Pressurization units

- **Standards:**
  - **General:** To BS EN 13831.
  - **Domestic heating and hot water supply:** In accordance with BS 7074-1.
  - **Low and medium temperature hot water heating:** In accordance with BS 7074-2.
  - **Chilled water and condenser water:** In accordance with BS 7074-3.
- **Format:** Fully automatic pre-wired packaged unit on common base plate.
- **Arrangement:** Diaphragm expansion tank with nitrogen.
- **Components:** Unless otherwise specified in the project specific documentation, provide the pressurisation unit complete with the following features: -
  1. Base frame
  2. Break tank, ball valve and float (suitably sized to provide high volume system fill).
  3. Drain valves and means of isolation for all components.
  4. Twin pump duty share unit (continuously rated to provide high volume system fill).
  5. All interconnecting wiring and a control panels
  6. Protective painting.

7. All interconnecting pipework valves and fittings including a non-return valve.
8. Pressure gauge and Pressure limit switches;
9. Suction tank with ball float valve and overflow connections.
10. Full interface to BMS, for high, low levels, constant fill signal, fault, running etc.

- **Accessories:** Anti-vibration mountings and
  Flexible connections.
- **Execution:** 90-10-70/630 Installing pressurization units.

Execution

610 Installation of pumps generally

- **Pipeline connections:** Arrange to prevent transmission of pipeline forces to pump casing.
- **Pressure gauge tappings:** Provide in flow and return pipeline connections and in common suction and delivery pipeline.
- **Brackets:** Support pipeline mounted pumps on purpose made brackets lined with vibration absorbent material.
- **Alignment:** Align and balance to minimize vibration.
- **Belt tension:** Correctly tension drive belts.
- **Access:** Provide adequate space for service and maintenance.
- **Identification plate:**
  - **Format:** Engraved.
  - **Details:** Manufacturer's name and address, serial number, duty and maximum head, speed and electrical loading.

615 Installing fuel transfer pumps

- **Isolation:** Provide a valve in the pump feed line to prevent tank contents from leaking.
- **Protection:** Protect fuel transfer pump from damage by impact.
- **Security:** Provide a means of locking the pump to prevent theft of fuel.

630 Installing pressurization units

- **Location of expansion vessel:** In the system return pipeline close to the heat source or chilled water unit.
- **Standards:** Domestic heating and hot water supply in accordance with BS 7074-1;
  Low and medium temperature hot water heating systems in accordance with BS 7074-2;
  and Chilled and condenser systems in accordance with BS 7074-3.

640 Commissioning preparation

- **In-line pumps:** Change impeller if necessary.
- **Belt driven pumps:** Change belt and pulley if necessary.

90-10-85 Trace heating products

Products

310 Electrical resistance surface trace heating

- **General requirements:** 90-10-85/350 Control and monitoring .
  Provide and include all necessary power supplies.
- **Standard:** To BS EN 60519-10 and IEC 62395-2.
- **Arrangement:** Submit proposals.
- **Tape:** Constant wattage;
  Mineral insulated;
  and Power limiting.
- **Voltage:** Maximum 230 V.
  Low voltage option preferred
- **Execution:** 90-10-85/610 Installing electrical resistance surface trace heating.

320 Electrical resistance surface heating for hazardous environments

- **General requirements:** 90-10-85/350 Control and monitoring.
- **Standard:** To BS EN 60079-30-2.
- **Hazardous area classification:**
  - **Standard:** To BS EN 60079-10-1.
  - **Zone:** As appropriate to the application;
    submit proposals where not defined.
  - **Gas group:** As appropriate to the application;
    submit proposals where not defined.
- **Arrangement:** Manufacturer's standard.
- **Tape:** Mineral insulated and Power limiting.
- **Voltage:** 50 V; unless differently specified in project specific specifications
- **Execution:** 90-10-85/610 Installing electrical resistance surface trace heating.

350 Control and monitoring

- **Controllers:** Electronic. Details as controls / BMS specification
- **Alarms:** As controls / BMS specification

Execution

610 Installing electrical resistance surface trace heating

- **Standard:**
  - **Industrial and commercial applications:** In accordance with BS EN 60519-10 and IEC 62395-2.

- **Hazardous environments:** In accordance with BS EN 60079-30-2.
- **Power supplies generally:** Provide all necessary power supplies and connections, incorporating control and switching devices.

90-10-90 Valves

Products

300 Valves generally

- **Material:** All water carrying valves to be of all metal construction, appropriate to the service; Do NOT use plastic components, including test points and the like,
- **Connections:** Generally:-;
  Screwed - up to 50mm;
  Flanged - over 50mm (54mm copper);
  to suit pipeline installation
- **Connections for accessories:** Capillary: BS EN 1254-1.
  Compression for copper tubes: BS EN 1254-2.
  Comperession for plastic tubes: BS EN 1254-3.
  Flanged for cast iron: BS EN 1092-2.
  Flanged for copper alloy: EN 1092-3.
  Threaded
  - pressure tight on threads: BS 21 or BS EN 10226-1.
  - pressure tight not on threads: BS EN ISO 228-1.
- **Finish:** Generally self finish;
  Chrome-plated where fitted in chrome plated pipelines;
  Radiator valves to be chrome-plated;
  Chrome plating to comply with BS EN 12540;
- **Execution:** 90-10-90/610 Installation of valves generally

305 Connections for accessories

- **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.

312 Gate valves for waterworks

- **Standards:** To BS 5163-1, BS 5163-2 and BS EN 1074-2.
- **Connections:** Flanged to BS EN 1092-2.
- **Options:** By-pass.
- **Execution:** 90-10-90/610 Installation of valves generally.

314 Stop valves for potable water

- **Standard:** To BS EN 1213.
- **Material:** Copper alloy.
- **Connections:** Manufacturer's standard.
- **Execution:** 90-10-90/610 Installation of valves generally.

316 Copper alloy underground stop valves

- **Standard:** To BS 5433.
- **Connections:** Manufacturer's standard.
- **Execution:** 90-10-90/610 Installation of valves generally.
  In proprietary valve pit with accessible cover.

318 Backflow prevention devices

- **Standards:**
  - **Anti-pollution check valves:** To BS EN 13959.
  - **Hose union:** To BS EN 14454.
  - **In-line anti-vacuum valves:** To BS EN 14451.
- **Material:** Copper alloy.
- **Connections:** Manufacturer's standard.
- **Execution:** 90-10-90/610 Installation of valves generally.

320 Float operated valves

- **General requirements:** 90-10-90/328 Floats for ball valves.
- **Diaphragm type:**
  - **Standard:** To BS 1212-2.
- **Delayed action type:**
  - **Standard:** To BS 1212-2.
  - **Delayed action:** Variable.
  - **Valve chamber:** Raised and Not raised.
- **Piston type:**
  - **Standard:** To BS 1212-1.
  - **Arrangement:** Non-equilibrium.
  - **Seat bore and body pattern designation:** Submit proposals.
- **Compact type:** To BS 1212-4.
- **Connections:** Bottom entry and Side entry, to suit sanitary fittings.
- **Execution:** 90-10-90/610 Installation of valves generally

328 Floats for ball valves

- **Standards:**
  - **Copper:** To BS 1968.
  - **Plastics:** To BS 2456.

- **Arrangement:** Submit proposals.
- **Diameter:** Submit proposals.
- **Grade:** C or H, *as appropriate*

330 Ball valves

- **Material:** Brass copper alloy and Bronze.
- **Connections:** Pressure tight joints threaded to BS EN 10226-1 and Threaded joints to BS EN ISO 228-1.
- **Finish:** Chrome plated and Natural.
- **Execution:** 90-10-90/610 Installation of valves generally.

332 Butterfly valves

- **Standard:** To BS EN 593.
- **Options:** Fire type tested design;
  Anti-static design;
  Limit switch signalling;
  and Emergency hand control, to suit application
- **Execution:** 90-10-90/610 Installation of valves generally.

  Where valve does not incorporate flanges, install valves between a pair of pipeline flanges; Where used as isolation valve fit a short length of pipework and flange joint downstream of valve to enable system / plant to be dismantled / removed.

336 Cast iron gate valves

- **Standard:** To BS EN 1171.
- **Execution:** 90-10-90/610 Installation of valves generally.

338 Carbon steel globe valves

- **Standard:** To BS EN 13709.
- **Execution:** 90-10-90/610 Installation of valves generally .

342 Copper alloy gate valves

- **Standard:** To BS EN 12288.
- **Execution:** 90-10-90/610 Installation of valves generally.

344 Copper alloy globe valves

- **Standard:** To BS 5154.
- **Execution:** 90-10-90/610 Installation of valves generally .

348 Cast iron check valves

- **Standard:** To BS EN 16767.
- **Third party certification:** Manufacturer's standard.
- **Arrangement:**

- **Type:** Generally, swing valves can be used in horizontal or vertical pipelines;
  Lift valves may be used in vertical pipelines with spring type utilised where flow direction is downwards.

- **Execution:** 90-10-90/670 Installation of check valves.

350 Carbon steel globe stop and check valves

- **Standard:** To BS EN 13709.
- **Pattern:** Angle;
  Oblique;
  and Straight.
- **PN rating:** As appropriate for the system pressures
- **Operation:** Handwheel.
- **Accessories:** 90-10-90/360 Test points.
- **Execution:** 90-10-90/610 Installation of valves generally.

352 Copper alloy check valves

- **Standard:** To BS 5154.
- **Third party certification:** Manufacturer's standard.
- **Lift type:**
- **Swing type:**
  - **Arrangement:** Horizontal and Vertical.
- **Execution:** 90-10-90/670 Installation of check valves.

  Generally install swing check (non-return) valve in horizontal pipelines or in vertical pipework with normal flow in the upwards direction; use spring type where flow direction is downwards.

356 Double regulating valves

- **Standard:** To BS 7350.
- **Execution:** 90-10-90/620 Installation of double regulating valves.

358 Flow measuring devices

- **General requirements:** 90-10-90/360 Test points
- **Standard:** To BS 7350 and To BS EN ISO 5167-2.
- **Execution:** 90-10-90/630 Installation of flow measurement devices.

360 Test points

- **Arrangement:** Self sealing and Valve controlled.
  Captive caps to seal units when not in use;
  Provide one thermometer and one pressure gauge suitable for use with test points
- **Material:** Brass and Stainless steel to suit service.

366 Low pressure thermostatic mixing valves

- **Standard:** To BS EN 1287.

- **Arrangement:** With special control devices.
- **Connections:** Compression to BS EN 1254-2 and Threaded to BS EN ISO 228-1.
- **Execution:** 90-10-90/610 Installation of valves generally and .

370 Thermostatic mixing valves

- **General requirements:** Install with check valve, strainer and isolating service valve on both hot and cold inlet;
  .
- **Standard:** To BS EN 1111.
- **Arrangement:** With special control devices.
- **Connections:** Threaded to BS EN ISO 228-1.
- **Execution:** 90-10-90/610 Installation of valves generally and .

372 Thermostatic mixing valves for use in care establishments

- **General requirements:** TMV3 compliance;
  Install with check valve, strainer and isolating service valve on both hot and cold inlet;
  .
- **Standard:** To BS 7942.
- **Arrangement:** Flow control and pre-set mixed water temperature.
- **Accessories:** Flow rate regulators and Integral backflow devices.
- **Execution:** 90-10-90/610 Installation of valves generally and .

374 Draining taps type A

- **General requirements:** Provide:-
  On all items of equipment;
  All low points;
  Sizes:-
  Generally 15mm;
  Risers and plant rooms 25mm;

  .
- **Standard:** To BS 2879.
- **Material:** Copper alloy.
- **Connections:** Threaded joints to BS EN 10226-1.
- **Accessories:** Lever pattern key and Spare hose union.
- **Execution:** 90-10-90/610 Installation of valves generally .

376 Safety valves

- **Standard:** To BS EN ISO 4126-1.
- **Lift type:** to suit application
- **Manufacturer:** Where supplied with boiler or other plant, manufacturer's standard provision; else Contractor's choice, submit proposals.
- **Arrangement:** Manufacturer's standard.
- **Material:** Manufacturer's standard. to suit application

- **Connections:** Manufacturer's standard.
- **Execution:** 90-10-90/660 Installation of discharge connections.

380 Ball valves, manually operated

- **Standard:** To BS EN 331.
- **Arrangement:** Lever operated.
- **Material:** Brass.
- **Connections:** Flanged to BS EN 1092-2;
  Flanged to BS EN 1092-3;
  Pressure tight joints threaded to BS EN 10226-1;
  and Threaded joints to BS EN ISO 228-1.
  To suit application
- **Execution:** 90-10-90/610 Installation of valves generally.

382 Plug valves, cast iron

- **Standard:** To BS 5158.
- **Arrangement:** Regular.
- **Connections:** Flanged to BS EN 1092-2 and Threaded to BS EN 10226-1.
  To suit application.
- **Operation:** Wrench.
- **Execution:** 90-10-90/610 Installation of valves generally.

384 Plug valves, steel

- **Standard:** To BS 5353.
- **Arrangement:** Regular.
- **Connections:** Flanged to BS EN 1092-2 and Threaded to BS EN 10226-1.
  To suit application.
- **Execution:** 90-10-90/610 Installation of valves generally.

386 Plug valves, taper

- **Standard:** To BS 1552.
- **Arrangement:** Tapered plug with square shank.
- **Material:** Dezincification resistant brass (DZR).
- **Connections:** Threaded to BS EN 10226-1.
- **Execution:** 90-10-90/610 Installation of valves generally.

410 Pressure regulating valves

- **Standard:** To BS EN 1567
- **Third party accreditation:** Water Regulations Advisory Scheme-approved.
- **Form:** Water pressure reducing.
- **Adjustment:** Adjustable.
- **Operating conditions:**
  - **Temperature (maximum):** To suit the system operating conditions.

- **Maximum working pressure:** 1.6 MPa.
- **Non-adjustable set pressure:** Submit proposals.

- **Connections:** Compression;
  Flanged;
  and Threaded.
  As appropriate to pipe size and system pressure
- **Accessories:** Strainer.
- **Material:** Valves to be of metal construction appropriate to the system served.
- **Execution:** 90-10-90/610 Installation of valves generally.

420 Pressure independent control valves (PICV)

- **Pressure rating:** to match pipeline
- **Actuator:** Modulating.
- **Accessories:** Drain.
- **Execution:** 90-10-90/610 Installation of valves generally.

Execution

610 Installation of valves generally

- **Installation:** In accordance with BS 6683.
- **Position:** Generally, unless indicated otherwise, fit valves or cocks to each branch, sub-main or item of equipment;
- **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.

620 Installation of double regulating valves

- **Position:** Provide 10 diameters of straight pipe upstream of valve and 5 diameters downstream.
- **General requirements:** 90-10-90/610 Installation of valves generally.

630 Installation of flow measurement devices

- **Position:** Provide straight length of pipe upstream and downstream, to manufacturer's recomendation.
- **General requirements:** 90-10-90/610 Installation of valves generally.

660 Installation of discharge connections

- **Safety and relief valves:** Terminate at a safe discharge point.
- **General requirements:** 90-10-90/610 Installation of valves generally.
- **Vent cocks:** Terminate 150 mm above floor level.
- **Air bottles:** Terminate with air cock or needle valve in a convenient position.

- **Automatic air vents:** Terminate over a suitable gully or drain line in a visible location.

670 Installation of check valves

- **General requirements:** 90-10-90/610 Installation of valves generally.
- **Lift type:** Install in direction of flow as indicated on the body.
- **Disc type:** With spring, fit in any plane. Without spring, fit in vertical plane with flow from bottom to top.
- **Wafer type:** Install between flanges. Fit in horizontal plane or vertical upward flow.
- **Split disc:** Install between flanges. Fit in horizontal plane or vertical upward flow.

90-10-95 Water tanks and cisterns

Products

310 Glass reinforced tanks and cisterns

- **Standard:** To BS EN 13280.
- **Accessories:** 90-10-95/450 Tank contents gauges;
  Ball valve boxes;
  External access ladder;
  Internal access ladder;
  Level alarm;
  Level switches;
  and Temperature probes.
- **Execution:** 90-10-95/610 Cleaning;
  90-10-95/630 Installing tanks and cisterns;
  90-10-95/640 Installing vent pipes over feed and expansion cisterns;
  and 90-10-95/650 Installing warning and overflow pipes to feed and expansion cisterns.

340 Moulded plastics cisterns

- **Standards:** To BS 7181 and BS 4213.
- **Covers:** Close fitting rigid.
- **Additional components:** Screened air inlet breather;
  Screened warning pipe termination assembly;
  Thermal insulation;
  Vent pipe entry device;
  and Additional fitting kit.
- **Accessories:** 90-10-95/450 Tank contents gauges.
- **Execution:** 90-10-95/610 Cleaning;
  90-10-95/630 Installing tanks and cisterns;
  90-10-95/640 Installing vent pipes over feed and expansion cisterns;
  and 90-10-95/650 Installing warning and overflow pipes to feed and expansion cisterns.

350 Prefabricated galvanized steel cisterns

- **Standard:** To BS 417-2.
- **Grade:** A (4.5m max working head);
  B (3.0m max working head)
- **Water:** Assume potable unless specifically stated otherwise.
- **Covers:** Required.
- **Cross ties:** Manufacturer's standard.
- **Accessories:** 90-10-95/450 Tank contents gauges.
- **Execution:** 90-10-95/610 Cleaning;
  90-10-95/630 Installing tanks and cisterns;
  90-10-95/640 Installing vent pipes over feed and expansion cisterns;

90-10-95/650 Installing warning and overflow pipes to feed and expansion cisterns; and 90-10-95/620 Installing feed and expansion cisterns.

360 Prefabricated galvanized steel tanks

- **Standard:** To BS 417-2.
- **Grade:** A (4.5m max working head);
  B (3.0m max working head)
- **Water:** Assume potable unless specifically stated otherwise.
- **Accessories:** 90-10-95/450 Tank contents gauges.
- **Execution:** 90-10-95/610 Cleaning and 90-10-95/630 Installing tanks and cisterns.

390 Sectional steel tank

- **Standard:** To BS 1564.
- **Arrangement:** 1 - Tanks with a combined double flange at an angle of 45° and 90° to the plane of the plate on all four sides. The plates are hot pressed complete;

  2 - Tanks with a single flange at an angle of 90° to the plane of the plate on each of two, three or four sides, depending on its position in the tank. Type 2 tanks are cold pressed with the flange corners welded;
- **On site erection:** By manufacturer.
- **Accessories:** 90-10-95/450 Tank contents gauges;
  ;
  Ball valve boxes;
  External access ladder;
  Level alarms;
  Level indicators;
  Level switches;
  Standing overflows;
  Support bearers;
  Support structure;
  and Warning pipes.
- **Execution:** 90-10-95/610 Cleaning;
  90-10-95/620 Installing feed and expansion cisterns;
  90-10-95/630 Installing tanks and cisterns;
  90-10-95/640 Installing vent pipes over feed and expansion cisterns;
  and 90-10-95/650 Installing warning and overflow pipes to feed and expansion cisterns.

450 Tank contents gauges

- **Arrangement:** Sight glass.
- **Float level indicator:** ‘Cat and mouse’ type;
  Hydrostatic dial type;
  and Lever arm type with dial.

Execution

610 Cleaning

- **General:** Clean out tanks and cisterns before site testing and commissioning.

620 Installing feed and expansion cisterns

- **Outlet positions:** Connect lowest outlets at least 30 mm above bottom of cistern.
- **Access:** Fix cistern with a minimum clear space of 350 mm above, or 225 mm if the cistern does not exceed 450 mm in any dimension.

630 Installing tanks and cisterns

- **Standards:**
  - **Moulded plastics:** In accordance with BS 4213.
  - **Glass reinforced plastics:** In accordance with BS EN 13280.
- **Base:** Install the tank on a firm, level and continuous base to spread the load.
- **Access:** Allow for internal and external inspection and cleaning. Provide space for cleaning and maintenance with clearance above the tank to service valves.

640 Installing vent pipes over feed and expansion cisterns

- **Route:** Install with no restrictions or valves and rising continuously from system connection to discharge over cistern.
- **Internal diameter (minimum):** 20 mm.

650 Installing warning and overflow pipes to feed and expansion cisterns

- **Material:** Copper and PVC-U as appropriate for the system
- **Jointing:** Copper capillary and Solvent welded.
- **Minimum OD:** Greater than inlet pipe OD, and at least 22 mm.
- **Vertical distance (minimum) of water supply inlet above overflow level:** Bore of warning pipe.
- **Fall of warning pipe (minimum):** 1 in 10.
- **Installation:** Support to prevent sagging. Terminate pipes separately in prominent positions, with turned down ends. Turn down within the cistern. Terminate 50 mm below normal water level.
- **Insulation:** Insulate within the building where the pipe is in an uninsulated space and subject to freezing.

90-15-35 Hot and cold water supply products

Products

301 Hot water storage cylinders / calorifiers generally

- **Standard:** BS 853: Part 1 and as appropriate to type - see subsequent clauses
- **Materials:**
  - **Body:** Copper / Bronze;
    Resistant to Dezincification
    Refer to project specific documentation;
  - **Connections:** Gunmetal
- **Fittings:** Three way cock;
  Safety Valve;
  Thermometer;
  Altitude gauge/pressure gauge;
  Drain cock;

310 Direct hot water storage cylinders

- **Standard:** To BS 1566-1.
- **Third party certification:** Kitemark certified.
- **Grade:** 1;
  2;
  and 3, as appropriate to the application.
- **Type G:**
  - **Height and diameter:** To BS 1566-1, Table 1.
  - **Metal thickness:** To BS 1566-1, Table 1 (minimum).
  - **Connections:** To BS 1566-1.
- **Type P:**
  - **Height and diameter:** To BS 1566-1, Table 1.
  - **Metal thickness:** To BS 1566-1, Table 1.
  - **Connections:** To BS 1566-1.
- **Type D:**
  - **Height and diameter:** To BS 1566-1, Table 1.
  - **Metal thickness:** To BS 1566-1, Table 1 (minimum).
  - **Connections:** To BS 1566-1.
- **Accessories:** Aluminium protector rod and Shunt pump.

320 Direct insulated combination units

- **Standard:** To BS 3198.
- **Third party certification:** Kitemark certified.
- **Shape:** Cylindrical and Non-cylindrical.

- **Hand hole:** In accordance with BS 3198.
- **Connections:** To suit application
- **Accessories:** Aluminium protector rod;
  Shunt pump;
  and Insulating jacket to BS 5615.

330 Multi-coil hot water storage cylinders

- **Standard:** To BS 1566-1.
- **Third party certification:** Kitemark certified.
- **Grade:** 1;
  2;
  and 3, as appropriate for the application
- **Type G:**
  - **Height and diameter:** To BS 1566-1, Table 1.
  - **Metal thickness:** To BS 1566-1, Table 1 (minimum)
  - **Connections:** To BS 1566-1
- **Type P:**
  - **Height and diameter:** To BS 1566-1, Table 1.
  - **Metal thickness:** To BS 1566-1, Table 1 (minimum).
  - **Connections:** To BS 1566-1.
- **Type D:**
  - **Height and diameter:** To BS 1566-1, Table 1.
  - **Metal thickness:** To BS 1566-1, Table 1 (minimum).
  - **Connections:** To BS 1566-1.
- **Coils:** To suit the application

340 Indirectly heated unvented hot water storage

- **Standard:** To BS EN 12897.
- **Safety equipment:** Provide energy cut-out device, temperature relief valve, pressure relief, pressure-reducing valve and backflow prevention in accordance with BS EN 12897.

350 Indirect hot water storage cylinders, double feed

- **Standard:** To BS 1566-1.
- **Third party certification:** Kitemark certified
- **Grade:** 1;
  2;
  and 3, as appropriate to the application.
- **Type G:**
  - **Height and diameter:** To BS 1566-1, Table 1.
  - **Metal thickness:** To BS 1566-1, Table 1 (minimum).
  - **Connections:** To BS 1566-1.
- **Type P:**
  - **Height and diameter:** To BS 1566-1, Table 1.

- **Metal thickness:** To BS 1566-1, Table 1 (minimum).
- **Connections:** To BS 1566-1.

- **Type D:**
  - **Height and diameter:** To BS 1566-1, Table 1.
  - **Metal thickness:** To BS 1566-1, Table 1 (minimum).
  - **Connections:** To BS 1566-1.

360 Indirect hot water storage cylinders, single feed

- **Standard:** To BS 1566-2.
- **Third party certification:** Kitemark certified
- **Grade:** 1;
  2;
  and 3, as appropriate to the application.
- **Connections:** To BS 1566-2.

370 Double feed indirect insulated combination units

- **Standard:** To BS 3198.
- **Third party certification:** Kitemark certified
- **Shape:** Cylindrical and Non-cylindrical, to suit the application.
- **Hand hole:** In accordance with BS 3198.
- **Connections:** As required for the application.

380 Single feed indirect insulated combination units

- **Standard:** To BS 3198.
- **Third party certification:** Kitemark certified
- **Shape:** Cylindrical and Non-cylindrical, to suit the application.
- **Hand hole:** In accordance with BS 3198.
- **Connections:** As required for the application.

390 Instantaneous shower units, electric

- **Standards:** To BS EN 60335-2-35, BEAB approved.
- **Third party certification:** WRAS-approved.
- **Flow rate:** 9 L/min at 37°C at 3 bar.
- **Operation:** Thermostatic control.
- **Accessories:** Flexible shower set.

400 Instantaneous water heaters, electric

- **Standards:** To BS EN 60335-2-35, BEAB approved.
- **Third party certification:** WRAS-approved.
- **Arrangement:** Multipoint – mains supply and Single point – mains supply.
- **Casing finish:** Manufacturer's standard.

410 Instantaneous water heaters, gas fired

- **Standard:** To BS EN 26.
- **Performance:** To BS EN 13203-1 and BS EN 13203-2.
- **Casing finish:** Manufacturer's standard.
- **Flues and chimneys:** Integral balanced flue and Integral metal flue.
- **Execution:** 90-15-35/610 Installing gas fired water heaters and 90-15-35/620 Installing balanced flue terminals.

440 Storage water heaters, electric

- **Standards:** To BS EN 60335-2-21.
- **Third party certification:** BEAB approved.
- **Casing finish:** Manufacturer's standard.

450 Storage water heaters, gas fired

- **Standard:** To BS EN 89.
- **Performance:** To BS EN 13203-1 and BS EN 13203-2.
- **Casing finish:** Manufacturer's standard.
- **Controls:** As detailed in the Controls/BMS Specifciation
- **Flues and chimneys:** Integral balanced flue and Integral metal flue.
- **Execution:** 90-15-35/610 Installing gas fired water heaters and 90-15-35/620 Installing balanced flue terminals.

460 Immersion heaters

- **Standards:** To BS EN 60335-2-73.
- **Third party certification:** BEAB approved.
- **Arrangement:** Alloy sheathed elements
- **Mounting:** To suit cylinder size and location.;
  horizontal preferred, in lower third of cylinder.
- **Thermostat:** Stem type adjustable.

Execution

610 Installing gas fired water heaters

- **Standard:** In accordance with BS 5546.
- **Label:** Attach, to advise users not to use the water heater for more than 5 minutes continuously.
- **Flueless water heaters:** Do not connect to taps outside the space where the heater is installed.

620 Installing balanced flue terminals

- **Opening in external wall:** Submit proposals.

90-15-95 Water treatment products

Products

310 Biodispersant chemicals for open circuit systems

- **Biodispersants:** contractors specialist to advise;
  else;
  Ethylene oxide co-polymers.

315 Corrosion inhibitor chemicals for open circuit systems

- **Corrosion inhibitors:** contractor's specialist to advise

317 Corrosion inhibitors for closed circuit systems

- **Corrosion inhibitors:** contractor's specialist to advise

320 Dispersant chemicals for open circuit systems

- **Dispersants:** Acrylates;
  Lignosulfonates;
  Methacrylates;
  Polycarboxylic acids;
  contractor's specialist to advise

325 Non-oxidizing biocides for open circuit systems

- **Non-oxidizing biocides:** contractor's specialist to advise

330 Oxidizing biocides for open circuit systems

- **Oxidizing biocides:** contractor's specialist to advise

335 Bacteria and biofouling inhibitors for closed circuit systems

- **Non-oxidizing biocides:** contractor's specialist to advise

340 Scale inhibitor chemicals for open circuit systems

- **Scale inhibitors:** contractor's specialist to advise

350 Dosing pots

- **Standard:** To PD 5500.
- **Material:** Mild steel.
- **Working pressure (maximum):** To suit system pressure
- **Execution:** 90-15-95/610 Installing dosing equipment.

355 Dosing pump units

- **Pump type:** Electric dosing pump;
  Mechanical dosing pump;
  and Peristaltic pumps,
  to suit application
- **Control:** Manual;
  Microprocessor;
  pH sensor;
  Preset;
  and Water meter signal, as required for teh application.
- **Accessories:** Manufacturer's standard.
- **Execution:** 90-15-95/610 Installing dosing equipment.

370 Filtration units

- **System pressure:** Select on System maximum operating pressure plus 20%;
- **Particle removal capability:** Manufacturer's standard.

380 Ion exchange demineralization units

- **Execution:** 90-15-95/620 Installing ion exchange demineralization units.

390 Ion exchange softening units

- **Standards:** To BS EN 15219 and BS EN 14743.
- **Output hardness:** *Contractor's specialist to advise.*
- **Execution:** 90-15-95/630 Installing ion exchange softening units.

400 Magnetic water conditioners

- **Execution:** 90-15-95/640 Installing water conditioning devices.

430 Ultra-violet light disinfection units

- **Lamps:** Low pressure;
  Medium pressure.

  Contractor's specialist to advise.
- **Components:** Alarm facilities;
  Lamp timer;
  Turbidimeter;
  and Ultraviolet intensity monitor.
- **Spares:** Two of each type of UV lamp.

Execution

610 Installing dosing equipment

- **Position:** As indicated on the drawings and 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.
  Install with isolating valves on all connections.

620 Installing ion exchange demineralization units

- **Supply continuity:** Fit bypass pipe and stop valves.
- **Drains:** Connect overflow and drain lines to trap and waste.
- **Back siphonage:** Prevent back siphonage during regeneration process.

630 Installing ion exchange softening units

- **Standard:** In accordance with BS EN 14743 and BS EN 15161.
- **Drains:** Connect overflow and drain lines to trap and waste.
- **Back siphonage:** Prevent back siphonage of brine during regeneration process.

640 Installing water conditioning devices

- **Standard:** In accordance with BS EN 15161 for devices for treatment of drinking water in buildings.

90-25-45 Liquid fuel supply products

Products

330 Filters

- **Standard:** To OFTEC OFS E104.
- **Arrangement:** Single or duplex, refer to project documentation
- **Material:** Manufacturer's standard.

340 Remote acting fire safety valves

- **Standards:** To BS 5410-1, BS 5410-2 and OFTEC OFS E101.
- **Actuation:** Electrical.
- **Execution:** 90-25-45/610 Installing fire safety valves.

350 Strainers

- **Standard:** To OFTEC OFS E104.

360 Water separators

- **Standard:** To OFTEC OFS E104.

Execution

610 Installing fire safety valves

- **Position:** Install the fire valve body external to the building, with the sensor at the appliance.

90-25-50 Liquid fuel tanks

Products

310 Contents gauges

- **Standards:** To BS 799-5 and OFTEC OFS E103 or BS EN 13352.
- **Arrangement:** Electronic;
  Float;
  Hydrostatic;
  and Sight tube.

320 Fill points

- **Accessories:** Cabinet and Cap and chain.
  Overfill prevention devices and alarms.

360 Carbon steel oil tanks

- **Service tanks:**
  - **Standards:** To BS 799-5 and OFTEC OFS T200;
    To BS EN 12285-1 and OFTEC OFS T200;
    and To BS EN 12285-2 and OFTEC OFS T200.
- **Storage tanks:**
  - **Standards:** To BS 799-5 and OFTEC OFS T200;
    To BS EN 12285-1 and OFTEC OFS T200;
    and To BS EN 12285-2 and OFTEC OFS T200.
  - **Arrangement:** Integrally bunded, double skin, suitable for above ground use and Integrally bunded, double skin, suitable for below ground use.
- **Integral bund:**
  - **Standard:** To OFTEC OFS T200.
- **Corrosion protection:** As project specific documentation, else Submit proposals.
- **Execution:** 90-25-50/610 Installing tanks.

365 Plastics oil tanks

- **Standards:**
  - **Tank:** To BS EN 13341 and OFTEC OFS T100.
  - **Integral bund and bund cover:** To OFTEC OFS T100.
- **Tank type:** Integrally bunded, double skin, suitable for above ground use and Integrally bunded, double skin, suitable for below ground use.
- **Execution:** 90-25-50/610 Installing tanks.

380 Overfill alarms and overfill prevention devices

- **Standard:** To BS EN 13616-1, BS EN 13616-2 and BS EN 16657 and To OFTEC OFS E105.

385 Outflow heaters

- **Standards:** To BS 799-5 and in accordance with BS 5410-2.
- **Heating method:** Electric.

420 Tank heaters

- **Standards:** To BS 799-5 and in accordance with BS 5410-2.
- **Arrangement:** Manufacturer's standard.
- **Method:** Electric.

Execution

610 Installing tanks

- **Standards:** To BS EN 976-2;
  To BS EN 12285-1;
  To BS EN 12285-2;
  To BS EN 13121-4;
  To BS EN 13341;
  To BS EN 14015;
  To OFTEC OFS T100;
  and To OFTEC OFS T200.
- **Above ground steel tanks:** Support on plinths built on concrete foundations. Run plinths across the shortest base dimension of the tanks. Plinth width to be slightly wider than the tank.
- **Above ground plastics tanks:** Support on a firm level base. Provide restraining straps in exposed conditions.
- **Fall:** Arrange horizontal tanks to slope slightly to drain off valve end.

90-30-35 Gas supply products

Products

320 Gas solenoid valves

- **Mounting:** Horizontal pipeline or Vertical pipeline to suit installation
- **Speed of opening:** Fast.
- **Connections:** Threaded or flanged to suit application, size and pressure.
- **Pressure rating:** To suit system pressure with min. PN10;
- **Pressure drop:** Select valve for pressure drop <0.25mb on full flow, unless stated otherwise in project specific documentation.
- **Solenoid supply voltage:** 24 V;
  110 V;
  230 V;
  as per the project specific specifications; else contractors choice.
- **Actuation method:** Knock off button;
  Remote signal;
  Sensor above each burner;
  and Sensor on ceiling.
  Interfaced with gas proving and safety systems, see clause 90-30-35/370.
- **Reset:** Manual.
- **Accessories:** Pressure test points and Strainer.

330 Mechanical gas safety valves

- **Arrangement:** Cut-off and Slam shut.
- **Accessories:** Manufacturer's standard.

340 Gas boosters

- **General requirements:** 90-30-35/360 Gas pressure switches.
- **Standard:** To BS 8487.
- **Boosters:** In accordance with IGEM Standard UP/2.
- **Booster installation:** Installation to be carried out by Gas Safe Registered Technician with Gas Booster module.
- **Control panel:** Mounted on booster;
  Wall mounted.
- **Accessories:** Control bypass;
  Initial surge control;
  Low pressure cut off switch;
  Non-return valve;
  Non-return valve for each booster in automatic duplex installations;
  and Outlet pressure control.

350 Gas filters

- **Filtration size:** 50 µm.
- **Pressure rating:** To suit system pressure with min. PN10
- **Element:** Pleated and Replaceable paper.
- **Accessories:** Blow down drain tap;
  Differential pressure gauge;
  Differential tappings;
  and Dust catching facilities.

360 Gas pressure switches

- **Pressure application:** Detection of positive pressure changes;
  Differential pressure;
  High pressure;
  and Low pressure.
  to suit installation
- **Accessories:** Adjustable control setting;
  Control spring;
  Earth terminal;
  and Micro switch.

370 Safety and control devices

- **Standard:** To BS EN 13611.
- **Gas Proving System:** Required for Laboratories, Kitchens and Workshops;
  Interfaced via gas sensors, with gas solenoid valves, ventilation interlocks, BMS, etc.
- **Boiler Guard:** Required in plant rooms, etc.
  Interface via gas sensors, with gas solenoid valves, etc.

90-40-05 Boilers

Products

300 Boilers Generally

- **Clause application:** This clause applies to boilers of all types in addition to the type specific clauses.
- **Standard:** To BS 779 and To BS EN 303-1.
- **Technical and operational details:** Refer to project specific documentation
- **Thermal performance testing:** To BS 845-1.
- **Mounting:** Floor.
- **Test pressure:** 1.5 x maximum system working pressure
- **Safety, control and monitoring of monobloc oil burners:** To BS EN 230.
- **Electrical supply type:** Refer to project specific documentation
- **Casing:** Manufacturer's standard.
- **Integral controls:** Manufacturer's standard,
  unless specified otherwise in the project specific documentation.
  Automatic gas burner control system to BS EN 298;
  Multi function gas burner control system to BS EN 126;
  Automatic electrical burner control system to BS EN 60730-2-5;
  Standards to be applied as appropriate.
- **Accessories:** Minimum requirements:-
  Pressure gauge;
  Safety valve;
  Temperature gauge;
  Two self sealing test points;
  25mm drain cock
- **Execution:** 60-45-40/620 Installing water based heating systems

310 Dual fuel fired cast iron boilers

- **Standard:** To BS EN 303-1;
  To BS EN 303-2;
  To BS EN 303-3;
  To BS EN 303-7;
  and To BS EN 14394.
- **Thermal performance testing:** To BS 845-1.
- **Mounting:** Floor.
- **Test pressure:** Minimum 1.5 x maximum system working pressure
- **Casing:** Manufacturer's standard.
- **Accessories:** Acoustic shroud;
  Optimization control unit with two digital sensors;
  Pressure gauge;

Safety valve;
and Temperature gauge.

- **Execution:** 90-40-05/610 Installing gas and oil fired boilers.

320 Dual fuel fired steel shell boilers

- **Standards:**
  - **Hot water boiler:** To BS 855;
    To BS EN 303-1;
    To BS EN 303-2;
    To BS EN 303-3;
    To BS EN 303-7;
    and To BS EN 14394.
  - **Steam boiler:** To BS 2790;
    To BS EN 12953-1;
    To BS EN 12953-2;
    To BS EN 12953-3;
    To BS EN 12953-4;
    To BS EN 12953-5;
    To BS EN 12953-6;
    To BS EN 12953-7;
    To BS EN 12953-8;
    To BS EN 12953-9;
    and To BS EN 12953-11.
- **Mounting:** Floor mounted.
- **Thermal performance testing:** To BS 845-1.
- **Test pressure:** Minimum 1.5 x maximum system working pressure
- **Casing material:** Manufacturer's standard.
- **Accessories:** Acoustic shroud;
  Optimization control unit with two digital sensors;
  Pressure gauge;
  Safety valve;
  and Temperature gauge.
- **Execution:** 90-40-05/610 Installing gas and oil fired boilers.

330 Gas fired boilers

- **Standard:** To BS EN 297, type B11;
  To BS EN 297, type B11BS;
  To BS EN 483, type C;
  To BS EN 656, type B;
  To BS EN 13836, type B;
  To BS EN 15502-2-1;
  and To BS EN 15502-2-2.
  Applicable standards to suit boiler application and rating.
- **Thermal performance testing:** To BS 845-1.
- **Electrical safety and performance:** To BS 5986.
- **Test pressure:** at least 1.5 times maximum system working pressure
- **Casing material:** Manufacturer's standard.

- **Integral controls:** Manufacturer's standard;
  unless specified otherwise in the project specific specification and/or BMS controls specification

  Standards:
  Automatic electrical burner control system to BS EN 60730-2-5;
  Automatic gas burner control system to BS EN 298;
  and Multi-function gas burner control system to BS EN 126.
- **Execution:** 90-40-05/610 Installing gas and oil fired boilers.

340 Gas fired condensing boilers

- **Standard:**
  - **Boilers with heat input not exceeding 70 kW:** To BS EN 677 and To BS EN 15502-1 and BS EN 15502-2-1.
  - **Boilers with heat input greater than 70 kW but not exceeding 1000 kW:** To BS EN 15417 and To BS EN 15502-1 and BS EN 15502-2-1.
- **Thermal performance testing:** To BS 845-1.
- **Materials:**
  - **Heat exchanger:** Stainless Steel.
- **Execution:** 90-40-05/610 Installing gas and oil fired boilers.

350 Gas fired cast iron boilers

- **Standard:** To BS 779;
  To BS EN 303-1;
  To BS EN 303-3;
  To BS EN 303-7;
  and To BS EN 14394.
- **Thermal performance testing:** To BS 845-1.
- **Electrical safety and performance:** To BS 5986.
- **Mounting:** Floor mounted.
- **Test pressure:** At least 1.5 x maximum system working pressure
- **Casing:** Manufacturer's standard.
- **Integral controls:** Manufacturer's standard;
  unless specified otherwise in the project specific specification and/or BMS controls specification;

  Standards:
  Automatic gas burner control system to BS EN 298;
  Automatic electrical burner control system to BS EN 60730-2-5;
  and Multi-function gas burner control system to BS EN 126.
- **Execution:** 90-40-05/610 Installing gas and oil fired boilers.

360 Gas fired steel shell boilers

- **Standard:**
  - **Hot water boiler:** To BS 855;
    To BS EN 303-1;

To BS EN 303-3;
To BS EN 303-7;
and To BS EN 14394.

- **Steam boiler:** To BS 2790.

- **Mounting:** Floor mounted.
- **Thermal performance testing:** To BS 845-1.
- **NOx emissions (maximum):**
- **Test pressure:** Minimum of at least 1.5 times system maximum working pressure.
- **Casing material:** Manufacturer's standard.
- **Integral controls:** Manufacturer's standard;
  unless specified otherwise in the project specific specification and/or BMS controls specification;

  Standards:
  Automatic electrical burner control system to BS EN 60730-2-5;
  Automatic gas burner control system to BS EN 298;
  and Multi-function gas burner control system to BS EN 126.
- **Execution:** 90-40-05/610 Installing gas and oil fired boilers.

380 Oil fired cast iron boilers

- **Standard:** To BS 779;
  To BS EN 303-1;
  To BS EN 303-2;
  To BS EN 303-4;
  and To BS EN 14394.
- **Thermal performance testing:** To BS 845-1.
- **Mounting:** Floor.
- **Test pressure:** Minimum 1.5 x maximum system working pressure
- **Casing:** Manufacturer's standard.
- **Accessories:** Acoustic shroud;
  Optimization control unit with two digital sensors;
  Pressure gauge;
  Safety valve;
  and Temperature gauge.
- **Execution:** 90-40-05/610 Installing gas and oil fired boilers.

390 Oil fired steel shell boilers

- **Standard:**
  - **Hot water boiler:** To BS 855;
    To BS EN 303-1;
    To BS EN 303-2;
    To BS EN 303-4;
    and To BS EN 14394.
  - **Steam boiler:** To BS 2790;
    To BS EN 12953-1;
    To BS EN 12953-2;
    To BS EN 12953-3;

To BS EN 12953-4;
To BS EN 12953-5;
To BS EN 12953-6;
To BS EN 12953-7;
To BS EN 12953-8;
To BS EN 12953-9;
and To BS EN 12953-11.

- **Mounting:** Floor mounted.
- **Seasonal efficiency (gross calorific value (minimum)):** minimum to meet DCLG guidance
- **Thermal performance testing:** To BS 845-1.
- **Test pressure:** Minimum 1.5 x maximum system working pressure
- **Casing material:** Manufacturer's standard.
- **Accessories:** Acoustic shroud;
  Optimization control unit with two digital sensors;
  Pressure gauge;
  Safety valve;
  and Temperature gauge.
- **Execution:** 90-40-05/610 Installing gas and oil fired boilers.

410 Solid fuel fired cast iron boilers

- **Standards:** To BS 779;
  To BS EN 303-1;
  and To BS EN 303-5.
- **Seasonal efficiencies (gross calorific value (minimum)):** 75% and to current DCLG Compliance Guide
- **Thermal performance testing:** To BS 845-1.
- **Test pressure:** Minimum 1.5 x maximum system working pressure
- **Burner:** Manufacturer's standard. unless otherwise specified
- **Fan:** Induced draught and Forced draught.
- **Casing material:** Manufacturer's standard.
- **Integral controls:** Manufacturer's standard.unless otherwise specified
- **Accessories:** Pressure gauges;
  Safety valves;
  and Temperature gauges.
- **Execution:** 90-40-05/620 Installing solid fuel boilers.

420 Solid fuel fired steel shell boilers

- **Standard:**
  - **Hot water boiler:** To BS 855;
    To BS EN 303-1;
    and To BS EN 303-5.
  - **Steam boiler:** To BS 2790;
    To BS EN 12953-1;
    To BS EN 12953-2;
    To BS EN 12953-3;
    To BS EN 12953-4;

To BS EN 12953-5;
To BS EN 12953-6;
To BS EN 12953-8;
To BS EN 12953-9;
and To BS EN 12953-11.

- **Seasonal efficiencies (gross calorific value (minimum)):** 75% and to current DCLG Compliance Guide
- **Thermal performance testing:** To BS 845-1.
- **Test pressure:** Minimum 1.5 x maximum system working pressure
- **Burner:** Manufacturer's standard.
- **Fan:** Induced draught and Forced draught.
- **Casing material:** Manufacturer's standard.
- **Integral controls:** Manufacturer's standard.
  unless specified otherwise in the project specific specification and/or BMS controls specification
- **Accessories:** Pressure gauges;
  Safety valves;
  and Temperature gauges.
- **Execution:** 90-40-05/620 Installing solid fuel boilers.

460 Forced draught dual fuel burners

- **Standards:** To BS EN 267 and BS EN 676.
- **Duty:** Matched to boiler
- **Fuel:** Fuel oil;
  LPG;
  and Natural gas.
- **Burner control:** Manufacturer's standard;
  unless specified otherwise in the project specific specification and/or BMS controls specification
  High/ low/ off;
  Modulating;
  and On/ off.

470 Forced draught gas burners

- **Standard:** To BS EN 676.
- **Burner control:** Manufacturer's standard;
  unless specified otherwise in the project specific specification and/or BMS controls specification
  High/ low/ off;
  Modulating;
  and On/ off.

480 Forced draught oil burners

- **Standard:** To BS EN 267.
- **Burner control:** Manufacturer's standard;
  unless specified otherwise in the project specific specification and/or BMS controls

specification
High/ low/ off;
Modulating;
and On/ off.

Execution

610 Installing gas and oil fired boilers

- **Standards:**
  - **Gas fired boilers:** In accordance with BS 6798 or BS 6644.
  - **Oil fired boilers:** In accordance with BS 5410-1 or BS 5410-2.
- **Position:** Minimum 75mm from combustible materials and to manufacturer's recommendations.
- **Space around boiler:** Minimum space to manufacturer's recommendations.
- **Preparation:** Pressure test joints immediately before installing lagging and casing. Submit test results.
- **Fixing of equipment, components and accessories:** Fix securely to purpose-made bases or supports.
- **Access:** Provide for inspection and servicing of boilers and ancillary equipment.

620 Installing solid fuel boilers

- **Standard:** In accordance with HVCA TR/38 and BS EN 303 or BS EN 12953.
- **Fixing of equipment, components and accessories:** Fix securely to purpose-made bases or supports.
- **Preparation:** Pressure test joints immediately before installing lagging and casing. Submit test results.
- **Position:** Minimum 75 mm from combustible material.
- **Space around boiler:** Ensure sufficient air circulation for draught diverter operation;
  Ensure sufficient air for combustion and cooling;
  and Facilitate maintenance and servicing.
- **Access:** Provide for inspection and servicing of boilers and ancillary equipment.

90-40-10 Chillers and cooling towers

Products

320 Air cooled condensing units

- **Standards:** To BS EN 378-1, and BS EN 60335-2-40.
- **Casing:**
  - **Type:** Manufacturer's standard.
  - **Finish:** Manufacturer's standard.
- **Leak detection:** Fluorescent additive to the refrigerant system.

330 Air cooled liquid chillers

- **General:** Confirm compliance with the relevant European Ecodesign Directive and provide any supplementary information necessary for compliance with the technical submission.
- **Standards:** To BS EN 378-1, BS EN 14511-1, BS EN 14511-2, BS EN 14511-3 and BS EN 14511-4.
- **Third party certification:** ECA compliant.
- **Design ambient temperature:** minimum 35°C.
- **Refrigerant additive:** Fluorescent additive to the refrigerant system.
- **Evaporators:** Manufacturer's standard, unless otherwise specified
- **Evaporator accessories:** 19 mm flexible closed cell insulation and Electric heaters to prevent freezing down to -28°C ambient temperature, complete with thermostat.
- **Condenser coils:** Manufacturer's standard, unless otherwise specified
- **Warning indication:**
- **Execution:** 90-40-10/620 Installing chillers.

360 Water cooled liquid chillers

- **General:** Confirm compliance with the relevant European Ecodesign Directive and provide any supplementary information necessary for compliance with the technical submission.
- **Standards:** To BS EN 378-1, BS EN 14511-1, BS EN 14511-2, BS EN 14511-3 and BS EN 14511-4.
- **Third party certification:** ECA compliant.
- **Refrigerant:**
- **Refrigerant additive:** Fluorescent additive to the refrigerant system.
- **Evaporators:** Shell and tube with internally finned copper tubes.
- **Evaporator accessories:** 19 mm flexible closed cell insulation and Electric heaters to prevent freezing down to -28°C ambient temperature, complete with thermostat.
- **Condensers:** Seamless, integrally finned high efficiency copper tubes, roll expanded into heavy carbon steel tube sheets.
- **Warning indication:** minimmum:
  High pressure switch;

Low pressure switch;
and No evaporator or condenser water flow.

- **Accessories:** Purge system.
- **Execution:** 90-40-10/620 Installing chillers.

380 Closed circuit cooling towers

- **Standards:** In accordance with BS 4485-2, BS 4485-3 and BS 4485-4.
- **Accessories:** Access ladder and gantry;
  Antivibration mountings;
  and Trace heating of exposed pipework.
- **Execution:** 90-40-10/630 Installing cooling towers.

390 Open circuit cooling towers

- **Standards:** In accordance with BS 4485-2, BS 4485-3 and BS 4485-4.
- **Accessories:** Access ladder and gantry;
  Antivibration mountings;
  and Capacity control to avoid freezing.
- **Execution:** 90-40-10/630 Installing cooling towers.

400 Dry air coolers

- **Standard:** To BS EN 1048.
- **Accessories:** Antivibration mountings.

Execution

610 Installing chillers and cooling towers generally

- **Fixing of equipment and components:** Fix on purpose made bases or supports.
- **Pressure testing of joints:** Immediately before installation of lagging and casing. Submit results.

620 Installing chillers

- **General requirements:** 90-40-10/610 Installing chillers and cooling towers generally.
- **Position:** Position to allow for air circulation across the condenser heat transfer surface;
  For air for combustion for direct fired units;
  and For maintenance and servicing.
- **Access:** Provide for inspection and servicing of chiller and ancillary equipment.

630 Installing cooling towers

- **General requirements:** 90-40-10/610 Installing chillers and cooling towers generally.
- **Position:** Position to allow for:
  Air supply to the fans;
  Maintenance and servicing;
  Eliminating air recirculation;

Preventing the introduction of warm air discharge air and associated drift; and Ensuring visible plumes are not objectionable.

90-40-15 Climatic beams and ceilings

Products

310 Active climatic beams

- **Beam type:** Closed and Open. Refer to project specific documentation
- **Induction:** One sided and Double sided. Refer to project specific documentation
- **Connections:** Manufacturer's standard.
- **Flexible connectors:** Provide long connectors to allow each panel to be lowered for inspection and maintenance.
- **Climatic ceilings and beams off site testing:**
  - **Area required:** Refer to project specific documentation for any requirement.
- **Execution:** 90-40-15/610 Installing climatic beams.

320 Passive climatic beams

- **Connections:** Manufacturer's standard.
- **Flexible connectors:** Provide long connectors to allow each panel to be lowered for inspection and maintenance.
- **Climatic ceilings and beams off site testing:**
  - **Area required:** Refer to project specific documentation for any reqirement
- **Execution:** 90-40-15/610 Installing climatic beams.

340 Climatic ceiling panels

- **Flexible connectors:** Provide long connectors to allow each panel to be lowered for inspection and maintenance.
- **Climatic ceilings and beams off site testing:**
  - **Area required:** Refer to project specific documentation for requirement
- **Execution:** 90-40-15/620 Installing climatic ceiling panels.

Execution

610 Installing climatic beams

- **General:** Position accurately, parallel to outside wall. and Locate as shown on drawings.
- **Alignment:** Level in relation to ceiling.
- **Mounting:** In ceiling opening;
  Recessed;
  Exposed;
  As indicated on the drawings or referred to in schedules
- **Support:** Provide chains to take the weight of the beams when lowered for inspection.

620 Installing climatic ceiling panels

- **General:** Position accurately.
- **Alignment:** Level in relation to ceiling.
- **Support:** Provide chains to take the weight of the panels when lowered for inspection.

90-40-30 Flues and chimneys

Products

310 Metal flues and chimneys

- **Manufacturer:** Member of the British Flue and Chimney Manufacturers Association (BFCMA).
  Submit proposals.
- **Standard:** To BS EN 1856-1 or BS EN 1993-3-2.
- **Construction:** Twin wall.
- **Insulation:** Integral.
  Appropriate to temperature and location.
- **Material and finish:** Galvanized steel to BS EN ISO 1461;
  Stainless steel.
  Self finish;
  Consistent throughout
- **Fittings:** Adaptors;
  Bends;
  Firestop plates;
  Flue collector box;
  Insulating cover;
  Ridge terminal and adaptor;
  Roof outlet;
  Storm collar and flashing;
  Wall brackets;
  and Wall outlet.
- **Execution:** 90-40-30/610 Installing flues and chimneys and 90-40-30/620 Testing flues and chimneys.

320 Liners

- **Manufacturer:** Member of the British Flue and Chimney Manufacturers Association (BFCMA).
  Submit proposals
- **Standard:** To BS EN 1856-2.
- **Liner type:** Flexible, spirally wound, stainless steel tube.
- **Steel grade:** 316 (1.4401).
- **Fittings:** Adaptors;
  Clamp plates;
  Roof flashings;
  and Terminals.

Execution

610 Installing flues and chimneys

- **Joints and bends:** Minimize number.
- **Slope (maximum):** 30° from the vertical.
- **Joints:** Install with sockets uppermost, fully supported and fixed securely with brackets supplied for the purpose. Do not locate joints within the depth of floors.
- **Sealing of joints:** To provide a gas-tight installation.
- **Expansion and contraction:** Accommodate thermal movement.
- **Fire safety:** Locate a safe distance from combustible materials.
- **Roof junction:** Weatherproof. Fit terminal and flashings, collars, and the like.

620 Testing flues and chimneys

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

90-40-35 Heat emitters

Products

310 Air curtains

- **Standards:** To BS 4856-1, BS 4856-2,BS 4856-3 and BS 4856-4.
- **Arrangement:** Cased unit;
  Chassis unit;
  Horizontal;
  and Vertical.
- **Casing finish:** Manufacturer's standard.unless otherwise indicated in project particular specification
- **Connections:** Manufacturer's standard.
- **Accessories:** Adjustable telescopic duct for supply air grille;
  Door interlock relay;
  and Remote on/ off switch.
- **Execution:** 90-40-35/670 Installing unit heaters and air curtains and 90-40-35/610 Installing heat emitters generally.

335 Fan convectors

- **Standards:** To BS EN 16430-1 and BS EN 16430-2.
- **Third party certification:** Manufacturer's standard.
- **Electrical supply:** Single phase.
- **Casing finish:** Manufacturer’s standard,
  rust free, primer ready for final paint application;
  unless indicated otherwise in the project particular specification
- **Connections:** Manufacturer's standard.
- **Accessories:** Integral room and water thermostats;
  Integral thermostat;
  Removable, washable air filter;
  Three speed fan;
  unless indicated otherwise in the project particular specification
- **General:**
  1) Units to be fitted with silent running fans and washable filter;
  2) Air vents to be extended through casing;
  3) Heaters to be fitted with both control and speed change thermostats;
  4) Low-temperature cut out switch to be fitted on water flow temperature;
- **Execution:** 90-40-35/610 Installing heat emitters generally.

380 Low temperature hot water heated towel rails

- **Standards:** To BS EN 442-1 and BS EN 442-2.
- **Third party certification:** To RADMAC scheme

- **Finish:** Chrome plated.
  unless indicated otherwise in project particular documentation.
- **Connections:** Manufacturer's standard.
- **Accessories:** Manufacturer's standard, unless indicated otherwise in project particular documentation.
- **Execution:** 90-40-35/610 Installing heat emitters generally.

395 Natural convectors

- **Standards:** To BS EN 442-1 and BS EN 442-2.
- **Third party certification:** To RADMAC scheme.
- **Casing finish:** Manufacturer's standard;
  rust free, primer ready for final paint application;
  unless indicated otherwise in the project particular documentation
  Insulation to be fitted between rear of casing and wall.
- **Connections:** Manufacturer's standard.
- **Accessories:** Manufacturer's standard.
- **Execution:** 90-40-35/610 Installing heat emitters generally.

405 Radiators

- **Standards:** To BS EN 442-1 and BS EN 442-2.
- **Third party certification:** To RADMAC scheme.
- **Finish:**
  Manufacturer's standard;
  unless indicated otherwise in the project specific documentation
- **Connections:** 15 mm B.O.E;
  15 mm T.B.O.E.
  refer to project specific documentation
- **Material:** Cast iron;
  Steel.
  Aluminium NOT preferred
- **Execution:** 90-40-35/610 Installing heat emitters generally.

425 Radiant panels

- **Standards:** To BS EN 14037-1;
  To BS EN 14037-2;
  To BS EN 14037-3;
  To BS EN 14037-4;
  and To BS EN 14037-5.
- **Finish:** Manufacturer's standard;
  unless indicated otherwise in the project specific documentation.
- **Connections:** 15 mm.
- **Accessories:** Acoustic felt lining and Factory perforated.
- **Execution:** 90-40-35/610 Installing heat emitters generally.

475 Trench convectors

- **Standards:**
  - **Standards:**
  - **Heating:** To BS EN 16430-1 and BS EN 16430-2.
  - **Cooling:** To BS EN 16430-1 and BS EN 16430-3.
- **Element:** cooper with aluminium fins
- **Outlet grilles:** Manufacturer's standard. unless otherwise specified
- **Accessories:** Manufacturer's standard.

485 Unit heaters

- **Standard:** To BS 4856-1.
- **Electrical supply:** Single phase and Three phase.
  refer to project particular specification
- **Arrangement:** Horizontal discharge;
  Vertical discharge, with motor and fan mounted above heating element;
  and Vertical discharge, with motor and fan mounted below heating element.
  refer to project particular specification
- **Casing finish:** Manufacturer's standard. unless otherwise stated
- **Connections:** Screwed.
- **Accessories:** Manufacturer's standard.
- **Execution:** 90-40-35/610 Installing heat emitters generally and 90-40-35/670 Installing unit heaters and air curtains.

Execution

610 Installing heat emitters generally

- **Fixing:** Secure and parallel or perpendicular to the structure of the building.
- **Stud walls:** Fix to studs and/ or noggings.

670 Installing unit heaters and air curtains

- **Suspension:** Fix high level supports.

90-40-40 Heat pumps

Products

310 Air to air heat pumps

- **Standards:**
  - **Safety and environmental:** To BS EN 378-1 and BS EN 378-2.
  - **Test requirements:** To BS EN 14511-2, BS EN 14511-3 and BS EN 14511-4.
  - **Electrical safety:** To BS EN 60335-2-40.

320 Air to water heat pumps

- **Standards:**
  - **Safety and environmental:** To BS EN 378-1 and BS EN 378-2.
  - **Test requirements:** To BS EN 14511-2, BS EN 14511-3 and BS EN 14511-4.
  - **Electrical safety:** To BS EN 60335-2-40.

330 Gas engine driven heat pumps

- **Standards:** To BS EN 378-1 and BS EN 378-2.
- **System:** Multisplit and Split.

90-40-45 Heating calorifiers and plate heat exchangers

Products

310 Hot water non-storage calorifiers

- **Standard:** To BS 853-1 or BS 853-2.
- **Mountings:** Fitted in accordance with BS 853-1, Appendix B.
- **Test certificates:**
  - **Hydraulic:** Submit on completion.
  - **Independent:** Submit on completion.
- **Execution:** 90-40-45/610 Installing heat exchangers.

330 Plate heat exchangers

- **Primary medium:**
  - **Fluid:** Water.
  - **Working pressure:** To suit installation (min. test pressure 1.5 x working pressure)
- **Secondary medium:**
  - **Fluid:** Water.
  - **Working pressure:** To suit installation (min. test pressure 1.5 x working pressure)
- **Output:** As scheduled, allowing for a 10% additional margin
- **Material:**
  - **Plates:** Stainless steel and Titanium.
    As scheduled
  - **Gaskets:** EPDM and NBR.
    As appropriate for the application.
- **Execution:** 90-40-45/610 Installing heat exchangers.

350 Steam non-storage calorifiers

- **Standard:** To BS 853-1 or BS 853-2.
- **Test certificates:**
  - **Hydraulic:** Submit on completion.
  - **Independent:** Submit on completion.
- **Execution:** 90-40-45/610 Installing heat exchangers.

Execution

610 Installing heat exchangers

- **Calorifiers and storage vessels:** In accordance with BS 853-1.
- **Tubular heat exchangers and storage vessels:** In accordance with BS 853-2.

90-40-80 Solid fuel handling products

Products

310 Fuel handling equipment

- **Arrangement:** Articulated blade rotary stirrer and worm conveyor;
  Auger conveyor;
  Belt conveyor;
  Drag chain conveyor;
  Elbow worm conveyor;
  Pneumatic extraction;
  Rotary agitator;
  Screw conveyor;
  and Spring blade rotary stirrer and worm conveyor,
  to suit project application.
- **Burn back protection:** Bi-metallic strip;
  Burn-back flap valve;
  Mains water drench valve;
  Rotary valve;
  and Wax plug and drench bottle,
  to suit project application.

320 Ash handling equipment

- **Arrangement:** Dry drag chain conveyors;
  Submerged chain conveyors;
  Pressure pneumatic ash handling systems;
  Vacuum pneumatic ash handling systems;
  Vacuum and pressure pneumatic ash handling systems;
  and Worm conveyors
  to suit project application.

330 Accumulators

- **Capacity:** as indicated and to the boiler manufacturer's recommendations.
- **Material:** Carbon steel, coated externally.
- **Heat exchanger:** Carbon steel fixed coil.
- **Insulation:**
  - **Material:** 45-45-70/380 Mineral fibre slab insulation and 45-45-70/385 Mineral wool slab insulation.
  - **Thermal conductivity:** 0.039 W/m K.
- **Connections:** Manufacturer's standard, to suit the application.
- **Execution:** 90-40-80/610 Installing accumulators.

Execution

610 Installing accumulators

- **Position:** Install accumulator vertically. Protect from frost.
- **Floor:** Adequate to support the filled vessel. Fix legs to floor.
- **Maintenance:** Provide 500 mm clearance at the front and 100 mm above.
- **Draining:** Allow provision to enable the accumulator to be drained.

90-40-95 Variable refrigerant products

Products

310 Electric driven compressors

- **Standards:** To BS EN 378-1, BS EN 378-2, BS EN 14511-2, BS EN 14511-3, BS EN 14511-4 and BS EN 60335-2-40.
- **Accessories:** Accumulator heater;
  Discharge temperature sensors;
  High pressure sensors;
  High pressure switch;
  Internal compressor crankcase heater;
  Internal overload relay;
  Low pressure switch;
  Overcurrent relay;
  Overcurrent sensor;
  Reverse phase protection;
  and Suction temperature sensors.

320 Gas engine driven compressors

- **Standards:** To BS EN 378-1 and BS EN 378-2.
- **Flues and chimneys:** Integral;
  Non-integral;
  and Use existing.
- **Execution:** 90-40-95/610 Installing gas engine driven compressors.

330 Indoor units

- **Standards:** To BS EN 378-1 and BS EN 378-2.
- **Condensate trays:** Provide insulation to outside face of trays to prevent condensation.

Execution

610 Installing gas engine driven compressors

- **Fixing:** Anchor bolts.
- **Space above units (minimum):** 2 m.
- **Space between units (minimum):** 50 mm.
- **Exhaust gas:** Away from intake openings, windows and ventilation openings.

90-45-05 Air conditioning units

Products

320 Fan coil units

- **Standard:** To BS 4856-1, BS 4856-2, BS 4856-3 and BS 4856-4.
- **Electrical supply type:** Single phase.
- **Casings:** Manufacturer's standard, unless noted otherwise in project specific documentation
- **Finish:** Manufacturer's standard, unless noted otherwise in project specific documentation
- **Ductwork connections:** Refer to project specific documentation
- **Access:** Provide access to filter, fan and motor, valves and controls.
- **Drip tray:**
  - **Position:** Under coil, and under control valve where fitted.
  - **Material:** Corrosion resistant.
  - **Finish:** Insulate external faces to prevent condensation.
  - **condensate trap:** Borosilacte glass;
    as condensate drain,
    to suit application.
- **Execution:** 90-45-05/610 Installing drain lines.

350 Room air conditioning units

- **Standards:** To BS EN 14511-2, BS EN 14511-3, BS EN 14511-4, BS EN 15218, BS EN 378-1, BS EN 378-2 and BS EN 60335-2-40.
- **Electrical supply:** Single phase.
- **Casing:** Manufacturer's standard.
- **Finish:** Manufacturer's standard.
- **Access:** Provide access to filter, fan and motor for maintenance.
- **Filter:** Washable.
- **Insulation:** Thermal and acoustic.
- **Controls:** On/off switch and Temperature control.
  Refer to equipment schedules and BMS/Controls specifications
- **Execution:** 90-45-05/610 Installing drain lines.

360 Split coil room air conditioning units

- **Standards:** To BS EN 14511-2, BS EN 14511-3, BS EN 14511-4, BS EN 15218, BS EN 378-1, BS EN 378-2 and BS EN 60335-2-40.
- **Electrical supply:** Single phase.
- **Casing finish:** Manufacturer's standard.
- **Access:** To filter, fan and motor.
- **Filters:** Washable.

- **Insulation:** Thermal and acoustic.
- **Controls:** On/off switch and Temperature control.
  Refer to equipment schedules and BMS/Controls specifications
- **Condensate drainage:** Condensate pump within unit and Gravity
  Refer to project specific documents.
- **Execution:** 90-45-05/610 Installing drain lines.

370 Split coil remote air cooled condensing units

- **Manufacturer:** As room unit
- **Standards:** To BS EN 378-1, BS EN 378-2 and BS EN 60335-2-40.
- **Duty:** Match split coil room air conditioning unit.
- **Electrical supply:** Single phase
  Three phase.
- **Casing:**
  - **Material:** Manufacturer's standard.
  - **Finish:** Weatherproof.

Execution

610 Installing drain lines

- **Drain connections:** Connect drainline flush with bottom of drip tray.
- **Drain line material:** Copper and Plastics.
  Plastic may only be used where pipeline is not subject to damage

90-45-10 Air filters

Products

301 Fan coil filters

- **Standards:**
  - **Performance:** To BS EN 779.
  - **Testing:** To Eurovent 4/9 Method of testing air filters.
- **Filter class:** G4, unless otherwise specifed in project specific documentation
- **Construction:** Galvanised steel frame. non-flamable filtre media
- **Execution:** 90-45-10/630 Installing filter frames

310 Activated carbon filters

- **General:** Provide absorbent bed filled with uniform thickness of activated carbon granules constructed to prevent settlement. Provide bonded carbon cells to prevent pinholing.
- **Media type:** Disposable
  Reactivation possible.
- **Casing:** Provide casing with removable panels.
- **Casing material:** Corrosion resistant zinc electro-plated steel;
  Rigid carbon steel with epoxy resin finish;
  Rigid carbon steel with plastic coating.

  Refer to project specific documentation, manufacturer's standard if not specified.
- **Accessories:** 90-45-10/440 Pressure gauges
  90-45-10/460 Terminal filter housings.
- **Execution:** 90-45-10/630 Installing filter frames;
  90-45-10/640 Installing filters;
  and 90-45-10/610 Edge seals.
- **Standard:** Performance to BS EN ISO 16890-1.

320 Efficient particulate arrestor (EPA) filters

- **Standard:** To BS EN 1822-1.
- **Filter media:** EPA filter media - Group E.
- **Filter casing:** Provide with gasket fitted to casing.
- **Filter material:** Carbon steel with corrosion resistant coating.
- **Flammability:** Non-flammable for duration of recommended working life.
- **Access:** Manufacturer's standard.
  unless specified otherwise in project specific documentation;
  Contractor to ensure suitable for site layout and space available.
- **Filter frame material:** Coated steel
  Stainless steel.

- **Accessories:** 90-45-10/440 Pressure gauges;
  90-45-10/460 Terminal filter housings;
  and 90-45-10/450 Safe change filter changing units.
- **Execution:** 90-45-10/610 Edge seals;
  90-45-10/630 Installing filter frames;
  and 90-45-10/640 Installing filters.

330 Electrostatic precipitators

- **Arrangement:** Single pass;
  Double pass;
  and Triple pass.
  to suit application
- **General:** Electrostatic agglomerator with bag-type collector section
  Modular unit flanged at both ends, with access to allow manual cleaning.
- **Components:** Casing;
  Perforated baffle or grid;
  Ionizer section;
  Collector section;
  and Electrical control panel including all controls pre-wired.
- **Automatic wash components:** Solenoid valve and drainage section;
  Wash plant unit including hot water storage, pump, distribution pipeline, spray nozzles and drain system;
  and Detergent tank and pump.
  Refer to project specific documentation
- **Safety measures:** Provide the following as a minimum, with additional provision against any particular risk:-
  Fail-safe interlocks on control panel door;
  Interlock to prevent washdown whilst precipitator is energized;
  Clear indication of high voltage danger;
  Refer to project specific documentation for additional requirements.
- **Accessories:** 90-45-10/440 Pressure gauges and 90-45-10/460 Terminal filter housings.
- **Execution:** 90-45-10/610 Edge seals;
  90-45-10/630 Installing filter frames;
  and 90-45-10/640 Installing filters.
- **Standard:** Performance to BS EN ISO 16890-1.

340 High efficiency particle arrestor (HEPA) filters

- **Standard:** To BS EN 1822-1.
- **Filter media:** HEPA filter media - Group H.
- **Filter casing:** Provide with gasket fitted to casing.
- **Filter material:** Carbon steel with corrosion resistant coating
  Stainless steel.
- **Flammability:** Non-flammable for duration of recommended working life.
- **Access:**
  Manufacturer's standard;
  unless specified otherwise in project specific documentation
- **Filter frame material:** Coated steel and Stainless steel.

- **Accessories:** 90-45-10/440 Pressure gauges;
  90-45-10/450 Safe change filter changing units;
  and 90-45-10/460 Terminal filter housings.
- **Execution:** 90-45-10/610 Edge seals;
  90-45-10/630 Installing filter frames;
  and 90-45-10/640 Installing filters.

360 Panel filters

- **Standards:**
  - **Performance:** To BS EN ISO 16890-1.
  - **Testing:** To Eurovent 4/9 Method of testing air filters.
- **Filter type:** Pleated panels.
- **Final filter pressure drop:** 250 Pa. (maximum)
- **Filter class:** G1;
  G2;
  G3;
  G4.
  Refer to project specific documentation
- **Flammability:** Non-flammable for duration of recommended working life.
- **Accessories:** 90-45-10/440 Pressure gauges.
- **Execution:** 90-45-10/630 Installing filter frames and 90-45-10/640 Installing filters.

370 Primary grease filters

- **Filter:**
  - **Standard:** To Loss Prevention Standard 1263.
  - **Class of filter:** GF20;
    GF28;
    GF36;
    GF44;
    GF52;
    GF58;
    GF60;
    GF64;
    GF68;
    GF70;
    GF80;
    GF85;
    GF90;
    GF94;
    GF98;
    GF101;
    and GF104.
- **Filter type:** Baffle;
  Cartridge;
  Water wash;
  Cold water mist.

- **Execution:** 90-45-10/610 Edge seals;
  90-45-10/630 Installing filter frames;
  and 90-45-10/640 Installing filters.

380 Bag filters type A

- **Standards:**
  - **Performance:** To BS EN ISO 16890-1.
  - **Testing:** To Eurovent 4/9 Method of testing air filters.
- **Final filter pressure drop:** 450 Pa.
- **Flammability:** Non-flammable for duration of recommended working life.
- **Access:** Suitable for site layout and available space
- **Filter mounting frames:**
  - **Material:** Manufacturer's standard;
    unless specified otherwise in project specific documentation.
- **Accessories:** 90-45-10/440 Pressure gauges.
- **Execution:** 90-45-10/630 Installing filter frames and 90-45-10/640 Installing filters.

400 Ultra low particle arrestor (ULPA) filters

- **Standard:** To BS EN 1822-1.
- **Filter media:** ULPA filter media - Group U.
- **Filter casing:** Provide with gasket fitted to casing.
- **Filter material:** Manufacturer's standard.
- **Flammability:** Non-flammable for duration of recommended working life.
- **Access:** Suitable for site layout and available space
- **Filter frame material:** Manufacturer's standard;
  unless specified otherwise in project specific documentation.
- **Accessories:** 90-45-10/440 Pressure gauges;
  90-45-10/450 Safe change filter changing units;
  and 90-45-10/460 Terminal filter housings.
- **Execution:** 90-45-10/610 Edge seals;
  90-45-10/630 Installing filter frames;
  and 90-45-10/640 Installing filters.

440 Pressure gauges

- **Arrangement:** Dial.
- **Gauge markings:** Positions equivalent to ‘Filter Dirty’ and ‘Filter Clean’ conditions.
- **Accessories:** Pressure differential switch.
- **Execution:** 90-45-10/660 Installing pressure gauges.

450 Safe change filter changing units

- **Material:** Manufacturer's standard.

460 Terminal filter housings

- **Housing seals:** Gaskets between holding frames on banks of filters. Seal filters into steel casing.

Execution

610 Edge seals

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

630 Installing filter frames

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

640 Installing filters

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

660 Installing pressure gauges

- **General:** Fix external to unit to allow easy observation, within 3 m of filter.
- **Pressure differential switch:** Connected to provide visual or audio warning of filter blocked condition.

90-45-15 Air handling units

Products

310 Air handling unit

- **Standard:** To BS EN 13053.
- **Construction:** Double skin.
  • Casing class: 2.
  • Thermal performance of casing:
  - Thermal transmittance: T3.
  - Thermal bridging: TB3.
  • Acoustic insulation of casing: Yes.
  • Fire protection: Category A.
  • Material: Plastics coated galvanized sheet steel .
  - Finish: Manufacturer's standard.
  • Air handling unit feet: Feet under each section.
  • Special requirements: refer to project specific documentation.
  -Submit shop drawings and details of dimensions and weight .
- **Casing construction:**
  - **Standard:** To BS EN 1886.
  - **Details:** Submit shop drawings and details of dimensions and weight.
- **Method of support:** Continuous channel supports
- **Anti-vibration mountings:** 90-90-95/320 Compression isolators and 90-90-95/330 Spring isolators. to suit duty and location
- **Components:**
- **Flexible connections:** To BESADW/144.
- **Access:**
  - **General:** Provide access openings and covers complete, including opening devices.
  - **Seal:** To prevent excessive air leakage.
  - **Seal durability:** For normal maintenance operations over at least 10 years.
  - **Access clear width (minimum):** 400 mm.
  - **Opening device:** Key-operated door locks.
  - **Components requiring access:** Air control dampers;
    Primary filters;
    Secondary filters;
    Humidifiers;
    Preheater coils;
    Cooling coils;
    Hot water coils;
    Fans.
    Ensure size, location and arrangement are appropriate for the application.
- **Accessories:** AHU mounted control panel and integral control devices;
  Remote controls;
  Refer to BMS/Controls specification;

Allow drip tray drainage pipework

- **Execution:** 90-45-15/610 Component assembly;
  90-45-15/615 Access;
  90-45-15/620 Coil installation generally;
  90-45-15/625 Installing cooling coils;
  90-45-15/630 Installing hot water coils;
  90-45-15/635 Humidifier water supply quality;
  90-45-15/645 Installing fans;
  90-45-15/650 Services connections;
  90-45-15/655 Isolation of air handling units;
  90-45-15/660 Support for air handling units;
  90-45-15/665 Pre-commissioning of coils;
  90-45-15/680 Air leakage testing;
  and 90-45-15/685 Testing.

Execution

610 Component assembly

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

615 Access

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

620 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.

625 Installing cooling coils

- **Airflow:** Evenly distributed over face area of coil.
- **Air velocity:** Ensure it is below level at which moisture carryover occurs.
- **Condensate drain lines:**
  - **Trap:** Provide to prevent flooding.
  - **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.
  - **Size:** At least that of the drain pan connection.

630 Installing hot water coils

- **Expansion:** Connect pipelines to allow free expansion of headers and tubes.

635 Humidifier water supply quality

- **Water quality:** Treated water.

645 Installing fans

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

650 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.

655 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.

660 Support for air handling units

- **Method:** Builder's work base or as detailed within project specific documentation.

665 Pre-commissioning of coils

- **Preparation:** Remove protective covering;
  Check frost protection and drain if heat is not available in freezing conditions;
  and Straighten fins.
- **Cleaning and chemical treatment:** Use chemicals compatible with the materials in the coils.

680 Air leakage testing

- **Testing:** In accordance with HEVACGuide to air handling unit leakage testing.

90-45-20 Air terminal devices

Products

320 Diffusers type A

- **Standards:**
  - **Mixed flow applications:** To BS EN 12238.
  - **Sound power levels:** To BS EN ISO 5135.
- **Core velocity (maximum):** 6 m/s.
- **Diffuser:** Multi-core and Perforated face.
- **Finish:** Anodized;
  Clear lacquer finish;
  Epoxy resin powder/ hardener coating;
  Etched or buffed with self colour satin finish;
  Primed to prevent rust;
  and Stove enamelled.
  As project specific documentation
- **Execution:** 90-45-20/620 Installing circular and rectangular diffusers and 90-45-20/690 Support of air terminal units in ceiling grids.

330 Displacement ventilation diffusers

- **Standards:**
  - **Displacement flow applications:** To BS EN 12239.
  - **Sound power levels:** To BS EN ISO 5135.
- **Application:** Supply.
- **Finish:** Anodized;
  Clear lacquer finish;
  Epoxy resin powder/ hardener coating;
  Etched or buffed with self colour satin finish;
  Primed to prevent rust;
  Stove enamelled.
  Refer to project specific documentation
- **Accessories:** 90-45-20/400 Ceiling or wall mounted plenum boxes and 90-45-20/410 Floor mounted plenum boxes.
- **Execution:** 90-45-20/620 Installing circular and rectangular diffusers.

350 Linear diffusers

- **Standards:**
  - **Mixed flow applications:** To BS EN 12238.
  - **Sound power levels:** To BS EN ISO 5135.
- **Core velocity (maximum):** 8 m/s.
- **Material:** Aluminium, unless otherwise specified.

- **Finish:** Anodized;
  Clear lacquer finish;
  Epoxy resin powder/ hardener coating;
  Etched or buffed with self colour satin finish;
  Primed to prevent rust;
  Stove enamelled.
  To suit project specific requirements
- **Accessories:** 90-45-20/400 Ceiling or wall mounted plenum boxes and 90-45-20/680 Location of grille or diffuser blanking plates.
- **Execution:** 90-45-20/660 Installing linear and slot diffusers.

360 Swirl diffusers

- **Standards:**
  - **Mixed flow applications:** To BS EN 12238.
  - **Sound power levels:** To BS EN ISO 5135.
- **Core velocity (maximum):** 8 m/s.
- **Application:** Supply.
- **Material:** Aluminium;
  Galvanized steel;
  Plastics;
  Stainless steel.
  Refer to project specific documentation.
- **Finish:** Anodized;
  Clear lacquer finish;
  Etched or buffed with self colour satin finish;
  Primed to prevent rust;
  Stove enamelled.
  Refer to project specific documentation.
- **Accessories:** 90-45-20/400 Ceiling or wall mounted plenum boxes;
  90-45-20/410 Floor mounted plenum boxes;
  and 90-45-20/680 Location of grille or diffuser blanking plates.
- **Execution:** 90-45-20/620 Installing circular and rectangular diffusers;
  90-45-20/690 Support of air terminal units in ceiling grids;
  and 90-45-20/640 Installing floor mounted swirl diffusers.

380 Grilles type A

- **Standards:**
  - **Mixed flow applications:** To BS EN 12238.
  - **Displacement flow applications:** To BS EN 12239.
  - **Sound power levels:** To BS EN ISO 5135.
- **Grille type:** Adjustable single deflection;
  Adjustable double deflection;
  Eggcrate;
  Fixed bar;
  High security;
  Non-vision;

Perforated, stamped;
and Perforated, mesh.

- **Finish:** Anodized;
  Clear lacquer finish;
  Epoxy resin powder/ hardener coating;
  Etched or buffed with self colour satin finish;
  Primed to prevent rust;
  and Stove enamelled.
  as project specific documentation
- **Execution:** 90-45-20/690 Support of air terminal units in ceiling grids and 90-45-20/650 Installing grilles.

390 Laminar flow panels

- **Finish:** Anodized;
  Clear lacquer finish;
  Epoxy resin powder/ hardener coating;
  Etched or buffed with self colour satin finish;
  Primed to prevent rust;
  Stove enamelled.
  Refer to project specific documentation.
- **Execution:** 90-45-20/610 Installing air terminal devices and 90-45-20/690 Support of air terminal units in ceiling grids.

400 Ceiling or wall mounted plenum boxes

- **Manufacturer:** As grille / diffuser manufacturer
- **Configuration:** Single plenum box or Series of plenum boxes butted together to form a continuous length.
  To suit specific application.
- **Construction:** Sturdy and rigid with circular inlet spigots of 65 mm minimum length.
- **Fixing:** Incorporate means for fixing to, or suspending from, building or other construction.

410 Floor mounted plenum boxes

- **Manufacturer:** As grille / diffuser manufacturer
- **Configuration:** Single plenum box or Series of plenum boxes butted together to form a continuous length.
  To suit specific application.
- **Construction:** Sturdy and rigid with circular inlet spigots of 65 mm minimum length. Provide box base and reinforcement able to withstand casting into floor slab.
- **Fixing:** Incorporate means for fixing to slab, or ties for casting into a floor slab.

450 Specialist air terminal devices

- **Standards:**
  - **Mixed flow applications:** To BS EN 12238.
  - **Sound power levels:** To BS EN ISO 5135.
- **Application:** Supply.

- **Air terminal device:** Disc valves;
  Drums;
  Nozzles.
- **Finish:** Anodized;
  Clear lacquer finish;
  Epoxy resin powder/hardener coating;
  Etched or buffed with self colour satin finish;
  Primed to prevent rust;
  Stove enamelled.
  Refer to project specific documentation
- **Accessories:** 90-45-20/400 Ceiling or wall mounted plenum boxes.
- **Execution:** 90-45-20/620 Installing circular and rectangular diffusers and 90-45-20/690 Support of air terminal units in ceiling grids.

460 Ventilated ceilings

- **General:** Ventilated ceilings must be installed as part of an integrated solution.
- **Air distribution:** Mixed flow.
- **Execution:** 90-45-20/610 Installing air terminal devices.

470 Ventilated ceilings for kitchens

- **Standard:** To BESADW/172.
- **Arrangement:** Modular cassette ceiling - linear;
  Modular cassette ceiling - square;
  and Plenum.
- **Execution:** 90-45-20/670 Installing ventilated ceilings in kitchens.

Execution

610 Installing air terminal devices

- **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.

620 Installing circular and rectangular diffusers

- **General requirements:** 90-45-20/610 Installing air terminal devices.
- **Method:** Hidden screw;
  Rear support angles;
  Rear suspension bracket;
  Spring edge clip;

and Suspension bolts and brackets.
As appropriate to the installation

640 Installing floor mounted swirl diffusers

- **General requirements:** 90-45-20/610 Installing air terminal devices.
- **General:** Fit flush with finished floor.
- **Method:** Back collar;
  Core and trim ring and cover plate;

650 Installing grilles

- **General requirements:** 90-45-20/610 Installing air terminal devices.
- **Method:** Concealed with rear bracket;
  Concealed with spring clip;
  Concealed with sub-frame.
  as appropriate to the installation;

660 Installing linear and slot diffusers

- **General requirements:** 90-45-20/610 Installing air terminal devices.
- **Method:** Bracket from plenum box;
  Flange screw fixing;
  Hidden screw fixing;
  Wire support.
  as appropriate to the installation;

670 Installing ventilated ceilings in kitchens

- **General requirements:** 90-45-20/610 Installing air terminal devices.
- **Standard:** To BESADW/172.

680 Location of grille or diffuser blanking plates

- **Position:** Where needed to restrict projection of air flow from section of grille or diffuser.

690 Support of air terminal units in ceiling grids

- **Standard:** To BESADW/144.
- **Wire safety support:** Angle trim support;
  Tile replacement support;
  Pattress support.
  as appropriate for ceiling / wall and terminal types ;
- **Independent support:** Plasterboard wall support;
  Independent support;
  Concrete wall/ soffit support.
  as appropriate for strucure and terminal types and maintaining access;
- **Position:** Agree final position of air terminals before installation.

90-45-25 Ductwork

Products

310 Circular plastics ductwork and fittings

- **Standard:** To BESADW/154.
- **Classification:** Class A;
  Class B;
  and Class C.
- **Air leakage testing:** As 90-45-25/315 Circular sheet metal ductwork and fittings
- **Material:** Self extinguishing polypropylene;
  Unplasticized polyvinyl chloride;
  Unplasticized polyvinyl chloride/ Rigid polyurethane self extinguishing foam / Glass reinforced plastic;
  and Unplasticized polyvinyl chloride/ Glass reinforced plastic.
- **Regulating dampers:**
  - **Standard:** To BESADW/154.
  - **Type:** Iris and Single-blade.
    (do not use iris dampers on ducts larger than 200mm diameter)
- **Flexible joint connections:** Fit on fan inlets and outlets and at building expansion joints.; elsewhere as indicated on drawings and/or project specific specifications.;
  Manufactured in accordance with DW/144;
  Length, 50mm to 150mm preferred; max length 250mm.
- **Hangers and supports:** To BESA DW/154.
- **Access openings:** Provide as DW144 and adjacent to all dampers and in-line plant items

  Sizes to BS EN 12097 and To BESA DW/154, Appendix H;
  Inspection only - 100 x 100mm;
  Service/maintenance/adjustment; as large as possible up to 450 sq.
- **Execution:** 90-45-25/610 Air ductwork generally;
  90-45-25/630 Installing plastics ductwork;
  and 90-45-25/710 Installing controls and sensing equipment in plastics ductwork.

315 Circular sheet metal ductwork and fittings

- **Standards:** To BESADW/144, BS EN 1506 and BS EN 12237.
- **Classification:** Class A;
  Class B;
  Class C;
  Class D.
- **Material:** Zinc coated steel to BS EN 10346 grade DX51D+Z140.
- **Construction:** Spirally wound and Straight seamed.
- **Regulating dampers:**
  - **Standard:** As BESADW/144.

- **Regulating function:** Balancing and Control.
- **Damper type:** Iris (up to 200mm);
  Single skin single-blade (up to 315mm).
  and Opposed blade;
- **Operation:** Balancing dampers:- to DW/144, clause 21.1.1;
  Control dampers:- to DW/144, clause 21.1.2.
- **Material:** To match ductwork.

- **Flexible joint connections:** Fit on fan inlets and outlets and at building expansion joints.; elsewhere as indicated on drawings and/or project specific specifications.;
  Manufactured in accordance with DW/144;
  Length, 50mm to 150mm preferred; max length 250mm.
- **Access openings:**
  - **Purpose:** Inspection /servicing:-
    DW/144 - section 20 and Appendix H;
    Cleaning/Maintenance:-
    DW/144 (clause 20.8),
    DW / 172 for kitchen installation
    BESA publication TR/19.
    Note: TR/19 incorporates and supersedes TR/17
  - **Sizes:** To BS EN 12097.
    Inspection /servicing:-
    DW/144 - section 20 and Appendix H;
    Cleaning/Maintenance:-
    DW/144 (clause 20.8),
    DW / 172 for kitchen installation
    BESA publication TR/19.
    Note: TR/19 incorporates and supersedes TR/17
- **Execution:** 90-45-25/610 Air ductwork generally;
  90-45-25/640 Installing sheet metal ductwork;
  90-45-25/700 Test holes in ductwork;
  90-45-25/740 Installing control equipment and instruments in metal ductwork;
  90-45-25/780 Air leakage testing of high pressure ductwork;
  and 90-45-25/785 Air leakage testing of medium pressure ductwork.

322 Fire resisting ductwork and fittings

- **Standard:**
  - **Ductwork:** In accordance with ASFPFire resisting ductwork – classified according to BS EN 13501, Parts 3 and 4 – European version (Blue book).
  - **Testing:** To BS EN 1366-1.
- **Classification:**
  - **Standard:** To BS EN 13501-3.
  - **Integrity class:** EI 120.
  - **Smoke leakage:** S.
- **Execution:** 90-45-25/610 Air ductwork generally;
  90-45-25/645 Installing fire and smoke extract ductwork;
  and 90-45-25/730 Fire rated ductwork sleeves and collars.

325 Flat oval sheet metal ductwork and fittings

- **Standard:** To BESADW/144.
- **Classification:** Class A;
  Class B;
  and Class C.
- **Material:** Zinc coated steel to BS EN 10346 grade DX51D+Z140.
- **Construction:** Spirally wound and Straight seamed.
- **Regulating dampers:**
  - **Standard:** To BESADW/144.
  - **Regulating function:** Balancing and Control.
  - **Damper type:** Opposed blade.
  - **Material:** To match ductwork.
- **Access openings:**
  - **Purpose:** Inspection;
    Cleaning;
    and Maintenance.
  - **Sizes:** To BS EN 12097.
- **Execution:** 90-45-25/610 Air ductwork generally;
  90-45-25/640 Installing sheet metal ductwork;
  90-45-25/700 Test holes in ductwork;
  90-45-25/740 Installing control equipment and instruments in metal ductwork;
  90-45-25/780 Air leakage testing of high pressure ductwork;
  and 90-45-25/785 Air leakage testing of medium pressure ductwork.

340 Kitchen canopies

- **Standard:** To BESADW/172.
- **Material:** Stainless steel - unpolished.
  Incorporate a condensation channel around lower edge.
- **Accessories:** Internal lighting, unless otherwise stated.
- **Execution:** 90-45-25/650 Installing kitchen ductwork and canopy.

350 Pre-insulated ductwork and fittings

- **Standard:** To BS EN 13403.
- **Accessories:**
  - **Material:** Compatible with ductwork.
  - **Finish:** To match ductwork.
- **Regulating dampers:**
  - **Regulating function:** Balancing and Control.
  - **Damper type:** Double skin multi-blade;
    Opposed blade;
    Single skin multi-blade;
    and Single skin single-blade, as appropriated to teh application.
- **Access openings:**

- **Purpose:** Inspection;
  Cleaning;
  and Maintenance.
- **Sizes:** To BS EN 12097.

- **Execution:** 90-45-25/610 Air ductwork generally;
  90-45-25/700 Test holes in ductwork;
  and 90-45-25/720 Weatherproofing ductwork penetrations.

360 Rectangular plastics ductwork and fittings

- **Standard:** To BESADW/154.
- **Classification:** Class A;
  Class B;
  and Class C.
- **Material:** Self extinguishing polypropylene;
  Unplasticized polyvinyl chloride;
  Unplasticized polyvinyl chloride/ Rigid polyurethane self extinguishing foam / Glass reinforced plastic;
  and Unplasticized polyvinyl chloride/ Glass reinforced plastic.
- **Accessories:**
  - **Material:** Compatible with ductwork.
  - **Finish:** To match ductwork.
- **Regulating dampers:**
  - **Standard:** To BESADW/154.
  - **Type:** Opposed blade.
- **Access openings:**
  - **Purpose:** Inspection;
    Cleaning;
    and Maintenance.
  - **Sizes:** To BESADW/154, Appendix D.
- **Execution:** 90-45-25/610 Air ductwork generally;
  90-45-25/630 Installing plastics ductwork;
  90-45-25/700 Test holes in ductwork;
  90-45-25/710 Installing controls and sensing equipment in plastics ductwork;
  and 90-45-25/720 Weatherproofing ductwork penetrations.

365 Rectangular sheet metal ductwork and fittings

- **Standards:** To BESADW/144, BS EN 1505 and BS EN 1507.
- **Classification:** Class A;
  Class B;
  Class C;
  Class D.
  As appropriate to the system
- **Material:** Zinc coated steel to BS EN 10346 grade DX51D+Z140.
- **Regulating dampers:**
  - **Standard:** To BESADW/144.
  - **Regulating function:** Balancing and Control.

- **Damper type:** Single blade dampers - max height and/or width - 300mm;
  Multi-blade dampers - max single blade height - 200mm
  Multi-blade dampers for regulating to be opposed blade type;
  Parallel blade type may be utilised only in open/closed applications.
- **Operation:** Balancing dampers:- to DW/144, clause 21.1.1;
  Control dampers:- to DW/144, clause 21.1.2.
- **Material:** To match ductwork.

- **Access openings:**
  - **Purpose:** Inspection /servicing:-
    DW/144 - section 20 and Appendix H;
    Cleaning/Maintenance:-
    DW/144 (clause 20.8),
    DW / 172 for kitchen installation
    BESA publication TR/19.
    Note: TR/19 incorporates and supersedes TR/17
  - **Sizes:** To BS EN 12097.
    To DW/144, Part 7
    Inspection only -100 x 100mm sq
    Service/maintenance/adjustment - as large as possible up to 450 x 450mm sq.
- **Execution:** 90-45-25/610 Air ductwork generally;
  90-45-25/640 Installing sheet metal ductwork;
  90-45-25/700 Test holes in ductwork;
  90-45-25/720 Weatherproofing ductwork penetrations;
  90-45-25/740 Installing control equipment and instruments in metal ductwork;
  90-45-25/780 Air leakage testing of high pressure ductwork;
  and 90-45-25/785 Air leakage testing of medium pressure ductwork.

370 Smoke extract ductwork

- **Standard:**
  - **Ductwork:** To BS EN 12101-7.
  - **Testing:** To BS EN 1366-1;
    To BS EN 1366-8;
    and To BS EN 1366-9.
  - **Classification:** To BS EN 13501-4, or as project specific documentation
- **Designation:**
  - **Multi-compartment:**

    Integrity class: EI 30;
    EI 60;
    EI 90;
    EI 120;
    E 30;
    E 60;
    E 90;
    E 120.
    As project specific documentation;

    Suitability: $V_{e.}$ and $H_{o,}$.
    As appropriate for the application

    Smoke leakage: S.

Under pressures: 500;
1000;
1500.
As appropriate for the application

- **Single compartment:**

Integrity class: E_{300} 30;
E_{300} 60;
E_{300} 90;
E_{300} 120;
E_{600} 30;
E_{600} 60;
E_{600} 120.
As appropriate for the application

Suitability: H_o.

Smoke leakage: S.

Under pressures: 500;
1000;
1500.
As appropriate for the application

- **Duct type:** C.
- **Accessories:**
  - **Material:** Compatible with ductwork.
  - **Finish:** Match ductwork.
- **Execution:** 90-45-25/610 Air ductwork generally;
90-45-25/645 Installing fire and smoke extract ductwork;
90-45-25/700 Test holes in ductwork;
90-45-25/720 Weatherproofing ductwork penetrations;
and 90-45-25/730 Fire rated ductwork sleeves and collars.

400 Access doors

- **Material:** Galvanized sheet steel
Stainless steel.
Compatible with ductwork
- **Locations:** As identified within project specific documentation and BESA TR/19 and DW series for relevant ductwork type

410 Bird guards

- **Material:** Black PVC coated 12 mm square mesh steel wire. Wire gauge at least 1 mm. Apply anti-corrosion protection to all metal ends exposed during manufacture.

420 Fire and smoke dampers type A

- **Type:** A
- **Standard:**
  - **Fire dampers:** To BS EN 15650.
  - **Test:** To BS EN 1366-2.
  - **Classification:** To BS EN 13501-3.

- **Aerodynamic performance:** To BS EN 1751 and BS EN ISO 5135.

- **Arrangement:** Folding curtain blades out of air stream
- **Classification:** E240.
- **Material:** Zinc coated steel.
- **Accessories:** Electrical cut-out switches;
  External visual indication of fire damper blade position;
  Microswitches for status indication.
- **Fusible links:**
  - **Fusing temperature:** 72°C.
  - **Spare fusible links:** Supply 1 spare link per 10 installed; with a minimum of 3.
- **Execution:** 90-45-25/725 Installing fire and smoke control dampers and 90-45-25/750 Access to dampers for resetting and maintenance.

430 Flexible ductwork

- **Standard:** To BESADW/144.
- **Flexible ductwork:** Submit proposals.
- **Material:** Aluminium and polyester laminate encapsulating high tensile steel wire helix.

445 Intumescent fire and smoke dampers

- **General:** Non-preferred: Intumescent dampers should only be utilised where other types are inappropriate
- **Standard:** To BS ISO 10294-5.
- **Arrangement:** Intumescent operated crush type and Intumescent sleeve.
- **Execution:** 90-45-25/725 Installing fire and smoke control dampers and 90-45-25/750 Access to dampers for resetting and maintenance.

460 Non-return dampers

- **Standard:** To BS EN 1751.
- **Leakage through closed blades:** Class 0, only acceptable where shut-off capability is not required;;
  Class 1;
  Class 2;
  Class 3;
  and Class 4.
- **Casing leakage:** A;
  B;
  C;
  D.
  To reflect related ductwork classification
- **Pressure:** Negative or Positive, as related ductwork.
- **Material:** Galvanized sheet steel frame and aluminium blades, unless detailed in project specific specifications.
- **Execution:** 90-45-25/750 Access to dampers for resetting and maintenance.

465 Pressure control flaps

- **Material:** Stainless steel flap and adjustable balance weight assembly.
- **Wall mounting casings material:** Nylon coated carbon steel;
  Stainless steel.
  unless detailed in project specific specifications
- **Control pressure of balance weight:** Manufacturer's standard, unless detailed in project specific specifications

470 Pressure relief dampers

- **Mounting:** Wall mounted, unless detailed in project specific specifications.
- **Material:**
  - **Frames:** Extruded aluminium section.
  - **Blades:** Aluminium.
- **Execution:** 90-45-25/750 Access to dampers for resetting and maintenance.

480 Shut off dampers

- **Standard:** To BS EN 1751.
- **Leakage through closed blades:** Class 1;
  Class 2;
  Class 3;
  Class 4;
  Refer to project specific documentation
- **Casing leakage:** A;
  B;
  C;
  Refer to project specific documentation
- **Pressure:** Negative;
  Positive;
  as appropriate to the application
- **Setting:** 100%.
- **Material:** Galvanized sheet steel.
- **Execution:** 90-45-25/750 Access to dampers for resetting and maintenance.

482 Smoke dampers

- **Standard:** To BS EN 12101-8.
- **Classification:**
  - **Standard:** To BS EN 13501-4.
  - **Multi-compartment:**

    Integrity class: EI 120.
    High operational temperature: HOT 400/30.
    Suitability: to reflect application
    Smoke leakage: S.
    Inside or outside: (i ↔ o).

- **Aerodynamic performance:** To BS EN 1751 and BS EN ISO 5135.
- **Actuators:** Tested to BS EN 1366-10.

490 VAV terminal units

- **Duty:**
  - **Reference:**
- **Volume control method:** Damper
  Pressure regulating valve.
- **Components:** Acoustic lining;
  Electric heating coil;
  Low temperature hot water heater battery.
- **Ductwork connections:** Manufacturer's standard.
- **Access:** Provide access to moving parts.

Execution

610 Air ductwork generally

- **Leakage testing requirements:** Carry out leakage testing for all ductwork pressure classifications, including Class A, unless explicitly instructed to the contrary.
- **Cut edges on ductwork, flanges and supports:** Smooth and burr free.
- **Connections to external openings:** Slope bottom edge of duct towards opening ad provide suitable drain.
  Provide bitumastic or epoxy finish on the inner surface of ductwork for one metre from opening, or to first fitting.

630 Installing plastics ductwork

- **Standard:** To BESADW/154.
- **Hangers and supports:** Install in accordance with BSRIA BG 10/2010 and Strength requirements to BS EN 12236.
- **Installing flexible joint connections:** Fit on fan inlets and outlets;
  Fit at building expansion joints;
  and Install fully stretched to minimize pressure drop.

640 Installing sheet metal ductwork

- **Standard:** To BESADW/144.
- **Hangers and supports:** Install in accordance with BSRIA BG 10/2010 and Strength requirements to BS EN 12236.
- **Installing flexible joint connections:** Fit on fan inlets and outlets;
  Fit at building expansion joints;
  and Install fully stretched to minimize pressure drop.

645 Installing fire and smoke extract ductwork

- **Standard:** Install fire resisting ductwork in accordance with ASFP Fire resisting ductwork

European version (Blue book) and ASFP TGD 018
Damper manufacturer's recommendations

- **Hangers and supports:** In accordance with BSRIA BG 10/2010.

650 Installing kitchen ductwork and canopy

- **Standard:** To BESADW/172.

700 Test holes in ductwork

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

710 Installing controls and sensing equipment in plastics ductwork

- **Generally:** Install sensors and test points to suit specialist control and sensing equipment.

720 Weatherproofing ductwork penetrations

- **Roof penetrations:** Submit proposals.
- **Wall penetrations:** Submit proposals.

725 Installing fire and smoke control dampers

- **Standard:** In accordance with ASFP Volume 1: EN fire dampers. (Grey book). 2nd edition;
  In accordance with HVCA DW/145;
  and To BS EN 12101-8.
- **Proposals:** The above standards include various methods and techniques to suit differing situations and wall/ floor constructions. Submit proposals for each fire damper to the Contract Administrator for comment/approval, prior to finalising the installation.

730 Fire rated ductwork sleeves and collars

- **Standard:** In accordance with ASFP Fire resisting ductwork - tested to BS 476 Part 24 (Blue book).
- **Position:** At fire compartment line
- **Material:** To match ductwork.

740 Installing control equipment and instruments in metal ductwork

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

750 Access to dampers for resetting and maintenance

- **Position:** Provide access to damper mechanisms on fire dampers; smoke dampers; combined smoke and fire dampers, and volume control dampers through access doors, suspended ceilings, etc. Where more than one fire damper is installed in a frame provide access to all fire dampers.

  All access doors, hatches and the like., are to be of sufficient size and suitably located to allow for easy and safe access allowing annual checks and maintenance.;

  Where access may be restricted by structures, solid ceilings, other services, (pipework, ductwork and the like), the damper is to be located remotely. In such instances involving

fire/smoke dampers the ductwork between the damper and the fire barrier (wall, floor, etc) to be fire rated both "in to out" and "out to in" to the same standard as the barrier being penetrated.

- **Fire links:** Provide access for replacement.

780 Air leakage testing of high pressure ductwork

- **Testing:** To BESADW/144 and in accordance with BESADW/143.
- **In-line plant:** The casings of all in-line plant must match the classification of the ductwork. Provide confirmation that the casings comply.
- **Test pressure:** To BESADW/144, Table 22.
- **Documentation:** Air leakage test sheet.
- **Report:**
  - **Format:** Electronic and Paper copy.
  - **Submit:** Weely and before handover.
  - **Number of copies:** Two

785 Air leakage testing of medium pressure ductwork

- **Standard:** To BESADW/144 and BESADW/143.
- **Extent:** Random testing of 10% maximum of the ductwork system.
  Carry out tests as work proceeds before thermal insulation is installed.
  Where a test fails, select two further sections for testing.
  Carry out remedial work where tests fail.
- **Documentation:** Air leakage test sheet.
  Details of calculations used to arrive at the allowable loss for the section to be tested.
- **Report:**
  - **Format:** Electronic and Paper copy.
  - **Submit:** Weely and before handover.
  - **Number of copies:** Two

790 Air leakage testing of plant items

- **Standard:** To BESADW/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:** Weely and before handover.
  - **Number of copies:** Two

90-45-30 Fans

Products

310 Axial flow fans

- **Performance:**
  - **Standard:** To BS 848-1.
- **Mechanical safety:** To BS 848-5.
- **Electrical safety:** To BS EN 60335-2-80.
- **Dimensions:** To BS EN ISO 13351.
- **Inspection doors:** Fit airtight inspection doors giving access to drive motors and other components requiring regular servicing and maintenance.
- **Accessories:** Anti-vibration mounts and flexible connections.
- **Execution:** 90-45-30/610 Installing fans generally.

320 Centrifugal fans type A

- **Performance:**
  - **Standard:** To BS 848-1.
- **Mechanical safety:** To BS 848-5.
- **Electrical safety:** To BS EN 60335-2-80.
- **Dimensions:** To BS EN ISO 13351.
- **Motor and drive:** Matched to fan.
- **Casing:** Manufacturer's standard.
- **Inspection doors:** Fit airtight hinged doors in scroll and cover.
- **Mounting:** Channel frame.
- **Material:** Galvanized sheet steel.
- **Accessories:** Anti-vibration mounts and flexible connections
- **Execution:** 90-45-30/610 Installing fans generally.

340 Mixed flow fans

- **Performance:**
  - **Standard:** To BS 848-1.
- **Mechanical safety:** To BS 848-5.
- **Electrical safety:** To BS EN 60335-2-80.
- **Dimensions:** To BS EN ISO 13351.
- **Motor and drive:** Matched to fan.
- **Inspection doors:** Fit airtight removable inspection doors giving access to drive motors and other components requiring regular servicing or maintenance.
- **Accessories:** Anti-vibration mounts and flexible connections

- **Execution:** 90-45-30/610 Installing fans generally.

360 Roof mounted fans

- **Performance:**
  - **Standard:** To BS 848-1.
- **Mechanical safety:** To BS 848-5.
- **Electrical safety:** To BS EN 60335-2-80.
- **Dimensions:** To BS EN ISO 13351.
- **Motor and drive:** Matched to fan.
- **Accessories:** Anti-vibration mounts and flexible connections
- **Execution:** 90-45-30/610 Installing fans generally.

380 Toilet extract fans

- **Performance:** To BS 848-1.
  - **Inlet and outlet arrangement:** As indicated on drawings and in project specific specifications.
- **Electrical safety:** To BS EN 60335-2-80.
- **Accessories:**
  - **Access panel:** Removable panel.
  - **Controls:** Speed controller to match fan, with on/ off and auto-changeover.
- **Execution:** 90-45-30/610 Installing fans generally.

Execution

610 Installing fans generally

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

90-45-45 Heat recovery products

Products

310 Heat pipes

- **Arrangement:** Horizontal and Vertical.
- **Access doors for maintenance:** Hinged, airtight and watertight.
- **Accessories:** By-pass duct and as scheduled
- **Execution:** 90-45-45/610 Installing drain traps;
  90-45-45/620 Installing eliminator plates;
  and 90-45-45/630 Supports.

320 Plate recuperators

- **Efficiency:** Minimum 73%
- **Casing:** Galvanized sheet steel
  unless otherwise specified
- **Finish:** Manufacturer's standard.
- **Access doors for maintenance:** Hinged, airtight and watertight.
- **Accessories:** By-pass duct and as scheduled
- **Execution:** 90-45-45/610 Installing drain traps;
  90-45-45/620 Installing eliminator plates;
  and 90-45-45/630 Supports.

330 Regenerators

- **Efficiency:** Minimum 67%
- **Access doors for maintenance:** Hinged, airtight and watertight.
- **Accessories:** by-pass arrangement
- **Execution:** 90-45-45/610 Installing drain traps;
  90-45-45/620 Installing eliminator plates;
  and 90-45-45/630 Supports.

340 Run-around coils

- **Standard:** To BS EN 1216.
- **Efficiency:** Minimum 68%
- **Fluid:** Ethylene glycol;
  Water;
  Water and ethylene glycol mix.
  Refer to project specific documentation
- **Materials:** 90-45-50/340 Low temperature hot water heating coils
- **Tube wall thickness (minimum):** 0.7 mm.
- **Fin thickness (minimum):**

  - **Aluminium:** 0.4 mm.
  - **Copper:** 0.3 mm.
- **Fin pitch (maximum):** 330 fins/m.
- **Thermal expansion:** Allow for movement.
- **Casing finish:** Galvanized carbon steel and Carbon steel painted with rust resisting primer.
- **Condensate drain trays:**
  - **Material:** Carbon steel.
  - **Thickness (minimum):** 2 mm.
  - **Finish:** Galvanized after manufacture and coated on the inside with bituminized paint.
  - **Vertical interval spacing (maximum):** 1 m.
  - **Drain connection size (minimum):** 22 mm.
- **Eliminator plates:**
  - **Requirement:** Downstream of coils if face velocity will exceed 2.25 m/s.
  - **Material:** Manufacturer's standard.
- **Draining and venting:** Provide draining and venting devices.
- **Access doors for maintenance:** Hinged, airtight and watertight.
- **Protection:** Fit blank flanges or caps to pipe connections after manufacture and Protect fins.
- **Pump:**
  - **Type:** Close-coupled centrifugal pump and electric motor unit with anti-vibration mountings. Provide sealed expansion vessel.
  - **Fixing:** Support externally from casing on brackets.
  - **Pressure gauge:** Fit in the pump discharge connection.
- **Accessories:** Antifreeze thermostat and Auto air purging valve.
- **Execution:** 90-45-45/610 Installing drain traps;
  90-45-45/620 Installing eliminator plates;
  and 90-45-45/630 Supports.

350 Thermal wheels

- **Efficiency:** Minimum 73%, unless higher efficieny identified in project specific documentation
- **Access doors for maintenance:** Hinged, airtight and watertight.
- **Accessories:** Adjustable purging sector;
  Antifreeze thermostat;
  Auto air purging valve;
  By-pass damper;
  and Speed controller.
- **Execution:** 90-45-45/610 Installing drain traps;
  90-45-45/620 Installing eliminator plates;
  and 90-45-45/630 Supports.

Execution

610 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.
- **Trap material:** Borosilicate glass;
  Copper,
  as appropriate to the project application

620 Installing eliminator plates

- **General:** Fit to allow removal from coil casing.
- **Locate:** Downstream.

630 Supports

- **Fixings:** Support heat recovery devices independently of ductwork.

90-45-50 Heating and cooling coils

Products

310 Chilled water cooling coils

- **Standards:** To BS 5141-1 and BS EN 1216.
- **Materials:** Solid drawn copper tubes, electro-tinned, with aluminium fins and Solid drawn copper tubes with copper fins, all electro-tinned.
  Copper, or vinyl coated aluminium, fins required in locations where air is contaminated;
  Should any special construction be required this will be set out in project specific documentation.
- **Tube wall thickness (minimum):** 0.4 mm, or as necessary for the working conditions.
- **Fin thickness (minimum):**
  - **Aluminium:** Manufacturer's standard.
  - **Copper:** 0.3 mm.
- **Fin spacing (maximum):** Manufacturer's standard.
- **Casing:**
  - **Finish:** Hot dipped galvanized.
  - **Return bends:** Provide removable covers. Lag and vapour seal the bends.
- **Condensate drain trays:**
  - **Material:** Carbon or stainless steel. Refer to project specific documentation.
  - **Thickness (minimum):** 2 mm.
  - **Finish:** Galvanized after manufacture and coated on the inside with bituminized paint.
  - **Vertical interval spacing (maximum):** 1 m.
  - **Drain connection size (minimum):** 22 mm.
- **Eliminator plates:**
  - **Condition:** Required where face velocity exceeds 2.25 m/s.
  - **Position:** Downstream of coils.
  - **Material:** Match coil casing.
- **Draining and venting:** Provide with venting and draining devices.
- **Drain trap material:** plastic, copper where vulnerable to damage; borosilacate glass, to suit project application
- **Access doors for maintenance:** Hinged, airtight and watertight.
- **Water test pressure:** Up to 2.1 MPa or 1.5x the working pressure, whichever is greater.
- **Protection:** Fit blank flanges or caps to pipe connections after manufacture.
- **Execution:** 90-45-50/610 Installing heating and cooling coils generally and 90-45-50/630 Installing eliminator plates.

320 Electric heater batteries

- **Arrangement:** Air duct heaters;
  Explosion proof air duct heaters;

Flameproof air duct heaters;
Stab in air heaters.
Refer to project specific documentation

- **Casing:**
  - **Material:** Galvanized mild steel.
  - **Finish:** Natural.
- **Access doors for maintenance:** Hinged, airtight and watertight.
- **Heating elements:**
  - **Mounting:** On removable terminal plate.
  - **Type:** Finned tubular and Metal sheathed tubular.
- **Terminal boxes:**
  - **Material:** Steel, galvanised or powder coated finish
  - **Ingress protection (minimum):** To BS EN 60529, IP31;
    To BS EN 60529, IP41;
    and To BS EN 60529, IP43;
    to suit location
- **Safety cut-out switch:**
  - **Manual reset:** Wired in series or via contactor with heating elements.
  - **Type:** Electronic resistance thermometer.
- **Controls:** Fan interlock to prevent heater operating without fan running and Run-on timer to allow airflow to cool heater before switching off fan.
  Additional controls as identified within project specific documentation.
- **Air flow detector switch:**
  - **Connection:** Wired in series with other safety devices, or as project specific documentation.
  - **Type:** Differential pressure.
- **Accessories:** Matching ductwork flanges.
- **Execution:** 90-45-50/610 Installing heating and cooling coils generally.

330 Gas fired heater batteries

- **Electrical supply:** Single phase.
- **Controls:** Close temperature control;
  On/Off;
  High/Low;
  Modulating.
- **Heat exchanger tube material:** Stainless steel tubes.
- **Accessories:** Diffuser plate.
- **Execution:** 90-45-50/610 Installing heating and cooling coils generally.

340 Low temperature hot water heating coils

- **Standards:** To BS 5141-2 and BS EN 1216.
- **Materials:** Solid drawn copper tubes with aluminium fins and Solid drawn copper tubes with copper fins.
  Copper, or vinyl coated aluminium fins required in locations where air is contaminated.

Should any special construction be required this will be set out in project specific documentation.

- **Tube wall thickness (minimum):** Manufacturer's standard.
- **Fin thickness (minimum):**
  - **Aluminium:** Manufacturer's standard.
    unless specified otherwise in project specific documentation
  - **Copper:** Manufacturer's standard.
    unless specified otherwise in project specific documentation
- **Fin spacing (maximum):** Manufacturer's standard.
- **Thermal expansion:** Allow for movement.
- **Casing finish:** Manufacturer's standard.
  unless specified otherwise in project specific documentation
- **Draining and venting:** Provide plugged connections in headers for drain cocks and air vents.
- **Tests:**
  - **Water test pressure:** Up to 2.1 MPa or 1.5 times the working pressure, whichever is greater.
  - **Air pressure test:** 22 barg air under water, for 30mins.- at coil manufacturer's works
  - **Certificates:** Issue certificates for each test.
- **Protection:** Fit blank flanges or caps to pipe connections after manufacture and Protect fins.
- **Execution:** 90-45-50/610 Installing heating and cooling coils generally.

350 Refrigerant cooling coils

- **Standard:** To BS EN 1216.
- **Coils:**
  - **Requirement:** Provide each section with its own thermostatic expansion valve and isolating inlet solenoid valve.
- **Protection:** Fit blank caps to pipe connections after manufacture and Protect fins.
- **Access doors for maintenance:** Hinged, airtight and watertight.
- **Accessories:** Antifreeze thermostat and Matching ductwork flanges.
- **Execution:** 90-45-50/610 Installing heating and cooling coils generally and 90-45-50/630 Installing eliminator plates.

Execution

610 Installing heating and cooling coils generally

- **Equipment, controls and instruments positioned next to heating coils:** Protect from thermal radiation.
- **Fixings:** Support coils independently of ductwork.

630 Installing eliminator plates

- **General:** Fit to allow removal from coil casing.

90-45-55 Humidifiers and dehumidifiers

Products

310 Evaporative humidifiers

- **Standards:** To BS EN 60335-1 and BS EN 60335-2-88.
- **Electrical supply type:** Manufacturer's standard.
- **Arrangement:** Wetted media.
- **Construction:** Use corrosion resistant material.
- **Access doors for maintenance:** Hinged, airtight and watertight.
- **Accessories:** Bulkhead luminaire and a switch mounted outside unit;
  Eliminator blades;
  and Inspection window.
- **Execution:** 90-45-55/610 Installing humidifiers generally;
  90-45-55/620 Condensate connections to air treatment units;
  90-45-55/630 Thermal expansion in humidifier connections;
  90-45-55/640 Installing humidifier condensate drain traps;
  and 90-45-55/650 Fixing of air treatment units.

320 Steam humidifiers

- **Standards:** To BS EN 60335-1 and BS EN 60335-2-88.
- **Electrical supply type:** Manufacturer's standard.
- **Steam source:** Electrode boiler;
  Electric resistance boiler;
  Gas fired;
  Mains steam.
  Refer to project specific documentation
- **Material:** Corrosion resistant.
- **Access doors for maintenance:** Hinged, airtight and watertight.
- **Drain trap material:** Copper.
- **Safety signs:** On access door, a label reading ‘Isolate steam supply before opening’ in letters at least 25 mm high.
- **Accessories:** Bulkhead luminaire and a switch mounted outside unit Inspection window and

  Internal lining for 1 m after humidifier.
- **Execution:** 90-45-55/610 Installing humidifiers generally;
  90-45-55/620 Condensate connections to air treatment units;
  90-45-55/630 Thermal expansion in humidifier connections;
  90-45-55/640 Installing humidifier condensate drain traps;
  and 90-45-55/650 Fixing of air treatment units.

330 Water atomizing humidifiers

- **Standards:** To BS EN 60335-1 and BS EN 60335-2-88.

- **Arrangement:** Atomizing nozzle;
  Mechanical atomization;
  and Ultrasonic.
- **Electrical supply type:** Single phase.
- **Water supply:** Demineralized
  Mains water.
  Refer to project specific documentation
- **Material:** Corrosion resistant.
- **Access doors for maintenance:** Hinged, airtight and watertight.
- **Drain trap material:** Copper.
- **Protection:** Fit blank flanges or caps to pipe connections after manufacture.
- **Accessories:** Bulkhead luminaire and a switch mounted outside unit;
  Eliminator blades;
  and Inspection window.
- **Execution:** 90-45-55/610 Installing humidifiers generally;
  90-45-55/620 Condensate connections to air treatment units;
  90-45-55/630 Thermal expansion in humidifier connections;
  90-45-55/640 Installing humidifier condensate drain traps;
  and 90-45-55/650 Fixing of air treatment units.

Execution

610 Installing humidifiers generally

- **Discharge:** Install humidifiers so that air flow is uniform over cross-section of ductwork.
- **Position:** Do not install next to air heating coils.

620 Condensate connections to air treatment units

- **General:** Arrange condensate lines so that back pressure does not exceed manufacturer's recommendations.

630 Thermal expansion in humidifier connections

- **General:** Connect pipelines to take up thermal expansion without stressing humidifiers.

640 Installing humidifier condensate drain traps

- **Air break:** Locate between trap outlet and drainage system.
- **Traps under suction:** Install the outlet below the inlet by a depth equivalent to at least one and a half times working pressure.
- **Traps under positive pressure:** Install inlet and outlet at same level.

650 Fixing of air treatment units

- **General:** Support humidifiers from building structure on zinc coated steel supports, independently of adjacent ductwork. Provide separate supports for components mounted outside casings.

90-45-75 Silencers and attenuators

Products

310 Air transfer and cross talk attenuators

- **Performance standards:** To BS EN ISO 7235 and BS EN ISO 11691.
- **Casing material:** Metal.
- **Lining material:** Inert, fire proof, inorganic and non- hygroscopic.

320 Circular silencers

- **Performance standards:** To BS EN ISO 7235 and BS EN ISO 11691.
- **Casing material:** Metal.
- **Lining material:** Inert, fire proof, inorganic and non- hygroscopic.
- **Markings:** Show direction of air flow on silencer.

330 Rectangular silencers

- **Performance standards:** To BS EN ISO 7235 and BS EN ISO 11691.
- **Casing material:** Metal.
- **Lining material:** Inert, fire proof, inorganic and non-hygroscopic.
- **Splitters:** Low loss fairings on entry and exit.
- **Markings:** Show direction of air flow on silencer.

350 Acoustic linings

- **Standard:** To BESADW/144.
- **Lining material:** Inert, fire proof, inorganic and non hygroscopic.
- **Protective lining:** Protect acoustic lining against product migration and erosion.
- **Execution:** 90-45-75/610 Protection of acoustic linings.

Execution

610 Protection of acoustic linings

- **Access:** Where personnel access is provided, protect acoustic linings to prevent damage.

90-50-35 Generators, engines and packaged CHP units

Products

490 Packaged CHP units

- **Prime mover:** Internal combustion engine and Gas turbine.
- **Fuel:** Biogas;
  Biofuel;
  and Diesel.
- **Electrical generator:**
  - **Standard:** To BS ISO 8528-5.
    To BS EN 60034-3.
  - **Type:** Synchronous.
  - **Operation:** Three phase, 415 V, 50 Hz.
- **Components:** Heat recovery exchanger;
  Control protection;
  Provision for remote monitoring;
  Vibration isolation sub-frame with anti-vibration mounts;
  and Flexible connections on pipelines.
- **Monitoring:**
  - **Display type:** LCD.
  - **Display the following conditions:**

    Environment: Air inlet temperature and Enclosure ambient temperature.

    Prime mover: Coolant temperature;
    Cylinder exhaust temperature;
    Gas pressure;
    Fuel flow rate;
    and Lubricating oil temperature.
    plus others as specified;

    Electrical properties: Mains frequency;
    Output current;
    Output frequency;
    Output power;
    Output voltage;
    and Power factor.
    plus others as specified;

    Heat exchanger: Flow and return temperature and Water flow rate.
- **Integral metering equipment:** For fuel input, power output and heat output.
- **Interconnection to Building Management and Monitoring System (BMMS):** Required.
- **Execution:** 90-50-35/615 Installing combined heat and power units.

Execution

615 Installing combined heat and power units

- **Standard:** In accordance with the BESA, Technical Report TR37.
- **Strainers:** Install to protect CHP unit from debris in the heating circuit.

90-65-50 Mechanical services controls, sensors and detectors

Products

310 Valve actuators

- **Standard:** To BS EN 60730-2-8.
- **Execution:** 90-65-50/610 Installing valve actuators.

350 Motorized valves

- **Standard:** To BS EN 60730-2-8.
- **Execution:** 90-65-50/640 Installing motorized valves.

380 Air temperature sensors

- **Standard:** To BS EN 60730-2-9.
- **Execution:** 90-65-50/675 Installing temperature sensors.

400 Flow in pipe sensors

- **Standards:** To BS EN 60730-2-15.
- **Execution:** 90-65-50/660 Installing flow sensors.

430 Water temperature sensors

- **Standards:** To BS EN 60730-2-9.
- **Execution:** 90-65-50/675 Installing temperature sensors.

Execution

605 Installing control components

- **Insulation:** Submit details of proposed insulation method where control components are on insulated pipelines.
- **Supports:** Do not strain components.
- **Access:** Adequate for operation and maintenance.

610 Installing valve actuators

- **General requirements:** 90-65-50/605 Installing control components.
- **Position:** Top of valve.

640 Installing motorized valves

- **General requirements:** 90-65-50/605 Installing control components.

- **Spindles:** Vertical.

650 Installing sensors generally

- **Standard:** In accordance with BCIAGuide: Control sensor installation.
- **Screening:** Screen from direct sunlight.
- **Immersion:** Immerse the sensor adequately in the medium.
- **Immersion pockets:** Provide for pipe sensors. Fill with thermal conductive compound.
- **Cable:** Flexible. Allow sufficient spare cable to allow for removal of sensor.
- **Stratification:** Install more than one sensor or an averaging sensor if necessary.

660 Installing flow sensors

- **General requirements:** 90-65-50/650 Installing sensors generally.
- **Differential pressure water sensors:** Do not locate valves between sensing points.
- **Differential pressure air sensors:** Locate an adequate distance from fans, filters, bends, fittings etc.
- **Velocity sensors:** Locate an adequate distance from fans, filters, bends, fittings etc.

675 Installing temperature sensors

- **General requirements:** 90-65-50/650 Installing sensors generally.
- **Pipe mounted immersion sensors:** Immerse full length of sensor in water.
- **Duct mounted immersion sensors:** Locate full length of sensor in the centre of the air flow.
- **Surface temperature sensors:** Provide clean contact with surface and thermal conducting compound.
- **Frost protection sensors:** Locate downstream of the first coil.

90-65-55 Monitoring, metering and test products

Products

300 Energy meters generally

- **Function:** Measurement of thermal energy
- **Location:** As indicated in the project documentation and to meet the requirements of Building regulations Part L.
- **Standards:** BSEN 1434;
  MID approved and certified
- **Accuracy classification:** Class 2
- **Execution:** Install in line with manufacturer's requirements;
  Only use matched temperature sensors as supplied with the meter;
  Fit with tamper seals after commissioning and prior to handover.

400 Secondary gas meters

- **Standards:**
  - **Third party certification:** Measuring Instruments Directive approved.
  - **Gas meters:** Diaphragm gas meters to BS EN 1359;
    Rotary displacement gas meters to BS EN 12480;
    Turbine gas meters to BS EN 12261;
    and Ultrasonic domestic gas meters to BS EN 14236.
  - **Low pressure meters:** In accordance with IGEM/GM/6.
- **Accessories:** 200 µm filter, or finer and Pulsed output for BMS monitoring.
- **Execution:** 90-65-55/640 Installing secondary gas meters.

420 Oil meters

- **Third party certification:** Measuring Instruments Directive approved.
- **Connections:** Threaded.
- **Output:** Pulsed;
  R232;
  and R485.

470 Water meters

- **Standards:** To BS EN ISO 4064-1 and BS EN ISO 4064-4.
- **Third party certification:** Measuring Instruments Directive approved and WRAS approved.
- **Format:** Pulsed output water meter on the mains water supply to each building;
  Sub-meters on individual water consuming plant or building areas drawing 10% or more of the total water demand of the building.;
  Connected to BMS,;
- **Environmental classification:** Class B;
  Class O;

and Class M,
to suit application.

- **Accuracy class:** Class 1. - Must be MID approved
- **Execution:** 90-65-55/670 Installing water meters.

Execution

640 Installing secondary gas meters

- **Secondary gas meters:**
  - **Low pressure:** In accordance with BS 6400-1.
  - **Medium pressure:** In accordance with BS 6400-2.
  - **Non-domestic:** In accordance with IGEM/GM/8, part 3 and part 5.
  - **Arrangement:** Provide a full bore bypass with locked valves adjacent to the point of connection to the main.
- **Electrical connections:** In accordance with IGEM GM/7A.

670 Installing water meters

- **Standards:** To BS EN ISO 4064-5.

90-70-95 Visual and audible displays and indicators

Products

310 Electronic sounders

- **Ingress protection (minimum):** To BS EN 60529, IP 44.
- **Colour:** Red.
- **Directional output at 1 m (minimum):** 75 dB(A).
- **Flashing beacon:** Integral.
- **Mounting:** Recessed;
  Semi-recessed;
  Surface.
- **Power supply:** Manufacturer's standard.
- **Execution:** 90-70-95/610 Installing sounders.

320 Visual alarm signal devices

- **Ingress protection (minimum):** To BS EN 60529, IP 44.
- **Format:** Xenon beacon.
- **Lens colour:** Clear;
  Red;
  and Yellow.
- **Execution:** 90-70-95/620 Installing visual alarm signal devices.

Execution

610 Installing sounders

- **Position:** Submit proposals.
- **Mounting height generally (above finished floor level):** 2.1 m.

620 Installing visual alarm signal devices

- **Position:** Submit proposals.
- **Mounting height generally (above finished floor level):** 2.1 m.

90-75-45 Leak detection products

Products

450 Fixed gas detectors

- **Detector type:** Catalytic bead;
  Electrochemical;
  and Thermal conductivity.
- **Gas:** Carbon monoxide.
- **Ingress protection (minimum):** To BS EN 60529, IP66.
- **Display type:** Integral backlit alphanumeric LCD display.
- **Standards:** To BS EN 14624;
  To BS EN 45544-1;
  To BS EN 45544-2;
  To BS EN 45544-3;
  To BS EN 50104;
  To BS EN 50270;
  To BS EN 50271;
  To BS EN 50545-1;
  To BS EN 60079-0 and BS EN 60079-1;
  and To BS EN 60079-29-1.
  Select standard appropriate to application
- **Equipment category:** ATEX Ex II 1 D;
  ATEX Ex II 2 D;
  ATEX Ex II 3 D;
  ATEX Ex II 1 G;
  ATEX Ex II 2 G;
  and ATEX Ex II 3 G.

90-90-40 Insulation and protection products

Products

301 Insulation Generally

- **General:** General properties applicable to all insulation products and applications.
- **function:** To limit heat loss / gain to / from the pipeline or to prevent condensation forming on the cold surface.
- **Properties:** All thermal insulation must be CFC-free and HCFC free to the minimum requirements of Part L.;
  Insulants must have a zero ODP and low GWP (less than 5).
- **Thickness:** Determine insulation thicknesses, vapour barriers, types, and the like by reference to BS 5422:2009 and the various tables therein.;

  For domestic cold water use the thickness corresponding to a fluid temperature of 5°C.

  For hot services use the maximum operating temperature and use the thickness one size above that indicated from the tables .

  Note: Aluminium sheet/foil finish and the like - apply low emissivity tables, else apply high emissivity tables.
- **Fire rating:** Minimum surface spread rating of Class O to BS 476-6 & BS 476-7.

320 Metal mesh faced mineral wool mattresses

- **Manufacturer:** Contractor's choice.
  Provide Technical submission to identify proposed product complies with specification.
- **Standard:** To BS 3958-3.
- **Thermal conductivity:** 0.032 W/m·K at 0°C.
  0.034 W/m·K at 10°C.
  0.037 W/m·K at 50°C.
  0.040 W/m·K at 75°C.
  0.044 W/m·K at 100°C.
- **Insulation thickness (minimum):** To BS 5422.
  BS 5422 incorporates various tables for differing applications; heat loss, condensation, etc. Refer to appropriate table to suit particular application.
- **Vapour barrier:**
  - **Material:** flexible sheet
  - **Vapour permeability:** To BS 5422, clause 5.6.
- **Protection:** 90-90-40/390 Protection.
- **Items to be insulated:** Include Cover plates and Removable access covers.
- **Execution:** 90-90-40/670 Installing insulation on tanks and 90-90-40/780 Installing vapour barriers type A.

330 Mineral wool pipe section insulation type A

- **Manufacturer:** Contractor's choice.
  Provide Technical submission to identify proposed product complies with specification.
- **Standard:** To BS 3958-4.
- **Recycled content:** 25% (minimum) to BS EN ISO 14021.
- **Thermal conductivity:** 0.032 W/m·K at 0°C.
  0.034 W/m·K at 10°C.
  0.037 W/m·K at 50°C.
  0.040 W/m·K at 75°C.
  0.044 W/m·K at 100°C.
- **Density:** Not less than 120 kg/m3
- **Finish:** Plant Rooms - Aluminium cladding;
  Exposed pipework in vulnerable areas - Aluminium cladding to 3m above FFL.;
  Exposed in other areas - Foil faced;
  Ceiling voids, risers and elsewhere concealed - Foil faced;
  External - 2-layer PIB sheeting - staggered joints;
  Note: all finishes materials to have Class 0 fire rating.
- **Insulation thickness (minimum):** To BS 5422.
  BS 5422 incorporates various tables for differing applications; heat loss, condensation, etc. Refer to appropriate table to suit particular application and follow guidance in 90-90-40/301; submit details.
- **Vapour barrier:**
  - **Material:** flexible sheet
  - **Vapour permeability:** To BS 5422, clause 5.6.
- **Protection:** 90-90-40/390 Protection.
- **Accessories:** 90-90-40/480 Insulation for valves and flanges and 90-90-40/485 Insulation at loadbearing pipeline supports.
- **Execution:** 90-90-40/620 Installing canvas faced mineral insulation;
  90-90-40/625 Installing foil faced mineral wool insulation on pipelines;
  90-90-40/755 Installing at non-loadbearing pipelines supports;
  90-90-40/760 Insulation not carried through pipelines supports;

340 Mineral wool slabs insulation

- **Manufacturer:** Submit proposals.
  Technical submission must demonstrate that the product complies with this specification.
- **Standard:** To BS 3958-5.
- **Form:** Rigid slabs;
  Semi-rigid slabs;
  and Wired mat.
- **Recycled content:** 25% (minimum) to BS EN ISO 14021.
- **Thermal conductivity:** 0.032 W/m·K at 0°C.
  0.034 W/m·K at 10°C.
  0.037 W/m·K at 50°C.
  0.040 W/m·K at 75°C.
  0.044 W/m·K at 100°C.

- **Finish:** Reinforced aluminium foil faced.
  With aluminium cladding within plant areas.
- **Insulation thickness (minimum):** To BS 5422.
  BS5422 incorporates various tables for differing applications; heat loss, condensation, etc.
  Refer to appropriate table to suit particular application; submit details.
- **Vapour barrier:**
  - **Material:** Flexible sheet
  - **Vapour permeability:** To BS 5422, clause 5.6.
- **Protection:** 90-90-40/390 Protection.
- **Density:** 45 kg/m3
- **Execution:** 90-90-40/620 Installing canvas faced mineral insulation.

350 Nitrile rubber insulation type A

- **Manufacturer:** Contractor's choice.
  Provide Technical submission to identify proposed product complies with specification.
- **Standard:** To BS EN 60684-3-151.
- **Form:** Manufacturer's standard.
- **Recycled content:** 60% (minimum) to BS EN ISO 14021.
- **Thermal conductivity:** 0.035 W/m·K at 0°C.
  0.037 W/m·K at 10°C.
  0.040 W/m·K at 50°C.
  0.043 W/m·K at 75°C.
- **Finish:** Plain - self finish, all joints to be cemented and fully sealed;
  Apply aluminium cladding as for mineral wool insulation.
  Provide UV protection for all elements exposed to daylight.
- **Insulation thickness (minimum):** To BS 5422.

  BS 5422 incorporates various tables for differing applications; heat loss, condensation, etc.
  Refer to appropriate table to suit particular application and follow guidance in 90-90-40/301; submit details.
- **Vapour barrier:**
  - **Material:** Flexible sheet
  - **Vapour permeability:** To BS 5422, clause 5.6.
- **Protection:** 90-90-40/390 Protection.
- **Accessories:** 90-90-40/480 Insulation for valves and flanges and 90-90-40/485 Insulation at loadbearing pipeline supports.
- **Items to be insulated:** As for mineral wool insulation
- **Execution:** 90-90-40/630 Installing nitrile rubber insulation on pipelines;
  90-90-40/755 Installing at non-loadbearing pipelines supports;
  and 90-90-40/780 Installing vapour barriers type A.

380 Vapour barrier type A

- **Material:** Flexible sheet.
- **Vapour permeability:** To BS 5422, clause 5.6.
- **Execution:** 90-90-40/780 Installing vapour barriers type A.

390 Protection

- **Material:** Plant Rooms - Aluminium cladding;
  Exposed pipework in vulnerable areas - Aluminium cladding to 3m above FFL.;
  Exposed in other areas - Foil faced;
  Ceiling voids, risers and elsewhere concealed - Foil faced;
  External - 2-layer PIB sheeting - staggered joints;
  Note: all finishes materials to have Class 0 fire rating.
- **Colour:** Self finish.
- **Execution:** 90-90-40/700 Installing canvas protection;
  90-90-40/710 Installing polyisobutylene (PIB) protection;
  and 90-90-40/720 Installing sheet aluminium protection.

480 Insulation for valves and flanges

- **Material:** To match pipelines insulation.
- **Form:** Cut sections of insulation to provide close fit around item;
  Utilise metal valve boxes;
  Valve jackets may be utilised where valves are concealed;
  Vapour barrier to be continuous across flange/valve.
- **Finish:** To match pipelines finish.
- **Execution:** 90-90-40/740 Installing at valves and flanges.

485 Insulation at loadbearing pipeline supports

- **Pipelines carrying fluids at temperature up to 120°C:** 300mm long PIR / PUR support blocks to match thickness of abutting insulation.
- **Pipelines carrying fluids at temperatures above 120°C:** 300 mm length of calcium silicate.
- **Pipelines carrying cold fluids:** PUR/PIR pre-formed block to same thickness as insulation .
- **Execution:** 90-90-40/750 Installing at loadbearing pipelines supports.

490 Insulation for boiler flues

- **Insulation materials:** 90-90-40/320 Metal mesh faced mineral wool mattresses and 90-90-40/340 Mineral wool slabs insulation.
- **Accessories to be insulated:** Cover plates, removable access covers, and the like.

Execution

610 Installing insulation and protection products generally

- **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.

620 Installing canvas faced mineral insulation

- **General requirements:** 90-90-40/610 Installing insulation and protection products generally .
- **Joints:** Close butt; secure canvas overlaps with adhesive.
- **At fittings:** Mitre. Secure with adhesive.
- **Sealant:** Apply two coats of class 0 polymer solution.

625 Installing foil faced mineral wool insulation on pipelines

- **General requirements:** 90-90-40/610 Installing insulation and protection products generally .
- **Joints:** Close butt; seal with 50 mm wide class 0 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 tape.

630 Installing nitrile rubber insulation on pipelines

- **General requirements:** 90-90-40/610 Installing insulation and protection products generally .
- **Joints:** Close butt, secure with adhesive.
- **At fittings:** Fabricate from mitre cut pieces. Secure with adhesive.

670 Installing insulation on tanks

- **General requirements:** 90-90-40/610 Installing insulation and protection products generally .
- **Fixing:** Adhesive.
- **Joints:** Seal with 100 mm wide class 0 foil tape.
- **Access:** Allow for removal of access covers and tank lid.

700 Installing canvas protection

- **Application:** Cover insulation with canvas with 50 mm overlaps. Seal joints.
- **Finish:** Two coats of class 0 polymer solution. Fix aluminium bands at 300 mm centres.

710 Installing polyisobutylene (PIB) protection

- **Thickness (minimum):** 0.8 mm.
- **Application:** Wrap sheeting with 50 mm overlap. Solvent weld joints.
- **Finish:** Secure with aluminium banding.

720 Installing sheet aluminium protection

- **Application:** Form sheet to fit circumference of insulation with 50 mm longitudinal and circumferential overlaps. Secure overlaps with self tapping screws or rivets. Seal joints with grey sealant.
- **Expansion:** Make provision.

740 Installing at valves and flanges

- **Application:** Do not obstruct removal of nuts and bolts, or operation of valves.
  Valves (and flanges) 65mm and above - utilise box type casing.

750 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.

755 Installing at non-loadbearing pipelines supports

- **Insulation:** Carry through pipe support.

760 Insulation not carried through pipelines supports

- **Insulation at supports:** Provide aluminium end caps.

780 Installing vapour barriers type A

- **Integrity:** Seal to maintain throughout. MUST BE CONTINUOUS.
  Double tape layer to be applied at supports and at junction with pipe insulation.
  Tape along pipe insulation seam;

90-90-55 Notices, identification and labels

Products

420 Identifying ductwork

- **Standard:** To BS 1710 and To BS EN 12101-7 for smoke extract ductwork.
- **Execution:** 90-90-55/650 Installing ductwork identification.

430 Identifying pipework

- **Standards:** To BS 1710.
- **Identification type:** Adhesive colour bands.
- **Execution:** 90-90-55/660 Installing identification on pipework.

440 Plastic warning devices for underground cables and pipelines

- **Standard:** To BS EN 12613, Type 1;
  To BS EN 12613, Type 2;
  and To ENA 12-23.
- **Material:** Heavy gauge polyethylene.
- **Size:**
  - **Width:** 100 mm.
- **Jointing method:** Peg.
- **Format:**
  - **Background colour:** Yellow.
  - **Text colour:** Black.
- **Legend:** WARNING - and wording appropriate to the service.
- **Wire detection aid:** Required.
- **Execution:** 90-90-55/700 Installing warning devices for underground cables and pipelines.

480 Mechanical plant and equipment identification labels type A

- **Material:** Face engraved rigid plastic laminate.
- **Label size:** Manufacturer's standard. Appropriate for location and minimum 25mm high.
- **Colour:**
  - **Background:** White.
  - **Lettering:** Black (or red if of a warning nature).
- **Typography:**
  - **Font:** Helvetica medium.
  - **Size:** Generally 12.5mm minimum
- **Information to be included:** Equipment name and Equipment reference number.
- **Execution:** 90-90-55/610 Installing mechanical plant and equipment identification.

490 Valve charts and schematics

- **Material:** Paper print, encapsulated.
- **Information to be included:** Location and identification of pipework regulating, isolating and control valves.

  Gas chart showing meter, main routes, control and isolation valves;
- **Execution:** 90-90-55/620 Installing valve charts and schematics.

495 Valve identification labels

- **Material:** Face engraved rigid plastic laminate.
- **Label size:** Min 25mm dia.
- **Colour:**
  - **Background:** White.
  - **Lettering:** Black.
- **Typography:**
  - **Font:** Helvetica medium.
  - **Size:** relevant to location
- **Information:** Purpose and reference number.
- **Execution:** 90-90-55/630 Installing valve identification labels.

Execution

610 Installing mechanical plant and equipment identification

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

620 Installing valve charts and schematics

- **Position:** Plant room.
- **Format:** Full colour on card;
  Laminated in clear plastic.

630 Installing valve identification labels

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

650 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:** Air being conveyed, direction of flow, destination of the air.

660 Installing identification on pipework

- **Application of basic identification colour:** Over the whole length of the pipe.
- **Safety colour identification:** On or next to the colour bands.
- **Information:** Chemical symbol for gases and Colour bands as BS 1710.
- **Direction of flow:** Indication arrow and the word FLOW or the letter F and Indication arrow and the word RETURN or the letter R.

700 Installing warning devices for underground cables and pipelines

- **Installation:** Lay along the route of underground pipelines during backfilling of excavation.
- **Marker position:**
  - **Pipelines less than 2 m:** To requirements of service undertaker.
  - **Pipelines deeper than 2 m:** To requirements of service undertaker.
- **Location, depth, colour and markings:** To requirements of service undertaker.

700 Installing warning devices for underground cables and pipelines type A

- **Installation:** Lay along the route of the pipelines during backfilling of excavation.
- **Marker position:**
  - **Cables:**
  - **Pipelines less than 2 m:** To requirements of service undertaker.
  - **Pipelines deeper than 2 m:** To requirements of service undertaker.
- **Location, depth, colour and markings:** To requirements of service undertaker.

90-90-60 Plant and equipment supports

Products

380 Roof equipment supports

- **Components:**
  - **Support base:**

    Type: Submit proposals.
    All details, to suit the roof construction and approved by the Contract Administrator;
    Provide a fully detailed Technical Submission of proposals 4 weeks before commencing manufacture.
  - **Support frame:**

    Type: Submit proposals.
    All details, to suit the roof construction and approved by the Contract Administrator;
    Provide a fully detailed Technical Submission of proposals 4 weeks before commencing manufacture.

390 Channel supports type A

- **Arrangement:** In accordance with BESA Standard TR/20 series;
- **Material:** Brass / Bronze / Copper / Gunmetal / Stainless steel / Steel;
  As appropriate for the pipeline material (avoid dissimilar metals);
  Where located externally, suitably protect supports and brackets against degradation.
- **Installation:** 90-90-60/620 Installing pipeline supports

Execution

620 Installing pipeline supports

- **General:**
  - **General suitability:** Consideration as to location, appearance and suitability for the location;
    All fixings to the building structure must be approved by the Contract Administrator;
    Drilling of structural steel will not generally be allowed.
  - **In plant rooms:** Bracket and support type as Contractors Choice;
    Submit Proposals;
    Max. spacing in accordance with TR/20 and manufacturer's recommendation.
  - **Distribution corridors and risers:** Bracket and support type as Contractors Choice;
    Submit Proposals;
    Max. spacing in accordance with TR/20 and manufacturer's recommendation.
    Hot and cold services must be mounted on separate bracketry to minimise heat transfer.
  - **Surface mountings:** Split ring, spacer nipple and backplate.

90-90-95 Vibration isolation products

Products

310 Mountings generally

- **Criteria:** Ensure that vibration generated by the engineering services is not transmitted to pipework, ductwork, the building and supporting structure.
- **Overload capacity (minimum):** 50%.
- **Colour code:** Identify for load and deflection rating.
- **Marking:** Label with load capacity.

320 Compression isolators

- **General requirements:** 90-90-95/310 Mountings generally.
- **Compression isolators type:** Submit proposals.
- **Colour code:** Manufacturer's standard.
- **Load:** To suit application
- **Deflection:** Submit proposals.

330 Spring isolators

- **General requirements:** 90-90-95/310 Mountings generally.
- **Spring isolators type:** Caged;
  Open;
  Vertical restrained.
  As appropriate to the installation
- **Colour code:** Manufacturer's standard.
- **Load:** To suit the application
- **Deflection:** Submit proposals.

350 Pad mountings

- **General requirements:** 90-90-95/310 Mountings generally.
- **Material:** Manufacturer's standard.

360 Inertia bases

- **General requirements:** 90-90-95/310 Mountings generally.
- **Inertia bases type:** Neoprene pad isolated.
- **Thickness:** Submit proposals.
- **Execution:** 90-90-95/610 Cast in situ bases.

370 Isolation hangers

- **General requirements:** 90-90-95/310 Mountings generally.

- **Isolation hangers type:** Submit proposals.
- **Colour code:** Manufacturer's standard.
- **Load:** As appropriate to the application.
- **Deflection:** Submit proposals.
- **Drop rod misalignment capability:** Manufacturer's standard.

380 Flexible hoses

- **General requirements:** 90-90-95/310 Mountings generally.
- **Flexible hoses type:** Rubber cored and Stainless steel braided pre-lagged.
  Note: steel braided type only acceptable on closed systems
- **Connections:**
  - **Rubber cored:** Manufacturer's standard.
  - **Stainless steel:** Submit proposals.
- **Execution:** 90-90-95/620 Installation of flexible hoses and rubber bellows.

390 Rubber bellows

- **General requirements:** 90-90-95/310 Mountings generally.
- **Rubber bellows type:** Tied.
- **Material:**
  - **Liner:** Ethylene-propylene diene monomer (EPDM) rubber.
  - **Reinforcement:** Manufacturer's standard.
  - **Cover:** Ethylene propylene diene monomer (EPDM) rubber.
- **Connections:** Flanged.
- **Execution:** 90-90-95/620 Installation of flexible hoses and rubber bellows.

Execution

610 Cast in situ bases

- **Supported equipment:** Arrange equipment on base to distribute load evenly.

620 Installation of flexible hoses and rubber bellows

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

Part C2

Standard Materials & Workmanship

Electrical Services

This Standard Materials and Workmanship Specification covers multiple aspects of electrical services systems and installation. In doing so it includes details of systems and equipment that may not apply to this particular project.

Refer to project particular documents for details of systems, switch gear, equipment and other project specific features. Project particular documents include, but may not be limited to, the invitation to tender, specifications, drawings and schedules, including the main contract documents and formal instruction. Information included in such project specific documentation takes precedence over information contained within this specification.

The inclusion of a feature within this specification does not alone make that feature applicable in all cases. For example, various cabling systems and materials are included and should that system be required, the standards set out in this specification apply. However, to establish what particular system and/or material is applicable on any project, refer to project specific documentation.

Should additional clarification be required contractors are to raise a query through the Contract Administrator (CA).

Version 0617.1

CUNDALL

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70-50-35 High voltage site connection systems

System outline

110 Incoming high voltage electricity supply system

- **System performance**: 70-50-35/210 Design of high voltage incoming electricity supply system.
- **Nature of current**: Alternating.
- **Nominal frequency**: 50 Hz.
- **Number of phases**: Three.
- **Execution**: 70-50-35/610 Removing and permanent isolation of high voltage connections; 70-50-35/620 Temporary isolation of existing supply; 70-50-35/630 Management of electricity distributor; and 70-50-35/640 Location of incoming point of supply.
- **System completion**: 70-50-35/810 Site supply characteristics; 70-50-35/820 Phase sequence; and 70-50-35/830 Documentation.

System performance

210 Design of high voltage incoming electricity supply system

Used by: 70-50-35/110 Incoming high voltage electricity supply system.

- **Design**: Complete the design of the high voltage connection in accordance with the electricity distributor's guidelines.
- **Requirement**: Submit detailed drawings showing electricity distributor's equipment and metering equipment positions, cable routes, technical information and calculations.
- **Evidence of agreement with Electricity Distributor**: Submit.

Execution

610 Removing and permanent isolation of high voltage connections

Used by: 70-50-35/110 Incoming high voltage electricity supply system.

- **Existing high voltage supply**: Engage the electricity distributor to isolate and disconnect.

620 Temporary isolation of existing supply

Used by: 70-50-35/110 Incoming high voltage electricity supply system.

- **Existing high voltage supply**: Engage the electricity distributor and electricity supplier to isolate and disconnect.
- **Reinstatement**: Submit proposals.

630 Management of electricity distributor

Used by: 70-50-35/110 Incoming high voltage electricity supply system.

- **Establishing the supply**: Manage and liaise with the electricity distributor and electricity supplier to establish the incoming electricity supply.
- **Evidence of liaison**: Submit.

640 Location of incoming point of supply

Used by: 70-50-35/110 Incoming high voltage electricity supply system.

- **Incoming point of supply**: Coordinate the location and establish the spatial requirements for the electricity distributor's equipment and metering.
- **Location and colour coding of equipment**: In accordance with NJUG guidelines on the positioning and colour coding of underground utilities' apparatus.

System completion

810 Site supply characteristics

Used by: 70-50-35/110 Incoming high voltage electricity supply system.

- **Prospective short-circuit current (Pscc)**: Measure and submit results.
- **External earth fault loop impedance (Ze)**: Measure and submit results.

820 Phase sequence

Used by: 70-50-35/110 Incoming high voltage electricity supply system.

- **Phase sequence**: Verify.
- **Means of identification**: Describe within the operation and maintenance manual.

830 Documentation

Used by: 70-50-35/110 Incoming high voltage electricity supply system.

- **Manufacturer's operation and maintenance instructions**: Include contact telephone numbers, MPAN and meter numbers.
- **Record drawings**:
  - **Content**: For all high voltage distribution circuits, the cable origin at the site boundary, route to service cut out, method of installation, depth of trench, details of ducts including sizes and position of cable joints.
- **Submittal date**: Before handover.

Ω End of section

70-50-45 Low voltage site connection systems

System outline

110 Incoming low voltage electricity supply

- **System performance**: 70-50-45/210 Design of incoming low voltage electricity supply; 70-50-45/230 Connecting generators to the public supply network; and 70-50-45/220 Supply characteristics.
- **Nature of current**: Alternating.
- **Phase**: Single phase 2 wire;
  Single phase 3 wire;
  and Three phase 4 wire.
- **Voltage**: 230 V and 400 V.
- **Metering**: Single meter;
  Dual tariff meter;
  and Single meter to landlords supplies.
- **Execution**: 70-50-45/610 Removing and permanent isolation; 70-50-45/620 Temporary isolation of existing supply; 70-50-45/630 Management of electricity distributor; 70-50-45/640 Location of incoming point of supply; and 70-50-45/660 Earthing arrangement.
- **System completion**: 70-50-45/810 Site supply characteristics; 70-50-45/820 Phase sequence; and 70-50-45/830 Documentation.

System performance

210 Design of incoming low voltage electricity supply

Used by: 70-50-45/110 Incoming low voltage electricity supply.

- **Standards**: In accordance with BS 7671 and the Electricity Distributor's guidelines.
- **Design**: Complete the design of the low voltage supply.
- **Requirement**: Submit detailed design drawings showing equipment positions and routes, technical information and calculations.
- **Evidence of agreement with Electricity Distributor**: Submit.

220 Supply characteristics

Used by: 70-50-45/110 Incoming low voltage electricity supply.

- **Overcurrent device at incoming point of supply**:
  - **Type**: Fuse to BS EN 60269-1 and BS HD 60269-2 and Fuse to BS EN 60269-1 and BS HD 60269-3.

230 Connecting generators to the public supply network

Used by: 70-50-45/110 Incoming low voltage electricity supply.

- **Standard**: In accordance with ENA G59/3 and In accordance with ENA G83/2.

Execution

610 Removing and permanent isolation

Used by: 70-50-45/110 Incoming low voltage electricity supply.

- **Existing low voltage supply**: Engage the Electricity Distributor to isolate and disconnect.

620 Temporary isolation of existing supply

Used by: 70-50-45/110 Incoming low voltage electricity supply.

- **Existing low voltage supply**: Engage the Electricity Distributor to isolate and disconnect.
- **Reinstatement**: Submit proposals.

630 Management of electricity distributor

Used by: 70-50-45/110 Incoming low voltage electricity supply.

- **Establishing the supply**: Manage and liaise with the Electricity Distributor to establish an incoming electricity supply.
- **Evidence of liaison**: Submit.

640 Location of incoming point of supply

Used by: 70-50-45/110 Incoming low voltage electricity supply.

- **Incoming point of supply**: Coordinate the location and establish the spatial requirements for the Electricity Distributor's equipment and metering.
- **Location and colour coding of equipment**: In accordance with NJUG guidelines on the positioning and colour coding of underground utilities' apparatus.

660 Earthing arrangement

Used by: 70-50-45/110 Incoming low voltage electricity supply.

- **Incoming earthing arrangement**: Establish with the Electricity Distributor.

System completion

810 Site supply characteristics

Used by: 70-50-45/110 Incoming low voltage electricity supply.

- **Prospective short-circuit current (Psca)**: Measure and submit results.
- **External earth fault loop impedance (Zs)**: Measure and submit results.

820 Phase sequence

Used by: 70-50-45/110 Incoming low voltage electricity supply.

- **Phase sequence**: Verify.
- **Means of identification**: Describe within the operation and maintenance manual.

830 Documentation

Used by: 70-50-45/110 Incoming low voltage electricity supply.

- **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.
- **Record drawings**:
  - **Content**: For all low voltage distribution circuits, the cable origin at the site boundary, route to service cut out, method of installation, depth of trench, details of ducts including sizes and position of cable joints.
- **Submittal date**: Before handover.

Ω End of section

70-65-35 Generator systems

System outline

110 Reciprocating internal combustion engine driven alternating current generator system

- **System Performance**: 70-65-35/210 Design of generator systems;
  70-65-35/215 Generator loading;
  70-65-35/220 Performance of generator systems;
  70-65-35/230 Generating systems for safety services;
  70-65-35/240 Service conditions;
  70-65-35/250 System mode of operation;
  70-65-35/260 Generator systems operating in parallel;
  70-65-35/265 Fuel and oil consumption;
  70-65-35/270 Diesel exhaust emissions;
  70-65-35/275 Connecting generators to the public supply network;
  and 70-65-35/280 Neutral earthing.
- **System manufacturer**: Refer to project specific documentation
- **Installation**: Refer to project specific documentation.
- **Mounting**:
  - **Type**: Refer to project specific documentation.
  - **Anti-vibration mountings**: Refer to project specific documentation.
  - **Accessories**: Refer to project specific documentation.
- **Engine and alternator connection**:
  - **Couplings**: Refer to project specific documentation.
  - **Assembly**: Refer to project specific documentation.
- **Generator set**: 90-50-35/310 Generator set.
- **Transfer switch equipment**: 90-50-45/460 Transfer switching equipment (TSE).
- **Fuel**:
  - **Type**: Refer to project specific documentation.
  - **Storage**: 90-25-50/330 Generator day tanks;
    90-25-50/340 Carbon steel liquid fuel tanks;
    and 90-25-50/345 Glass reinforced plastics liquid fuel tanks.
- **Exhaust and silencer**: 70-65-35/510 Exhausts
- **Generator housing**: 90-50-35/370 Generator enclosures.
- **Accessories**: 90-25-50/315 Drip trays;
  90-50-35/380 Load banks;
  and 90-75-75/310 Padlocks and keys.
- **Electrical identification**: 90-90-55/320 Electrical shock treatment signs type B and .
- **Execution**: 70-65-35/610 Removing generator systems;
  70-65-35/620 Interruptions to existing supplies;

70-65-35/630 Installing generator systems;
70-65-35/640 Installing exhausts;
70-65-35/650 Installing control panels;
70-65-35/660 Installing emergency stop buttons;
70-65-35/670 Installing drip trays;
and 70-65-35/680 Installing permanent load banks.

- **System completion**: 70-65-35/810 Testing and commissioning generator systems generally;
  70-65-35/815 Testing generators operating in parallel;
  70-65-35/820 Documentation;
  70-65-35/830 Spares and consumables;
  and 70-65-35/840 Maintenance.

120 Customized reciprocating internal combustion engine driven alternating current generator system

- **System Performance**:
- **Installation**:
- **Mounting**:
  - **Type**:
  - **Anti-vibration mountings**:
  - **Accessories**:
- **Engine and alternator connection**:
  - **Couplings**:
  - **Assembly**:
- **Internal combustion engine**:
- **Battery**:
- **Battery charger**:
- **Governor**:
- **Alternator**:
- **Automatic voltage regulators**:
- **Control panel**:
- **Transfer switch equipment**:
- **Fuel**:
  - **Type**:
  - **Storage**:
- **Exhaust and silencer**:
- **Generator housing**:
- **Accessories**:
- **Electrical identification**:
- **Execution**:
- **System completion**:

System performance

210 Design of generator systems

Used by: 70-65-35/110 Reciprocating internal combustion engine driven alternating current generator system.

- **Design**: Complete the design of the generator system.
- **Prime mover and alternator size**: Take into account connected loads including ancillaries, harmonics and transient operation.
- **Proposals**: Submit detailed design drawings, technical information, calculations and manufacturers' literature;
  Control diagrams.Prime mover and alternator dataPower output curves;
  Generator system efficiency at 50, 75 and 100% full load;
  Start up temperature (minimum);
  Fuel and lubricating oil characteristics and consumption, as outlined in BS ISO 3046-1;
  Run time without fuel and lubricating oil tank replenishment (minimum);
  Calculations for performance of acoustic enclosures and silencers;
  Maintenance access dimensions;
  and Details of plinths and anti-vibration mountings.

215 Generator loading

Used by: 70-65-35/110 Reciprocating internal combustion engine driven alternating current generator system.

- **Total load (active power)**: Refer to project specific documentation.
- **Total load (reactive power)**: Refer to project specific documentation.
- **Load description and size**: Refer to project specific documentation.

220 Performance of generator systems

Used by: 70-65-35/110 Reciprocating internal combustion engine driven alternating current generator system.

- **Standard**: To BS ISO 8528-1.
- **Application**: Refer to project specific documentation.
- **Electrical characteristics**:
  - **Number of phases**: Refer to project specific documentation.
  - **Voltage**: Refer to project specific documentation.
  - **Frequency**: Refer to project specific documentation.
  - **Engine start battery**:
    - **Capacity**: Refer to project specific documentation.
  - **Fixing**: Refer to project specific documentation.
- **Site criteria**: Land use.
- **Operation**: Refer to project specific documentation.

- **Start-up mode**: Refer to project specific documentation.
- **Full load acceptance**: Refer to project specific documentation.
  - **Start-up time to full load acceptance (maximum)**: Refer to project specific documentation.
- **Performance Class**: Refer to project specific documentation.

230 Generating systems for safety services

Used by: 70-65-35/110 Reciprocating internal combustion engine driven alternating current generator system.

- **Standard**: To BS 7698-12.
- **Performance Class**: Refer to project specific documentation.

240 Service conditions

Used by: 70-65-35/110 Reciprocating internal combustion engine driven alternating current generator system.

- **Environment**: Refer to project specific documentation.
- **Site temperature**:
  - **Maximum**: Refer to project specific documentation.
  - **Minimum**: Refer to project specific documentation.
- **Altitude (above sea level)**: Refer to project specific documentation.
- **Humidity (RH)**: Refer to project specific documentation.
- **Atmospheric conditions**: Refer to project specific documentation.

250 System mode of operation

Used by: 70-65-35/110 Reciprocating internal combustion engine driven alternating current generator system.

- **Details**: Refer to project specific documentation

260 Generator systems operating in parallel

Used by: 70-65-35/110 Reciprocating internal combustion engine driven alternating current generator system.

- **Synchronization**: Refer to project specific documentation.

265 Fuel and oil consumption

Used by: 70-65-35/110 Reciprocating internal combustion engine driven alternating current generator system.

- **Fuel consumption (maximum)**: Refer to project specific documentation.
- **Oil consumption (maximum)**: Refer to project specific documentation.

270 Diesel exhaust emissions

Used by: 70-65-35/110 Reciprocating internal combustion engine driven alternating current generator system.

- **Emission standard**: Refer to project specific documentation.

275 Connecting generators to the public supply network

Used by: 70-65-35/110 Reciprocating internal combustion engine driven alternating current generator system.

- **Standard**: Refer to project specific documentation.

280 Neutral earthing

Used by: 70-65-35/110 Reciprocating internal combustion engine driven alternating current generator system.

- **Arrangement**: Refer to project specific documentation.

Custom made products

510 Exhausts

Used by: 70-65-35/110 Reciprocating internal combustion engine driven alternating current generator system.

- **Manufacturer**: System manufacturer and Member of the British Flue and Chimney Manufacturer's Association (BFCMA).
- **Standard**: In accordance with BS 5854.
- **Arrangement**: Refer to project specific documentation.
- **Material**: Refer to project specific documentation.
- **Fittings**: Adaptors;
  Bends;
  Firestop plates;
  Flexible coupling;
  Flue collector boxes;
  Ridge terminal and adaptors;
  Storm collars and flashings;
  and Wall brackets.
- **Exhaust silencers**: Refer to project specific documentation.

Execution

610 Removing generator systems

Used by: 70-65-35/110 Reciprocating internal combustion engine driven alternating current generator system.

- **Scope**: Refer to project specific documentation.

620 Interruptions to existing supplies

Used by: 70-65-35/110 Reciprocating internal combustion engine driven alternating current generator system.

- **Notice before interruption**: Refer to project specific documentation.
- **Connection to existing switchgear**: Submit proposals.

630 Installing generator systems

Used by: 70-65-35/110 Reciprocating internal combustion engine driven alternating current generator system.

- **System**: Install to provide access for maintenance without having to remove connections and accessories. Allow minimum of 1 m clearance around the generator set.
- **Mounting**: Secure generator set level to floor with set in line with access doors to plant room.
- **Fuel pipelines**: Flexible final connection to engine.
- **Safety guards and stone guards**: Install.
- **Labelling**: Indelibly mark starter battery with year of manufacture and installation.

640 Installing exhausts

Used by: 70-65-35/110 Reciprocating internal combustion engine driven alternating current generator system.

- **Layout**: Refer to project specific documentation
- **Arrangement**: Position to minimize noise levels and prevent exhaust gases entering the building through doors, windows or ventilation systems. Slope exhaust away from engine, terminate exhaust with rain cap. Seal fabric penetrations to provide same level of protection from transmission of sound and fire as original fabric.
  Apply minimum of 50 mm lagging to exhaust in plant rooms.

650 Installing control panels

Used by: 70-65-35/110 Reciprocating internal combustion engine driven alternating current generator system.

- **Position**: Refer to project specific documentation.
- **Interconnection**: Connect between control panel, battery charger, battery, starter, alternator, transfer switches and incoming supply and outgoing cabling including emergency stop buttons and remote monitoring equipment.

660 Installing emergency stop buttons

Used by: 70-65-35/110 Reciprocating internal combustion engine driven alternating current generator system.

- **Position**: At each end of the generator system;

At generator system room exit;
Integral within generator system control panel;
and Next to generator system control panel.

- **Connection arrangement**: Wired to shut down the generator system immediately on activation.

670 Installing drip trays

Used by: 70-65-35/110 Reciprocating internal combustion engine driven alternating current generator system.

- **Position**: Under parts of the generator system where fuel or lubricant leakage may occur.
- **Overflow outlet pipe**: Run to a location where a container can be fitted below the pipe outlet.

680 Installing permanent load banks

Used by: 70-65-35/110 Reciprocating internal combustion engine driven alternating current generator system.

- **Position**: Install to provide access for maintenance without having to remove connections and accessories. Allow minimum of 1 m clearance around the load bank.

System completion

810 Testing and commissioning generator systems generally

Used by: 70-65-35/110 Reciprocating internal combustion engine driven alternating current generator system.

- **Standard**: To BS ISO 8528-6.
- **Operation of control panel**: Verify.
- **Cold start-up test**: Record start-up time with generator idle for previous 24 h.
- **Results**: Submit two copies of system commissioning completion certificate.
- **Notice before commencing tests (minimum)**: Refer to project specific documentation.

815 Testing generators operating in parallel

Used by: 70-65-35/110 Reciprocating internal combustion engine driven alternating current generator system.

- **Synchronization controls**: Verify.
- **Load sharing**: Verify.
- **Operation of controls**: Verify.
- **Start-up and shutdown**: Verify.
- **Results**: Submit two copies.

820 Documentation

Used by: 70-65-35/110 Reciprocating internal combustion engine driven alternating current generator 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**: Refer to project specific documentation.
- **Record drawings**:
  - **Content**: General arrangement drawings showing the location of generator set, control panel, transfer switch, emergency stop buttons, exhaust layout, and permanent load bank, or point of connection for transportable load bank and layout of fuel system and oil tank.
    Schematic diagram showing all final circuit cabling, the cable origin, route from control panel and transfer switch to generator set, connections to remote monitoring points and alarms. 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**: Refer to project specific documentation.
  - **Number of copies**: Refer to project specific documentation.
- **Submittal date**: At handover.

830 Spares and consumables

Used by: 70-65-35/110 Reciprocating internal combustion engine driven alternating current generator system.

- **Indicator lamps**: Supply two of each type used.
- **Filter elements**: Supply one set.

840 Maintenance

Used by: 70-65-35/110 Reciprocating internal combustion engine driven alternating current generator system.

- **Servicing and maintenance**: Undertake.
- **Duration**: Refer to project specific documentation.
- **Maintenance interval**: Refer to project specific documentation.
- **Consumables**: Provide in accordance with manufacturer's recommended service regime.

Ω End of section

70-65-60 Photovoltaic systems

System outline

110 Grid connected photovoltaic system

- **System performance**: 70-65-60/210 Design of photovoltaic systems and 70-65-60/220 Structural and weatherproofing considerations.
- **Input source**: 90-50-80/310 Photovoltaic modules;
  Integrated PV from roof tiles;
  Integrated PV from metal sheet roofing;
  and Integrated PV from single ply roofing membrane.
- **Mounting**: 90-90-60/320 Ballasted mounting frame for solar modules;
  90-90-60/340 Metal cladding solar module clamps;
  90-90-60/330 Free standing mounting frame for solar modules;
  90-90-60/350 Solar module support rails;
  and 90-90-60/360 Roof anchors for solar modules.
- **d.c. side equipment**: 90-50-45/450 Switch-disconnectors type A;
  90-60-25/490 PV array junction boxes;
  and 90-50-45/396 PV generator junction boxes.
- **Switchgear and controls**: 90-60-40/320 Inverters.
- **Cable type**: 90-55-15/350 Thermosetting insulated and thermoplastic sheathed (LSHF) cables type A and 90-55-15/324 Thermosetting insulated and thermoplastic sheathed (LSHF) armoured cables.
- **Rewireable installation**: Required.
- **Cable containment**: 90-55-10/380 Rigid conduit type A - External and/or cast-in-situ installations.
- **Containment accessories**:
- **System accessories**: 90-60-30/410 Surge protective devices for low voltage power supplies type A.
- **Execution**: 70-65-60/620 Installing photovoltaic systems generally;
  70-65-60/630 Installing PV module arrays;
  70-65-60/640 Installing building fabric integrated slate and tile PV modules;
  70-65-60/650 Installing building fabric integrated thin film amorphous silicon PV modules;
  70-65-60/660 Installing d.c. isolation switches;
  70-65-60/670 Installing PV array junction boxes;
  70-65-60/680 Installing PV generator junction boxes;
  70-65-60/690 Installing a.c. isolation switches;
  70-65-60/700 Installing batteries and battery charge controllers;
  70-65-60/720 Installing power conditioning units;
  70-65-60/730 Installing energy meters;

70-65-60/740 Connection to electricity distribution network;
70-65-60/750 Earthing and equipotential bonding;
70-65-60/760 Connection to lightning protection system;
and 70-65-60/770 Labelling.

- **System completion**: 70-65-60/810 Inspection and testing;
  ;
  70-65-60/815 PV array performance tests;
  70-65-60/820 Documentation;
  70-65-60/830 Spares and consumables;
  and 70-65-60/840 Maintenance.

115 Stand-alone photovoltaic system

- **System performance**:
- **System manufacturer**:
- **Input source**:
- **Mounting**:
- **Switchgear and controls**:
- **Cable type**:
- **Cable sizes**:
- **Rewireable installation**:
- **Concealed installation**:
- **Cable containment**:
- **Containment accessories**:
- **System accessories**:
- **Execution**:
- **System completion**:

System performance

210 Design of photovoltaic systems

Used by: 70-65-60/110 Grid connected photovoltaic system.

- **Design**: Complete the design of the photovoltaic system.
- **Standards**: To BS 7671, BS EN 62124 and in accordance with ENA 59/2-1;
  To BS 7671, BS EN 62124 and in accordance with ENA G83/1;
  MCS Guide to the installation of photovoltaic systems;
  and To BS EN 61427-1.
- **Testing and commissioning**: Incorporate adequate measures to allow full testing and commissioning of the completed system.
- **Proposals**: Submit detailed design drawings, manufacturers' literature and technical information, and calculations showing estimated annual energy yield using the Photovoltaic Geographical Information System (PVGIS) calculator.

- **Approvals**: Obtain planning approval from the relevant authorities and Obtain written approval of the Electricity Distributor.

220 Structural and weatherproofing considerations

Used by: 70-65-60/110 Grid connected photovoltaic system.

- **Modifications to existing structures**: Assess the existing structure to ensure that it can sustain a significant increase in permanent or imposed loading;
  Assess the existing structure to ensure that it can resist increased net wind uplift;
  and Where the existing structure is not adequate to support revised loadings, Submit proposals.
- **Supports and fixings**:
  - **Requirement**: No impairment to the thermal and weatherproofing performance of the building fabric.
  - **Arrangement of fixings or proposed supporting structure**: Submit proposals.

Execution

620 Installing photovoltaic systems generally

Used by: 70-65-60/110 Grid connected photovoltaic system.

- **Standards**: To BS 7671;
  To ENA 59/2-1;
  and To ENA G83/1-1.
- **Installer**: Microgeneration Certification Scheme accredited.
- **Materials**: Separate dissimilar metallic materials to prevent bi-metallic corrosion.
- **Fixing equipment**: Fix independently of any other systems installation with zinc electroplated fasteners indoors and stainless steel fasteners outdoors.
- **Orientation**: Accurate and square to vertical and horizontal axes. Align adjacent items of switchgear on the same horizontal axis.
- **Cable installation**:
  - **Timing**: Complete installation of d.c. cabling before connecting to PV array.
  - **Routes and arrangement**: Minimize length of d.c. cable runs and Install positive and negative conductors from the same string together.
- **Cable terminations**: Label string cables with push-on plastics markers showing unique circuit reference and Label main incoming d.c. and outgoing a.c. cables at power conditioning unit with push-on plastics markers showing unique circuit reference.

630 Installing PV module arrays

Used by: 70-65-60/110 Grid connected photovoltaic system.

- **Fixings**: Suitable for wind loading and Minimum of four clamps per module, placed symmetrically.
- **General requirements**:

- **PV modules**:
  - **Mounting**: Allow adequate ventilation between building fabric and underside of PV module.
  - **Electrical connection**: Form strings beginning at bottom left of array when viewed from front.
- **Interconnecting string cable routes**: Interconnecting string cables should be inaccessible to building occupants, but easily accessible to maintenance personnel. Routes should be as short as practicable to minimize voltage drop. Cables routes need to be carefully concealed, particularly if the PV forms part of a cladding system or the PV array is semi-transparent.

640 Installing building fabric integrated slate and tile PV modules

Used by: 70-65-60/110 Grid connected photovoltaic system.

- **General requirements**:
- **Electrical connection**: Interconnect between PV tiles using integrated connection cables, connector plugs and string cables to form an array consisting of one string, consisting of eight modules.
- **Interconnecting string cable routes**: Interconnect between PV tiles beginning at bottom left of array when viewed from front.

650 Installing building fabric integrated thin film amorphous silicon PV modules

Used by: 70-65-60/110 Grid connected photovoltaic system.

- **General requirements**:
- **Electrical connection**: Interconnect between thin film PV modules using integrated connection cables, connector plugs and string cables to form an array consisting of four strings, each string consisting of eight modules.
- **Interconnecting string cable routes**: Interconnect between PV modules beginning at bottom left of array when viewed from front.

660 Installing d.c. isolation switches

Used by: 70-65-60/110 Grid connected photovoltaic system.

- **Position**: Conveniently accessible for operation inspection and maintenance and Next to power conditioning unit.

670 Installing PV array junction boxes

Used by: 70-65-60/110 Grid connected photovoltaic system.

- **Position**: Conveniently accessible for operation inspection and maintenance.
- **Separate positive and negative junction boxes**: Required.

680 Installing PV generator junction boxes

Used by: 70-65-60/110 Grid connected photovoltaic system.

- **Position**: Adjacent to power conditioning unit. Conveniently accessible for operation inspection and maintenance.

690 Installing a.c. isolation switches

Used by: 70-65-60/110 Grid connected photovoltaic system.

- **Position**: Next to point of connection to a.c. grid;
  Next to power conditioning unit;
  and Conveniently accessible for operation inspection and maintenance.

700 Installing batteries and battery charge controllers

Used by: 70-65-60/110 Grid connected photovoltaic system.

- **Position**: Conveniently accessible for operation inspection and maintenance.

720 Installing power conditioning units

Used by: 70-65-60/110 Grid connected photovoltaic system.

- **Position**: Conveniently accessible for operation inspection and maintenance.

730 Installing energy meters

Used by: 70-65-60/110 Grid connected photovoltaic system.

- **Meters to show**: a.c. energy exported from the premises;
  a.c. energy imported into the premises;
  a.c. output of complete PV system;
  d.c. output of each string;
  and d.c. output of total PV array.
- **Digital metering equipment**: Connect to building management system.

740 Connection to electricity distribution network

Used by: 70-65-60/110 Grid connected photovoltaic system.

- **Interconnection**: Connect between a.c. switch-disconnector and the supply side of the protective device at the local distribution board.

750 Earthing and equipotential bonding

Used by: 70-65-60/110 Grid connected photovoltaic system.

- **Standards**: In accordance with BS 7671 and BS 7430.

760 Connection to lightning protection system

Used by: 70-65-60/110 Grid connected photovoltaic system.

- **Standards**: To BS EN 62305-3 and BS EN 62305-4.

770 Labelling

Used by: 70-65-60/110 Grid connected photovoltaic system.

- **Dual supply warning notices (grid connected systems only)**:
  - **Requirement**: Provide danger warning notices stating that the system has a dual supply and is energized from more than one source.
  - **Position**: Electricity supplier's meter;
    At the main entry point to the building;
    At distribution board to which output from power conditioning unit is to be connected;
    and PV a.c. isolation switch.
  - **Electricity Distributor's approval of text**: Obtain.
- **PV modules**: 'Danger, do not disconnect under load. Isolate a.c. supply first'. Label with warning notices describing the presence of live terminals.
- **Connectors**: Label with notices stating 'Do not disconnect d.c. plugs and sockets under load – turn off a.c. supply first'.
- **d.c. switch disconnector**: 'PV array d.c. isolator- Danger - contains live parts during daylight'.
- **dc.junction boxes**: Label with notices stating 'PV array d.c. junction box - Danger, contains live parts during daylight'.
- **Power conditioning units (PCUs)**: Label with notices stating 'Isolate a.c. and d.c. before carrying out work'.
- **a.c. isolation switches**: Label with notices stating 'PV system - main a.c. isolator'.
- **Circuit diagram**: Provide at point of interconnection to a.c. distribution board.
- **Details of protective settings incorporated in the PCU**: Provide at PCU.
- **Contact telephone number for the maintainer of the system**: Provide at point of PCU.
- **Fuses, terminal blocks and other assembly components**: Label, describing their purpose.
- **Spare fuses**: Label, describing their rating and purpose.

System completion

810 Inspection and testing

Used by: 70-65-60/110 Grid connected photovoltaic system.

- **Standards**: To BS 7671;
  MCS Guide to the installation of photovoltaic systems;
  In accordance with ENA 59/2-1;
  and In accordance with ENA G83/1-1.
- **Witnessing of testing and commissioning**: Required.
- **Approval**: Obtain written approval of the Electricity Distributor.

811 Cleaning and general inspection

- **Dust and debris**: Remove.
- **PV array**: Inspect for damage.

- **Enclosures**: Inspect.
- **Earthing**: Verify.
- **Cable terminations**: Inspect.
- **Inspection report**: Submit.

815 PV array performance tests

Used by: 70-65-60/110 Grid connected photovoltaic system.

- **Standard**: To BS EN 62446-1, Annex C.
- **Test conditions**: Minimum irradiation level 600 W/m².

820 Documentation

Used by: 70-65-60/110 Grid connected photovoltaic 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.
- **Record drawings**:
  - **Content**: General arrangement drawings showing the location of modules, PV array junction boxes, d.c. isolation switches, PV generator junction boxes, power conditioning units, energy meters, a.c. isolation switches and point of connection to a.c. distribution network. Include cabling routes, conductor material and c.s.a., insulation type and colour, number of cores per cable, number of cables in ducts, on tray or ladder.
- **Submittal date**: Before handover.
- **Site test results and system performance analysis**: Submit.
- **Test equipment calibration certificates**: Submit.
- **System commissioning completion certificate**: Submit.
- **Approval of Electricity Distributor (grid connected systems only)**: Submit.
- **Warranty for system**: Submit.
- **Microgeneration Certification Scheme**: Submit certificate.

830 Spares and consumables

Used by: 70-65-60/110 Grid connected photovoltaic system.

- **Supply the following spares**: Two of each type and rating used.

840 Maintenance

Used by: 70-65-60/110 Grid connected photovoltaic system.

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

Ω End of section

70-65-85 Small scale wind generating systems

System outline

110 Small scale wind generating system

- **System performance**: 70-65-85/210 Design of small scale wind generating systems
- **System manufacturer**: Refer to project specific documentation.
- **Mode of operation**: Refer to project specific documentation.
- **Wind turbine type**: Refer to project specific documentation.
- **Mounting arrangement**: Refer to project specific documentation.
- **Foundations**: Refer to project specific documentation.
- **Switchgear and controls**: Refer to project specific documentation.
- **Cable type**: Refer to project specific documentation.
- **Rewireable installation**: Required.
- **Concealed installation**: Required.
- **Containment**: Refer to project specific documentation.
- **Containment accessories**: Refer to project specific documentation.
- **System accessories**: Refer to project specific documentation.
- **Execution**: 70-65-85/610 Removing small scale wind generating systems;
  70-65-85/620 Installation generally;
  70-65-85/630 Installing turbine support structures;
  70-65-85/640 Installation of switch disconnectors;
  70-65-85/650 Installation of interconnecting cabling;
  70-65-85/660 Installation of central battery units;
  70-65-85/665 Installation of energy meters;
  70-65-85/670 Labelling of controls;
  70-65-85/675 Labelling of turbine;
  and 70-65-85/680 Earthing of turbine support structure.
- **System completion**: 70-65-85/810 Inspection and testing;
  70-65-85/820 Documentation;
  70-65-85/830 Spares and consumables;
  and 70-65-85/840 Maintenance.

System performance

210 Design of small scale wind generating systems

Used by: 70-65-85/110 Small scale wind generating system.

- **Standards**: To BS EN 61400-2, and in accordance with BS 7671 and BWEA Small wind turbine performance and safety standard.
- **Design**: Complete the design of the small scale wind generating system.

- **Design life (minimum)**: Refer to project specific documentation.
- **Requirement**: Submit proposals including detailed design drawings, technical information, calculations and manufacturers' literature, including detailed requirements for cable trenches.
- **Approvals**: Obtain written approval of the District Network Operator.

Execution

610 Removing small scale wind generating systems

Used by: 70-65-85/110 Small scale wind generating system.

620 Installation generally

Used by: 70-65-85/110 Small scale wind generating system.

- **Standards**: To BS EN 61400-2 and in accordance with BS 7671.
- **Installer**: Microgeneration Certification Scheme accredited.
- **Location of turbine**: Refer to project specific documentation.
- **Dissimilar metals**: Separate.

630 Installing turbine support structures

Used by: 70-65-85/110 Small scale wind generating system.

- **Turbine support poles and fixings**: Do not locate fixings into mortar courses.

640 Installation of switch disconnectors

Used by: 70-65-85/110 Small scale wind generating system.

- **Position**: Refer to project specific documentation.

650 Installation of interconnecting cabling

Used by: 70-65-85/110 Small scale wind generating system.

- **Equipment interconnection**: Interconnect between turbine, turbine control unit, switch disconnectors, inverters and low voltage distribution equipment.
- **Point of connection to low voltage distribution system**: Refer to project specific documentation.

660 Installation of central battery units

Used by: 70-65-85/110 Small scale wind generating system.

- **Standard**: To BS EN 50272-2.
- **Position**: Refer to project specific documentation.

665 Installation of energy meters

Used by: 70-65-85/110 Small scale wind generating system.

- **Position**: Refer to project specific documentation.

670 Labelling of controls

Used by: 70-65-85/110 Small scale wind generating system.

- **Location of labels**: Refer to project specific documentation.

675 Labelling of turbine

Used by: 70-65-85/110 Small scale wind generating system.

- **Content of turbine nameplate**: Wind turbine manufacturer and country. Model and serial number.
  Production year. Rated power. Reference wind speed. Hub height operating wind speed range.
  Operating temperature range.Wind turbine class.
  Rated voltage at the wind turbine terminals.
  Frequency at the wind turbine terminals or frequency range in the case where nominal variation is greater than 2%.

680 Earthing of turbine support structure

Used by: 70-65-85/110 Small scale wind generating system.

- **Point of connection**: Refer to project specific documentation.

System completion

810 Inspection and testing

Used by: 70-65-85/110 Small scale wind generating system.

- **Standards**: In accordance with BS 7671;
  In accordance with ENA G59/3;
  and In accordance with ENA G83/2.
- **Notice before commencing tests (minimum)**: Refer to project specific documentation.
- **Witnessing of testing and commissioning**: Required.
- **Approval**: Obtain written approval of the Electricity Distributor.
- **Controls**: Check operation.

820 Documentation

Used by: 70-65-85/110 Small scale wind generating 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.
- **Record drawings**:

- **Submittal date**: At handover.
- **Site test results and system performance analysis**: Submit.
- **Test equipment calibration certificates**: Submit.
- **System commissioning completion certificate**: Submit.
- **Approval of Electricity Distributor (grid connected systems only)**: Submit.
- **Warranty for system**: Submit.
- **Microgeneration Certification Scheme**: Submit certificate.

830 Spares and consumables

Used by: 70-65-85/110 Small scale wind generating system.

- **Supply the following spares**: Refer to project specific documentation.

840 Maintenance

Used by: 70-65-85/110 Small scale wind generating system.

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

Ω End of section

70-70-25 Earthing and bonding systems

System outline

110 Earthing and bonding system

- **System performance**: 70-70-25/210 Design of earthing and bonding systems;
  70-70-25/220 Electricity distributor's requirements;
  70-70-25/230 Equipotential bonding in buildings with information technology equipment;
  70-70-25/240 Functional earthing design;
  70-70-25/250 Generator earthing design;
  70-70-25/255 Mobile generator earthing;
  and .
- **Main incoming earth**: Establish with the Electricity Distributor or Separate earth electrode network.
- **Main earth electrode type**: 90-75-50/330 Earth rods type A;
  90-75-50/320 Earth plates type A;
  and .
- **Main protective bonding conductors**: 90-55-15/350 Thermosetting insulated and thermoplastic sheathed (LSHF) cables type A.
- **Supplementary bonding conductors**: 90-55-15/352 Thermosetting insulated non-armoured PVC sheathed cables type A.
- **Circuit protective conductors**: Cable armour;
  Cable armour and auxiliary;
  and Core of cable.
- **Earth terminal type**: 90-75-50/310 Earth bars.
- **Accessories**: 90-55-15/305 Anti-vandal capping;
  90-75-50/350 Earthing and bonding clamps;
  90-65-55/385 Residual current monitoring devices;
  90-75-50/460 Soil conditioning agents type A;
  and .
- **Electrical identification**: 90-90-55/395 Electrical diagrams;
  90-90-55/320 Electrical shock treatment signs type A;
  and 90-90-55/390 Equipment labels and warning notices.
- **Execution**: ;
  70-70-25/620 Measurement of characteristics of existing installations;
  70-70-25/630 General installation;
  70-70-25/640 Installing earth conductor joints and connections;
  70-70-25/650 Installing surface barriers around earth rods;
  70-70-25/660 Installing earthing conductor;
  70-70-25/670 Installing main protective bonding conductors;
  70-70-25/680 Installing supplementary bonding conductors;

70-70-25/690 Dissimilar metals;
70-70-25/700 Earthing and bonding of street furniture;
70-70-25/720 Notices and labels;
and 70-70-25/730 Installing functional earthing conductors.

- **System completion**: 70-70-25/810 Inspection and testing and 70-70-25/820 Documentation.

System performance

210 Design of earthing and bonding systems

Used by: 70-70-25/110 Earthing and bonding system.

- **Standards**: In accordance with BS 7671 and BS 7430.
- **Design**: Complete the design of the earthing and bonding systems.
- **Earthing conductor**: To BS 7671, Regulation 543.1.4.
- **Main protective bonding conductors**:
  - **Connect the following to the main earthing terminal**:
  - **Size (minimum)**: In accordance with BS 7671, Regulation 544.1.1.
- **Supplementary bonding conductors**:
  - **Bond the following**:
  - **Size (minimum)**: Minimum of 2.5 mm² if sheathed or where mechanical protection is provided, otherwise 4 mm².
- **Requirement**: Submit proposals including detailed design drawings, technical information, calculations and manufacturers' literature.
- **Circuit protective conductors**:

220 Electricity distributor's requirements

Used by: 70-70-25/110 Earthing and bonding system.

- **Evidence of compliance**: Submit, in accordance with the requirements of the Electricity Distributor.

230 Equipotential bonding in buildings with information technology equipment

Used by: 70-70-25/110 Earthing and bonding system.

- **Standard**: To BS EN 50310.

240 Functional earthing design

Used by: 70-70-25/110 Earthing and bonding system.

- **Standard**: To BS 6701.
- **Connection type**: To a separate functional earth bar connected directly to the main earth bar.

250 Generator earthing design

Used by: 70-70-25/110 Earthing and bonding system.

- **Standards**: To BS 7430 and in accordance with the Electricity Distributor's requirements.
- **Independent earth electrode network**: Provide.
- **Individual earth electrode resistance (maximum)**: 20 ohm.
- **Earth connection to generator**: Provide.

255 Mobile generator earthing

Used by: 70-70-25/110 Earthing and bonding system.

- **Mobile generator earthing**: Provide an earthing system capable of being connected to a mobile generator.

Execution

620 Measurement of characteristics of existing installations

Used by: 70-70-25/110 Earthing and bonding system.

- **External earth fault loop impedance (Ze)**: Direct measurement.
- **Earth fault loop impedance (Zs)**: Calculate from measurement of the sum of the resistance of the phase conductor and the resistance of the circuit protective conductor.
- **Results**: Submit.

630 General installation

Used by: 70-70-25/110 Earthing and bonding system.

- **Standards**: In accordance with BS 7430 and BS 7671.

640 Installing earth conductor joints and connections

Used by: 70-70-25/110 Earthing and bonding system.

- **Number of joints**: Minimize.
- **Contact surfaces**: Clean. Coat with corrosion inhibitor.
- **Bimetallic joints**: Do not cross-contaminate.
- **Protection to joints and connections**: Heat shrink clear sheathing.
- **Connections to test points**: Clamp.
- **Copper tape jointing**:
  - **Type**: Phosphor bronze clamps, nuts, bolts and washers.
  - **Copper tape overlap (minimum)**: 100 mm.
- **Protective cable terminations**: Compression lugs with phosphor bronze nuts, bolts and washers.

650 Installing surface barriers around earth rods

Used by: 70-70-25/110 Earthing and bonding system.

- **Non-conducting barriers**: Install to prevent personnel or livestock contact with the ground within 2 m of earth rods.

660 Installing earthing conductor

Used by: 70-70-25/110 Earthing and bonding system.

- **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.
- **Connection to earth electrodes**:
- **Protection to earthing conductor**: 90-55-10/380 Rigid conduit type C - Stainless steel; 90-55-10/380 Rigid conduit type B - Internal installations; 90-55-10/380 Rigid conduit type A - External and/or cast-in-situ installations; and 90-55-10/380 Rigid conduit type D - PVC-U (only acceptable if specifically allowed by project specific documentation).

670 Installing main protective bonding conductors

Used by: 70-70-25/110 Earthing and bonding system.

- **Separate and continuous connections**: Install between each service and the main earth terminal.
- **Bonding connections at main earth terminal**: Connect with compression lugs and phosphor bronze nuts and bolts and spring washers.

680 Installing supplementary bonding conductors

Used by: 70-70-25/110 Earthing and bonding system.

- **Earth connections**: Connect with compression lugs.

690 Dissimilar metals

Used by: 70-70-25/110 Earthing and bonding system.

- **Connecting dissimilar metals**: Prevent electrolytic action.

700 Earthing and bonding of street furniture

Used by: 70-70-25/110 Earthing and bonding system.

- **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.

710 Earthing of metal fencing around substations

Used by: 70-70-25/110 Earthing and bonding system.

- **Earthing arrangement**: Connected to substation earthing system or Independent earth.

720 Notices and labels

Used by: 70-70-25/110 Earthing and bonding system.

- **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'.

730 Installing functional earthing conductors

Used by: 70-70-25/110 Earthing and bonding system.

- **Labelling**: Identify the purpose of functional earth cables along their length using clip-on cable markers.
- **Standard**: To BS 6701.
- **Spacing (maximum)**: 3 m.

System completion

810 Inspection and testing

Used by: 70-70-25/110 Earthing and bonding system.

- **Standards**: In accordance with BS 7430 and BS 7671.
- **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 (Ze)**: Direct measurement.
- **Earth fault loop impedance (Zs)**: Direct measurement.

820 Documentation

Used by: 70-70-25/110 Earthing and bonding 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.
- **Record drawings**:
  - **Content**: Location and arrangement of plant in plant rooms;
    Location, size and route of earth electrodes;
    and Location of earth terminals.
- **Submittal date**: Before handover.

Ω End of section

70-70-35 High voltage distribution systems

System outline

110 High voltage distribution system

- **System performance**: 70-70-35/210 Design of high voltage distribution systems; 70-70-35/215 High voltage distribution circuit cables generally; 70-70-35/220 Grading study; 70-70-35/225 Special indoor service conditions for high voltage switchgear and controlgear assemblies; 70-70-35/230 Special outdoor service conditions for high voltage switchgear and controlgear assemblies; 70-70-35/235 Provision for unusual service conditions for high voltage distribution transformers; and 70-70-35/240 Transportation, off-load and installation restrictions for high voltage switchgear and transformers.
- **Connection to high voltage supply**: Refer to project specific documentation.
- **Switchgear**: 90-50-40/310 High voltage modular switchboards and 90-50-40/320 Ring main units.
- **Protection and measurement equipment**: 90-50-40/400 Protection and control module; 90-50-40/460 Current transformers; and 90-50-40/465 Inductive voltage transformers.
- **Transformers**: 90-50-40/450 Liquid immersed transformers and 90-50-40/455 Dry-type transformers.
- **Cable type**: 90-55-20/320 High voltage power cables with low smoke thermosetting insulation and 90-55-20/325 High voltage power cables with thermosetting insulation.
- **Cable accessories**: 90-10-65/445 Plastic ducts for buried electric cables type A; 90-55-10/310 Cable cleats type B; 90-55-15/313 Underground plastics cable protection covers type B; 90-55-15/311 Underground concrete cable protection covers type B; and 90-55-20/340 High voltage cable terminations for extruded insulation cables.
- **Containment**: Refer to project specific documentation.
- **Containment accessories**: Refer to project specific documentation.
- **Electrical identification**: 90-90-55/320 Electrical shock treatment signs type A; 90-90-55/390 Equipment labels and warning notices; and 90-90-55/395 Electrical diagrams.
- **System accessories**: 90-50-75/310 Electrical insulating matting type A.
- **Execution**: 70-70-35/610 Removal of high voltage distribution systems; 70-70-35/620 Installing high voltage distribution systems; 70-70-35/630 Electrical property measurement of high voltage systems; 70-70-35/640 Thermal video imaging surveys of high voltage distribution systems;

and 70-70-35/715 Excavations.

- **System completion**: 70-70-35/810 Inspecting, testing and commissioning of switchgear generally;
  70-70-35/820 Documentation;
  70-70-35/825 Type tests;
  70-70-35/830 Spares and consumables;
  and 70-70-35/840 Maintenance.

System performance

210 Design of high voltage distribution systems

Used by: 70-70-35/110 High voltage distribution system.

- **Design**: Complete the design of the high voltage distribution system.
- **Standards**: High-voltage switchgear and controlgear to BS EN 62271-1 and BS EN 62271-200 and In accordance with Health Technical Memorandum 06-01 Part A.
- **System parameters**:
  - **Nominal voltage**: Refer to project specific documentation.
  - **Nominal frequency**: Refer to project specific documentation.
- **Earthing**:
  - **Standard**: To BS EN 50522.
  - **High voltage system earthing**: Refer to project specific documentation.
  - **Low voltage system earthing**: Solidly earthed neutral.
- **Spare capacity throughout the high voltage distribution system**: Refer to project specific documentation.

215 High voltage distribution circuit cables generally

Used by: 70-70-35/110 High voltage distribution system.

- **Selection of high voltage distribution cables**: Refer to project specific documentation.
- **Conductor sizes (minimum)**: Refer to project specific documentation.
- **Requirement**: Submit drawings, technical information, calculations and manufacturer's literature.
- **Calculation format**: Amtech PowerNet HV.

220 Grading study

Used by: 70-70-35/110 High voltage distribution system.

- **Scope**: Complete for high voltage distribution system from electricity distributors intake to connection to LV system.
- **Protective devices**: Coordinate the selection and adjustment of protective device settings to achieve discrimination throughout the fault level range. Grade so that a fault on any outgoing

branch circuit is cleared by the switching device installed in the faulted branch circuit without affecting the other outgoing branch circuits.

- **Manufacturers' details and recommended settings**: Include in study report.
- **Study report**:
  - **Content**:

    Discrimination threshold: Demonstrate discrimination using time-current coordination curves with single line diagrams.

    Fault calculations: Include fault impedance, and short circuit, asymmetric and symmetrical fault current analysis.

225 Special indoor service conditions for high voltage switchgear and controlgear assemblies

Used by: 70-70-35/110 High voltage distribution system.

- **Ambient air temperature**: Refer to project specific documentation.
- **Altitude**: Refer to project specific documentation.
- **Local pollution levels**: Refer to project specific documentation.
- **Relative humidity**: Refer to project specific documentation.
- **Vibration**: Refer to project specific documentation.

230 Special outdoor service conditions for high voltage switchgear and controlgear assemblies

Used by: 70-70-35/110 High voltage distribution system.

- **Ambient air temperature**: Refer to project specific documentation.
- **Solar radiation**: Refer to project specific documentation.
- **Altitude**: Refer to project specific documentation.
- **Local pollution levels**: Refer to project specific documentation.
- **Ice coating**: Refer to project specific documentation.
- **Wind speed**: Refer to project specific documentation.
- **Condensation and precipitation**: Refer to project specific documentation.
- **Vibration**: Refer to project specific documentation.

235 Provision for unusual service conditions for high voltage distribution transformers

Used by: 70-70-35/110 High voltage distribution system.

- **Altitude**: Refer to project specific documentation.
- **Ambient air temperature**: Refer to project specific documentation.
- **Special service conditions**: Refer to project specific documentation.
- **Generator connection**: Refer to project specific documentation.
- **Parallel operation**: Refer to project specific documentation.
- **Duty**: Refer to project specific documentation.

240 Transportation, off-load and installation restrictions for high voltage switchgear and transformers

Used by: 70-70-35/110 High voltage distribution system.

- **Transportation, off-load and installation**: Refer to project specific documentation.

Execution

610 Removal of high voltage distribution systems

Used by: 70-70-35/110 High voltage distribution system.

- **Scope**: Refer to project specific documentation.
- **Insulating medium**:
  - **Sulfur hexafluoride (SF6)**: Refer to project specific documentation.
  - **Mineral oil**: Recover the oil from the redundant switchgear and send for specialist recycling.

620 Installing high voltage distribution systems

Used by: 70-70-35/110 High voltage distribution system.

- **Standards**: In accordance with BS EN 62271-1, section 10 and BS EN 62271-200, section 10.2 and In accordance with BS EN 62271-1, section 10, BS EN 62271-200, section 10.2 and Health Technical Memorandum 06-01 Part A.
- **Earthing**: To BS EN 50522.
- **Layout**: Position cabling and equipment to provide safe and easy access for operation and maintenance.

630 Electrical property measurement of high voltage systems

Used by: 70-70-35/110 High voltage distribution system.

- **Objectives**: Refer to project specific documentation.
- **Property values to be recorded**: Active energy (kWh);
  Active power (W);
  Active power demand (W);
  Apparent power (VA);
  Apparent power demand (VA);
  Current demand (A);
  Daily active power profile;
  Frequency (Hz);
  Phase currents (A);
  Power factor;
  Reactive power (VA(r));
  Voltage between phases (V);
  Voltage between phases and neutral (V);
  and Voltage characteristics of electricity supply from public network in accordance with BS EN 50160.
- **Sampling**:

  - **Start date and time**: Refer to project specific documentation.
  - **Period**: Refer to project specific documentation.
  - **Interval**: Refer to project specific documentation.
- **Connection to existing switchgear**: Refer to project specific documentation.
- **Results**: Refer to project specific documentation.

640 Thermal video imaging surveys of high voltage distribution systems

Used by: 70-70-35/110 High voltage distribution system.

- **Thermal imaging personnel**: Specialist thermographer.
- **Plant to be surveyed**: Refer to project specific documentation.
- **Special conditions**: Refer to project specific documentation.
- **Measurements**: Refer to project specific documentation.
- **Method statement**: Submit.

- **Report content**: Document and provide images for plant inspected. Include prioritized recommendations for remedial work.
- **Results**: Submit.

715 Excavations

Used by: 70-70-35/110 High voltage distribution system.

- **Excavations next to existing underground services**: In accordance with HSG47.
- **Existing underground services**: Detect, expose and identify.

System completion

810 Inspecting, testing and commissioning of switchgear generally

Used by: 70-70-35/110 High voltage distribution system.

- **Notice before testing and commissioning**: Refer to project specific documentation.
- **Standard**: In accordance with BS EN 62271-1, section 10 and BS EN 62271-200, section 10.2.
- **Earthing**: To BS EN 50522, Annex L.
- **Anti-condensation heaters**: Check and confirm correct operation.
- **Inspection and test results**: Submit.
- **Certificates of calibration for meters and instruments**: Submit.

820 Documentation

Used by: 70-70-35/110 High voltage distribution system.

- **Manufacturer's operation 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, cleaning and maintenance requirements.
- **Record drawings**:
  - **Submit record layout drawings indicating the following**: For all high voltage 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 ducts, on tray or ladder.
    Location, route and depth of underground cables, including cable joints.
    Location of HV switchgear and transformers.
    Routes of duct, cable tray and cable ladders.
    Joint and service phasing.
    Location of busbar trunking and tap-off units.
  - **Submit schematic drawings indicating the following**: For all high voltage distribution circuits: the cable origin, circuit designation, cable type, size, number of cores, size and type of overcurrent protective device.
  - **Drawing format**: Refer to project specific documentation.
  - **Number of copies**: Refer to project specific documentation.
- **Submittal date**: At handover.

825 Type tests

Used by: 70-70-35/110 High voltage distribution system.

- **High voltage switchgear and controlgear**: Submit in accordance with BS EN 62271-1, clause 6.1.3 and BS EN 62271-200, section 6.1.
- **Circuit breakers**: In accordance with BS EN 62271-100, section 6.
- **Disconnectors and earthing switches**: In accordance with BS EN 62271-102, clause 6.1.1.
- **Switches**: In accordance with BS EN 62271-103, section 6.101.10.
- **Transformers**: In accordance with BS EN 60076-1, section 11.1.

830 Spares and consumables

Used by: 70-70-35/110 High voltage distribution system.

- **Switchgear**:
  - **Tools**: Supply one set as recommended by the switchgear manufacturer for maintaining the equipment, including racking handles and a torque spanner.
  - **Operating handles for circuit breakers and switches**: Supply one per device.
  - **Spare fuses**: Supply two of each type and rating used.
- **Dry-type transformers**: Supply two sets of cooling system filters.

840 Maintenance

Used by: 70-70-35/110 High voltage distribution system.

- **Servicing and maintenance**: Undertake.
- **Standard**: In accordance with BS 6626.
- **Duration**: Until 12 months after Practical Completion.

Ω End of section

70-70-40 Inspection and testing low voltage electrical installations

System outline

110 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.
- **Execution**: 70-70-40/610 Test equipment calibration and 70-70-40/620 Inspection and testing electrical installations generally.
- **System completion**: 70-70-40/860 Electrical installation certificates.

120 Inspection and testing of minor electrical installation work

- **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.
- **Execution**: 70-70-40/610 Test equipment calibration and 70-70-40/620 Inspection and testing electrical installations generally.
- **System completion**: 70-70-40/870 Minor electrical installation works certificates.

130 Inspection and testing of existing electrical installations

- **General requirements**:
  - **Electrical test engineer**: Electrical installation contractor and Independent of installation contractor.
  - **Approval**: National Inspection Council for Electrical Installation Contracting (NICEIC).
  - **Evidence of approval**: Submit.
  - **Test equipment calibration**: UKAS approved.
- **Execution**: 70-70-40/610 Test equipment calibration and 70-70-40/620 Inspection and testing electrical installations generally.
- **System completion**: 70-70-40/880 Electrical installation condition report.

Execution

610 Test equipment calibration

Shared by: 70-70-40/110 Inspection and testing of new low voltage electrical installations or changes to an existing installation; 70-70-40/120 Inspection and testing of minor electrical installation work; and 70-70-40/130 Inspection and testing of existing electrical installations.

- **Test equipment calibration**: UKAS approved.

620 Inspection and testing electrical installations generally

Shared by: 70-70-40/110 Inspection and testing of new low voltage electrical installations or changes to an existing installation; 70-70-40/120 Inspection and testing of minor electrical installation work; and 70-70-40/130 Inspection and testing of existing electrical installations.

- **Standards**: In accordance with BS 7671 and IET Guidance Note 3.
- **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.
- **External earth fault loop impedance (Ze)**: Direct measurement.
- **Earth fault loop impedance (Zs)**: Calculated from measurement of the sum of the resistance of the phase conductor and the resistance of the circuit protective conductor.
- **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

860 Electrical installation certificates

Used by: 70-70-40/110 Inspection and testing of new low voltage electrical installations or changes to an existing installation.

- **Standard**: In accordance with BS 7671, appendix 6 and To National Inspection Council for Electrical Installation Contracting (NICEIC) standard.
- **Test equipment identity**: Record on test certificates.
- **Certificates of calibration**: Submit for each test instrument.

870 Minor electrical installation works certificates

Used by: 70-70-40/120 Inspection and testing of minor electrical installation work.

- **Standard**: In accordance with BS 7671 appendix 6 and To National Inspection Council for Electrical Installation Contracting (NICEIC) standard.
- **Test equipment identity**: Record on test certificates.
- **Certificates of calibration**: Submit for each test instrument.

880 Electrical installation condition report

Used by: 70-70-40/130 Inspection and testing of existing electrical installations.

- **Standard**: In accordance with BS 7671, appendix 6 and To National Inspection Council for Electrical Installation Contracting (NICEIC) standard.
- **Test equipment identity**: Record on test certificates.
- **Certificates of calibration**: Submit for each test instrument.
- **Remedial works**: Submit proposals and itemised quotation for each item classified as 'requiring urgent attention'.

Ω End of section

70-70-45 Low voltage distribution systems

System outline

110 Low voltage distribution system type A

- **System Performance**: 70-70-45/210 Design of low voltage distribution systems;
  70-70-45/215 Low voltage distribution circuit cables generally;
  70-70-45/225 Grading study;
  70-70-45/230 Input power supply characteristics;
  70-70-45/245 Performance of power factor correction equipment;
  and 70-70-45/220 Selection of conduit, trunking and ducting.
- **Connection to low voltage supply**: Refer to project specific documentation
- **Switchgear**: 90-50-45/390 Cable distribution cabinets;
  90-50-45/410 Distribution boards type A;
  90-50-45/420 Cubicle switchboards Generally;
  90-50-45/450 Switches, disconnectors, switch-disconnectors and fuse combination units GENERALLY type B;
  90-50-45/410 Composite Distribution Board (CDB) General Three Phase type B;
  90-50-45/410 Power Distribution Unit GENERALLY type C;
  and 90-50-45/410 Distribution Boards and Consumer Units GENERALLY type D.90-60-30/310 Air circuit breakers90-60-30/320 Moulded case circuit breakers
- **Distribution circuit cabling**: 90-55-15/324 Thermosetting insulated and thermoplastic sheathed (LSHF) armoured cables;
  90-55-15/330 Fire resistant screened (LSHF) cables;
  90-55-15/332 Thermosetting insulated armoured fire resistant (LSHF) cables;
  90-55-15/334 Single core non-sheathed cables with LSHF insulation;
  90-55-15/338 Light duty mineral insulated cables;
  90-55-15/339 Heavy duty mineral insulated cables;
  90-55-15/340 Multicore screened thermosetting insulated (LSHF) sheathed cables type A;
  90-55-15/350 Thermosetting insulated and thermoplastic sheathed (LSHF) cables;
  90-55-15/352 Thermosetting insulated non-armoured PVC sheathed cables type B;
  90-50-45/320 Power busbar trunking;
  90-55-15/340 Multicore screened thermosetting insulated (LSHF) sheathed cables type E;
  and 90-55-15/340 Multicore screened thermosetting insulated (LSHF) sheathed cables type F.
- **Cable accessories**: 90-55-10/310 Cable cleats type A;
  90-55-10/315 Cable ties;
  90-55-10/320 Cable bands type A;
  90-10-65/445 Plastic ducts for buried electric cables type B;
  90-55-15/311 Underground concrete cable protection covers type C
- **Containment**: 90-55-10/305 Channel cable supports;
  90-55-10/325 Cable baskets type A;

90-55-10/330 Cable ladders;
90-55-10/335 Cable trays type B - General;
90-55-10/380 Rigid conduit type C - Stainless steel;
90-55-10/380 Rigid conduit type B - Internal installations;
90-55-10/380 Rigid conduit type A - External and/or cast-in-situ installations;
90-55-10/380 Rigid conduit type D - PVC-U (only acceptable if specifically allowed by project specific documentation);
90-55-10/410 Cable trunking and cable ducting for wall and ceiling mounting type E - Stainless Steel;
90-55-10/410 Cable trunking and cable ducting for wall and ceiling mounting type A - Steel (no apparatus mounting);
90-55-10/410 Cable trunking and cable ducting for wall and ceiling mounting type C - PVC-U (no apparatus mounting);
90-55-10/410 Cable trunking and cable ducting for wall and ceiling mounting type B - Steel (with apparatus mounting);
and 90-55-10/410 Cable trunking and cable ducting for wall and ceiling mounting type D - PVC-U (with apparatus mounting).

- **Containment accessories**: 90-55-10/460 Conduit fittings type A and 90-55-10/470 Intumescent linear gap seals type A.
- **Rewireable installation**: Required.
- **Concealed installation**: Required.
- **Electrical identification**: 90-90-55/320 Electrical shock treatment signs type A;
  90-90-55/390 Equipment labels and warning notices;
  and 90-90-55/395 Electrical diagrams.
- **Cable Compliance**: In accordance with mandatory obligations and the introduction of the Construction Products Regulations (CPR) on 1st July 2017 under the UK Statutory Instrument no. 1387 all cables supplied for installation within the project associated with this specification must comply with this legal requirement. The contractor is to provide legitamate certification of the product installed ensuring compliance with the CPR.
- **Execution**: 70-70-45/610 Removing low voltage distribution systems;
  70-70-45/615 Alterations to existing switchgear;
  70-70-45/620 Alterations to existing busbar trunking;
  70-70-45/625 Installing low voltage distribution systems;
  70-70-45/630 Electrical property measurement of low voltage systems;
  70-70-45/640 Thermal video imaging surveys of low voltage distribution systems;
  and 70-70-45/650 Connection to the incoming supply.
- **System Completion**: 70-70-45/810 Inspecting, testing and commissioning of switchgear generally;
  70-70-45/811 Inspecting, testing and commissioning automatic power factor correction equipment;
  70-70-45/812 Inspecting, testing and commissioning harmonic filters;

70-70-45/813 Inspecting, testing and commissioning UPS equipment;
70-70-45/820 Documentation;
70-70-45/830 Spares and consumables;
and 70-70-45/840 Maintenance.

110 Low voltage distribution system type B

- **System performance**:
- **Connection to low voltage supply**: Refer to project specific documentation
- **Switchgear**:
- **Distribution circuit cabling**: 90-55-15/340 Multicore screened thermosetting insulated (LSHF) sheathed cables type G
- **Cable accessories**:
- **Containment**:
- **Containment accessories**:
- **Rewireable installation**: Required.
- **Concealed installation**: Required.
- **Monitoring and metering**:
- **Power conditioning equipment**:
- **Accessories**:
- **Electrical identification**:
- **Execution**:
- **System completion**:

System performance

210 Design of low voltage distribution systems

Used by: 70-70-45/110 Low voltage distribution system type A.

- **Design**: Complete the design of the low voltage distribution system.
- **Standard**: In accordance with BS 7671.
- **Provision of low voltage distribution**: Provide electrical supplies to equipment requiring power.
- **Spare capacity throughout the low voltage distribution system**: Refer to project specific documentation
- **Requirement**: Submit proposals including detailed design drawings, technical information, calculations and manufacturers' literature.

215 Low voltage distribution circuit cables generally

Used by: 70-70-45/110 Low voltage distribution system type A.

- **Proposed selection of low voltage distribution cables**: Submit drawings, technical information, calculations and manufacturers' literature.
- **Cable sizes not stated**: Refer to project specific documentation

220 Selection of conduit, trunking and ducting

Used by: 70-70-45/110 Low voltage distribution system type A.

- **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.

225 Grading study

Used by: 70-70-45/110 Low voltage distribution system type A.

- **Scope**: Complete for the low voltage distribution system (including existing, if any).
- **Fault calculations**: Include fault impedance and short circuit fault current analysis.
- **Protective devices**: Coordinate the selection and adjustment of protective device settings to achieve discrimination throughout the fault level range. Grade so that a fault on any outgoing branch circuit is cleared by the switching device installed in the faulted branch circuit without affecting the other outgoing branch circuits. Demonstrate discrimination using time-current coordination curves with single line diagrams, in the study report.
- **Manufacturers' details and recommended settings**: Include in study report.
- **Study report**:
  - **Format**: Printed output from proprietary electrical design software and electronic copy.

230 Input power supply characteristics

Used by: 70-70-45/110 Low voltage distribution system type A.

245 Performance of power factor correction equipment

Used by: 70-70-45/110 Low voltage distribution system type A.

- **Power factor when corrected**: Refer project Specific documentation.
- **Capacitor bank size and number of stages**: Submit proposals.
- **Power factor equipment sizing calculations**: Submit.

Execution

610 Removing low voltage distribution systems

Used by: 70-70-45/110 Low voltage distribution system type A.

- **Scope**: Refer to project specific documentation.

615 Alterations to existing switchgear

Used by: 70-70-45/110 Low voltage distribution system type A.

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

620 Alterations to existing busbar trunking

Used by: 70-70-45/110 Low voltage distribution system type A.

- **Standards**: In accordance with type test certification.
- **Records**: Submit.

625 Installing low voltage distribution systems

Used by: 70-70-45/110 Low voltage distribution system type A.

- **Standard**: In accordance with BS 7671.
- **Layout**: Position cabling and equipment to provide safe and easy access for operation and maintenance.

630 Electrical property measurement of low voltage systems

Used by: 70-70-45/110 Low voltage distribution system type A.

- **Property values to be recorded**: To monitor voltage characteristics of electricity supply from public network in accordance with BS EN 50160;
  To record daily active power profile;
  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);
  and Apparent power demand (V·A).
- **Sampling**:
  - **Start date and time**: To be agreed, submit proposals.
  - **Period**: Refer to project specific documentation.
  - **Interval**: Refer to project specific documentation.
- **Connection to existing switchgear**:
  - **Method statement**: Submit.
  - **Timing**: Refer to project specific documentation.
- **Results**:
  - **Format**: Refer to project specific documentation.

640 Thermal video imaging surveys of low voltage distribution systems

Used by: 70-70-45/110 Low voltage distribution system type A.

- **Thermal imaging personnel**: Specialist thermographer.
- **Plant to be surveyed**: Refer to project specific documentation.
- **Sampling**: Refer to project specific documentation.
- **Results**:
  - **Format**: Refer to project specific documentation.

650 Connection to the incoming supply

Used by: 70-70-45/110 Low voltage distribution system type A.

- **Customer's installation**: Connect to the incoming point of supply.

System completion

810 Inspecting, testing and commissioning of switchgear generally

Used by: 70-70-45/110 Low voltage distribution system type A.

- **Standard**: In accordance with BS 7671.
- **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.
- **Certificates of calibration for meters and instruments**: Submit.

811 Inspecting, testing and commissioning automatic power factor correction equipment

Used by: 70-70-45/110 Low voltage distribution system type A.

- **Standard**: In accordance with BS 7671.
- **Operation of instruments and displays**: Check and confirm correct operation.
- **Controls**: Commission and adjust for optimum power factor correction.

812 Inspecting, testing and commissioning harmonic filters

Used by: 70-70-45/110 Low voltage distribution system type A.

- **Standard**: In accordance with BS 7671.
- **Commissioning of filters**: By manufacturer.
- **Operation of instruments and displays**: Check and confirm correct operation of:
  Reactive compensation.
  Selection of harmonic orders for mitigation.
  Number of parallel connected filters.
  Alarm functions.
  Communication port function.
  Check and confirm correct display of:
  Supply current (rms) L1, L2, L3 and neutral current.
  Load current (rms) L1, L2, L3 and neutral current.
  Supply THD % L1, L2, L3.
  Load THD % L1, L2, L3.
  Supply voltage.
  Load on the filter expressed as a percentage for L1, L2, L3.
  Detailed load current spectrum 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.
- **Controls**: Commission and adjust for optimum harmonic mitigation and reactive power compensation.

813 Inspecting, testing and commissioning UPS equipment

Used by: 70-70-45/110 Low voltage distribution system type A.

- **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.

820 Documentation

Used by: 70-70-45/110 Low voltage distribution system type A.

- **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.
- **Record drawings**:
  - **Content**: For all low voltage distribution 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 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.

- **Submittal date**: Before handover.

830 Spares and consumables

Used by: 70-70-45/110 Low voltage distribution system type A.

- **Supply the following spares**:
  - **Fuses**: Two of each type and rating used.
  - **Operating handles for circuit breakers and switches**: One per device.

840 Maintenance

Used by: 70-70-45/110 Low voltage distribution system type A.

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

Ω End of section

70-70-75 Small power systems

System outline

110 Hard wired low voltage small power system

- **System performance**: 70-70-75/210 Design of low voltage small power systems;
  70-70-75/215 Low voltage small power cables generally;
  70-70-75/220 Selection of conduit, trunking and ducting generally;
  and 70-70-75/230 Multi-gang power outlets.
- **Final circuit cabling**: 90-50-45/320 Power busbar trunking;
  90-55-15/324 Thermosetting insulated and thermoplastic sheathed (LSHF) armoured cables;
  90-55-15/330 Fire resistant screened (LSHF) cables;
  90-55-15/332 Thermosetting insulated armoured fire resistant (LSHF) cables;
  90-55-15/334 Single core non-sheathed cables with LSHF insulation;
  90-55-15/338 Light duty mineral insulated cables;
  90-55-15/339 Heavy duty mineral insulated cables;
  90-55-15/340 Multicore screened thermosetting insulated (LSHF) sheathed cables type A;
  90-55-15/350 Thermosetting insulated and thermoplastic sheathed (LSHF) cables;
  90-55-15/352 Thermosetting insulated non-armoured PVC sheathed cables type A;
  and 90-55-15/352 Thermosetting insulated non-armoured PVC sheathed cables type B.
- **Cable accessories**: 90-55-10/310 Cable cleats type A;
  90-55-10/315 Cable ties;
  and 90-55-10/320 Cable bands type A.
- **Containment**: 90-55-10/305 Channel cable supports;
  90-55-10/325 Cable baskets type A;
  90-55-10/330 Cable ladders;
  90-55-10/335 Cable trays type B - General;
  90-55-10/380 Rigid conduit type C - Stainless steel;
  90-55-10/380 Rigid conduit type B - Internal installations;
  90-55-10/380 Rigid conduit type A - External and/or cast-in-situ installations;
  90-55-10/380 Rigid conduit type D - PVC-U (only acceptable if specifically allowed by project specific documentation);
  90-55-10/410 Cable trunking and cable ducting for wall and ceiling mounting type E - Stainless Steel;
  90-55-10/410 Cable trunking and cable ducting for wall and ceiling mounting type A - Steel (no apparatus mounting);
  90-55-10/410 Cable trunking and cable ducting for wall and ceiling mounting type C - PVC-U (no apparatus mounting);
  90-55-10/410 Cable trunking and cable ducting for wall and ceiling mounting type B - Steel (with apparatus mounting);

and 90-55-10/410 Cable trunking and cable ducting for wall and ceiling mounting type D - PVC-U (with apparatus mounting).
Refer to project specific documentation.

- **Containment accessories**: 90-55-10/460 Conduit fittings type A and 90-55-10/470 Intumescent linear gap seals type A.
- **Rewireable installation**: Required.
- **Concealed installation**: Required.
- **Final connections**: Required.
- **Partial installation**: Required.
- **Power conditioning equipment**: 90-60-30/410 Surge protective devices for low voltage power supplies type D;
  90-60-40/410 Uninterruptible power supply (UPS) unit type B;
  and 90-60-40/420 Uninterruptible power supply (UPS) remote alarm and indicator panels type B.
- **Electrical accessories and outlets**:
- **Controls and starters**: 90-65-25/350 a.c. drives;
  90-65-25/310 a.c. semiconductor motor controllers and starters;
  90-65-25/320 Direct-on-line starters;
  90-65-25/330 Star delta starters;
  90-65-25/340 Electromechanical contactors;
  90-65-25/360 Electromechanical control circuit devices;
  and 90-65-25/370 Emergency stop buttons.
- **Accessories**: 90-50-45/340 Feed units;
  90-50-45/350 Fire barrier units;
  90-50-45/330 Tap-off units;
  and 90-60-30/380 Fuse links.
- **Electrical identification**: 90-90-55/320 Electrical shock treatment signs type A;
  90-90-55/390 Equipment labels and warning notices;
  and 90-90-55/395 Electrical diagrams.
- **Execution**: 70-70-75/610 Removing small power systems;
  70-70-75/620 Small power installation;
  70-70-75/630 Installing cabling to socket outlets;
  and 70-70-75/650 Partial installation.
- **System completion**: 70-70-75/812 Inspection, testing and commissioning of harmonic filters;
  70-70-75/813 Inspecting, testing and commissioning UPS equipment;
  70-70-75/820 Documentation;
  70-70-75/830 Spares;
  and 70-70-75/840 Maintenance.

120 Low voltage small power systems with prefabricated wiring

- **System performance**: Refer to project specific documentation.

- **Connection to low voltage supply**:
- **System components**: 90-55-15/465 Home run cables type B and 90-55-15/490 Starter leads type B.
- **Containment**: Refer to project specific documentation.
- **Containment accessories**:
- **Rewireable installation**: Required.
- **Concealed installation**: Required.
- **Partial installation**: Required.
- **Power conditioning equipment**:
- **Electrical accessories and outlets**:
- **Accessories**:
- **Electrical identification**:
- **Execution**:
- **System completion**: 70-70-75/812 Inspection, testing and commissioning of harmonic filters; 70-70-75/813 Inspecting, testing and commissioning UPS equipment; 70-70-75/820 Documentation; 70-70-75/830 Spares; and 70-70-75/840 Maintenance.

System performance

210 Design of low voltage small power systems

Used by: 70-70-75/110 Hard wired low voltage small power system.

- **Provision of small power**: For fixed and portable equipment requiring power.
- **Design**: Complete for the low voltage small power systems.
- **Standards**:
- **Diversity**: In accordance with IET Guidance Note 1.
- **Spare capacity throughout the small power system**:
- **Requirement**: Submit proposals including detailed design drawings, technical information, calculations and manufacturers' literature.

215 Low voltage small power cables generally

Used by: 70-70-75/110 Hard wired low voltage small power system.

- **Standard**: In accordance with BS 7671.
- **Proposed selection of low voltage cables**: Submit drawings, technical information, calculations and manufacturers' literature.
- **Cable sizes not stated**: Submit.

220 Selection of conduit, trunking and ducting generally

Used by: 70-70-75/110 Hard wired low voltage small power system.

- **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.

230 Multi-gang power outlets

Used by: 70-70-75/110 Hard wired low voltage small power system.

Execution

610 Removing small power systems

Used by: 70-70-75/110 Hard wired low voltage small power system.

- **Scope**: Refer to project specific documentation.

620 Small power installation

Used by: 70-70-75/110 Hard wired low voltage small power system.

- **Standard**: In accordance with BS 7671.

630 Installing cabling to socket outlets

Used by: 70-70-75/110 Hard wired low voltage small power system.

- **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.

650 Partial installation

Used by: 70-70-75/110 Hard wired low voltage small power system.

- **Equipment to be installed only**: Refer to project specific documentation.
- **Equipment requiring power supplies and final connection only**: Refer to project specific documentation.
- **Containment**:
  - **Provide for the following systems**: Refer to project specific documentation.
  - **Draw cords**: Required.

System completion

812 Inspection, testing and commissioning of harmonic filters

Shared by: 70-70-75/110 Hard wired low voltage small power system; and 70-70-75/120 Low voltage small power systems with prefabricated wiring.

- **Standard**: In accordance with BS 7671.
- **Commissioning of filters**: By manufacturer.
- **Filters, CTs, wiring, components, connections and equipment installation**: Inspect.

- **Operation of instruments and displays**: 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.

813 Inspecting, testing and commissioning UPS equipment

Shared by: 70-70-75/110 Hard wired low voltage small power system; and 70-70-75/120 Low voltage small power systems with prefabricated wiring.

- **Standards**: In accordance with BS 7671 and BS EN 62040-3.
- **Method statement**: Submit.
- **Phase rotation**: Verify.
- **Emergency and safety circuits**: Check and confirm correct operation.
- **Operation of instruments and displays**: 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.
Ventilation test.

- **Output tests**: Harmonic components measurement.
  Frequency variation test.
  Output over voltage test.
  Output frequency slew rate test.
  Periodic output voltage variation test.
  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.

820 Documentation

Shared by: 70-70-75/110 Hard wired low voltage small power system; and 70-70-75/120 Low voltage small power systems with prefabricated wiring.

- **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.
- **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..

- **Submittal date**: At handover.

830 Spares

Shared by: 70-70-75/110 Hard wired low voltage small power system; and 70-70-75/120 Low voltage small power systems with prefabricated wiring.

- **Fuse links**: Supply ten of each rating.

840 Maintenance

Shared by: 70-70-75/110 Hard wired low voltage small power system; and 70-70-75/120 Low voltage small power systems with prefabricated wiring.

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

Ω End of section

70-80-25 External lighting systems

System outline

110 Roadway lighting system

- **System performance**: 70-80-25/210 Roadway lighting design;
  70-80-25/230 Maintenance factor calculations type A;
  70-80-25/240 Luminaire and lamp maintenance properties type A;
  70-80-25/250 Lighting performance type A;
  70-80-25/270 Lighting cables generally type A;
  and 70-80-25/280 Conduit, trunking and ducting generally type A.
- **Electrical supply**: Refer to project specific documentation.
- **Final circuit cabling**: Refer to project specific documentation.
- **Containment**: 90-55-10/325 Cable baskets type A;
  90-55-10/330 Cable ladders;
  90-55-10/335 Cable trays type B - General;
  90-55-10/380 Rigid conduit type A - External and/or cast-in-situ installations;
  90-55-10/410 Cable trunking and cable ducting for wall and ceiling mounting type E - Stainless Steel;
  90-55-10/410 Cable trunking and cable ducting for wall and ceiling mounting type A - Steel (no apparatus mounting);
  90-55-10/410 Cable trunking and cable ducting for wall and ceiling mounting type C - PVC-U (no apparatus mounting);
  90-55-10/410 Cable trunking and cable ducting for wall and ceiling mounting type B - Steel (with apparatus mounting);
  and 90-55-10/410 Cable trunking and cable ducting for wall and ceiling mounting type D - PVC-U (with apparatus mounting).
- **Containment accessories**: 90-55-10/460 Conduit fittings type A;
  90-55-10/460 Conduit fittings type B;
  90-55-10/470 Intumescent linear gap seals type A;
  90-55-10/470 Intumescent linear gap seals type B;
  90-55-15/309 Plastic warning devices for underground cables and pipelines;
  90-55-15/311 Underground concrete cable protection covers type A;
  and 90-55-15/313 Underground plastics cable protection covers type A.
- **Rewireable installation**: Required.
- **Concealed installation**: Required.
- **Low voltage switchgear**: 90-50-45/390 Cable distribution cabinets.
- **Columns and brackets**: Refer to project specific documentation.
- **Luminaires**: 90-60-50/405 General purpose luminaires type A.
- **Controls**:

  - **Types**: 90-65-05/430 Photoelectric control units type A.
  - **Configuration**: Refer to project specific documentation.
- **System accessories**: Refer to project specific documentation.
- **Electrical identification**: 90-90-55/320 Electrical shock treatment signs type A; 90-90-55/390 Equipment labels and warning notices; and 90-90-55/395 Electrical diagrams.
- **Execution**: 70-80-25/610 Removing external lighting systems type A; 70-80-25/620 Installing roadway and amenity lighting systems generally type A; 70-80-25/630 Modifying existing external lighting systems type A; and 70-80-25/720 Cleaning type A.
- **System completion**: 70-80-25/810 Inspection and testing of road lighting; 70-80-25/812 Commissioning type A; 70-80-25/815 Photometric survey of road lighting systems; 70-80-25/820 Documentation type A; 70-80-25/830 Spares type A; and 70-80-25/840 Maintenance type A.

120 Amenity lighting system

- **System performance**: 70-80-25/220 Amenity lighting design; 70-80-25/230 Maintenance factor calculations type B; 70-80-25/240 Luminaire and lamp maintenance properties type B; 70-80-25/250 Lighting performance type B; 70-80-25/270 Lighting cables generally type B; and 70-80-25/280 Conduit, trunking and ducting generally type B.
- **System manufacturer**: Refer to Schedule of Manufacturers
- **Electrical supply**: Refer to project specific documentation.
- **Final circuit cabling**: Refer to project specific documentation.
- **Containment**: 90-55-10/325 Cable baskets type A; 90-55-10/330 Cable ladders; 90-55-10/335 Cable trays type B - General; 90-55-10/380 Rigid conduit type A - External and/or cast-in-situ installations; 90-55-10/410 Cable trunking and cable ducting for wall and ceiling mounting type E - Stainless Steel; 90-55-10/410 Cable trunking and cable ducting for wall and ceiling mounting type A - Steel (no apparatus mounting); 90-55-10/410 Cable trunking and cable ducting for wall and ceiling mounting type C - PVC-U (no apparatus mounting); 90-55-10/410 Cable trunking and cable ducting for wall and ceiling mounting type B - Steel (with apparatus mounting); and 90-55-10/410 Cable trunking and cable ducting for wall and ceiling mounting type D - PVC-U (with apparatus mounting).

- **Containment accessories**: 90-55-10/460 Conduit fittings type A;
  90-55-10/460 Conduit fittings type B;
  90-55-10/470 Intumescent linear gap seals type A;
  90-55-10/470 Intumescent linear gap seals type B;
  90-55-15/309 Plastic warning devices for underground cables and pipelines;
  90-55-15/311 Underground concrete cable protection covers type A;
  and 90-55-15/313 Underground plastics cable protection covers type A.
- **Rewireable installation**: Required.
- **Concealed installation**: Required.
- **Low voltage switchgear**: 90-50-45/390 Cable distribution cabinets.
- **Columns and brackets**: Refer to project specific documentation.
- **Luminaires**: 90-60-50/405 General purpose luminaires type B.
- **Controls**:
  - **Types**: 90-65-05/430 Photoelectric control units type B and 90-65-25/380 Time switches type A.
  - **Configuration**: Refer to project specific documentation.
- **System accessories**: 90-50-45/392 Electrical cut outs and 90-60-50/470 Separated extra-low voltage lighting transformers type A.
- **Electrical identification**: 90-90-55/320 Electrical shock treatment signs type A;
  90-90-55/390 Equipment labels and warning notices;
  and 90-90-55/395 Electrical diagrams.
- **Execution**: 70-80-25/610 Removing external lighting systems type B;
  70-80-25/620 Installing roadway and amenity lighting systems generally type B;
  70-80-25/630 Modifying existing external lighting systems type B;
  and 70-80-25/720 Cleaning type B.
- **System completion**: 70-80-25/812 Commissioning type B;
  70-80-25/817 Photometric survey of amenity lighting systems;
  70-80-25/820 Documentation type B;
  70-80-25/830 Spares type B;
  and 70-80-25/840 Maintenance type B.

System performance

210 Roadway lighting design

Used by: 70-80-25/110 Roadway lighting system.

- **Design**: Complete the design of the roadway lighting system.
- **Standards**: In accordance with Guidance notes for the reduction of obtrusive light GN01;
  In accordance with BS 5489-1;
  and To Highways EnglandSpecification for highway works, Volume 1.
- **Lighting class**: Refer to project specific documentation.

- **Average power density energy consumption (maximum)**: Refer to project specific documentation.
- **Initial circuit luminous efficacy (minimum)**: Refer to project specific documentation.
- **Proposals**: Submit detailed design drawings including circuit diagrams, luminaire layouts, luminaire photometric data including flux fraction ratios, polar intensity curves and utilisation factors, lamp and luminaire technical information, road surface reflectance values, power density and efficacy of the installation. Include computer generated point calculations with contribution from inter-reflected light, maintenance factor calculations, schedule of design and calculated maintained average illuminance values, and a schedule of design and calculated uniformity values.

220 Amenity lighting design

Used by: 70-80-25/120 Amenity lighting system.

- **Design**: Complete the design of the amenity lighting system.
- **Standards**: In accordance with Guidance notes for the reduction of obtrusive light GN01 and To BS 5489-1.
- **Lighting class**: Refer to project specific documentation.
- **Average power density energy consumption (maximum)**: Refer to project specific documentation.
- **Initial circuit luminous efficacy (minimum)**: Refer to project specific documentation.
- **Proposals**: Refer to project specific documentation.

230 Maintenance factor calculations type A

Used by: 70-80-25/110 Roadway lighting system.

- **Luminaire maintenance strategy**: Refer to project specific documentation.
- **Lamp replacement strategy**: Refer to project specific documentation.
- **Maintenance factors**: Refer to project specific documentation.

230 Maintenance factor calculations type B

Used by: 70-80-25/120 Amenity lighting system.

- **Luminaire maintenance strategy**: Refer to project specific documentation.
- **Lamp replacement strategy**: Refer to project specific documentation.
- **Maintenance factors**: Refer to project specific documentation.

240 Luminaire and lamp maintenance properties type A

Used by: 70-80-25/110 Roadway lighting system.

- **Lamp replacement method**: Refer to project specific documentation.
- **Lamp lumen maintenance factor**: Submit proposals.
- **Lamp survival factor**: Submit proposals.
- **Luminaire maintenance class**: Submit proposals.

- **Luminaire cleaning interval**: Refer to project specific documentation.
- **Luminaire maintenance factor**: Submit proposals.

240 Luminaire and lamp maintenance properties type B

Used by: 70-80-25/120 Amenity lighting system.

- **Lamp replacement method**: Refer to project specific documentation.
- **Lamp lumen maintenance factor**: Submit proposals.
- **Lamp survival factor**: Submit proposals.
- **Luminaire maintenance class**: Submit proposals.
- **Luminaire cleaning interval**: Refer to project specific documentation.
- **Luminaire maintenance factor**: Submit proposals.

250 Lighting performance type A

Used by: 70-80-25/110 Roadway lighting system.

- **Task area**: Refer to project specific documentation.
- **Maintained average illuminance level (lx)**: Refer to project specific documentation.
- **Colour rendering class (Ra)**: Refer to project specific documentation.
- **Uniformity (minimum)**: Refer to project specific documentation.

250 Lighting performance type B

Used by: 70-80-25/120 Amenity lighting system.

- **Task area**: Refer to project specific documentation.
- **Maintained average illuminance level (lx)**: Refer to project specific documentation.
- **Colour rendering class (Ra)**: Refer to project specific documentation.
- **Uniformity (minimum)**: Refer to project specific documentation.

270 Lighting cables generally type A

Used by: 70-80-25/110 Roadway lighting system.

- **Standard**: In accordance with BS 7671.
- **Proposed selection of low voltage cables**: Submit drawings, technical information, calculations and manufacturers' literature.
- **Conductor sizes (minimum)**:
  - **Lighting circuits**: Refer to project specific documentation.
  - **Final connection**: Refer to project specific documentation.
- **Cable sizes not stated**: Submit.
- **Format**: Amtech.

270 Lighting cables generally type B

Used by: 70-80-25/120 Amenity lighting system.

- **Standard**: In accordance with BS 7671.
- **Proposed selection of low voltage cables**: Submit drawings, technical information, calculations and manufacturers' literature.
- **Conductor sizes (minimum)**:
  - **Lighting circuits**: Refer to project specific documentation.
  - **Final connection**: 0.75 mm².
- **Cable sizes not stated**: Submit.
- **Format**: Amtech.

280 Conduit, trunking and ducting generally type A

Used by: 70-80-25/110 Roadway lighting system.

- **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.

280 Conduit, trunking and ducting generally type B

Used by: 70-80-25/120 Amenity lighting system.

- **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.

Execution

610 Removing external lighting systems type A

Used by: 70-80-25/110 Roadway lighting system.

- **Scope**: Refer to project specific documentation.

610 Removing external lighting systems type B

Used by: 70-80-25/120 Amenity lighting system.

- **Scope**: Refer to project specific documentation.

620 Installing roadway and amenity lighting systems generally type A

Used by: 70-80-25/110 Roadway lighting system.

- **Standard**: In accordance with BS 7671 and To Highways EnglandSpecification for highway works Volume 1.

620 Installing roadway and amenity lighting systems generally type B

Used by: 70-80-25/120 Amenity lighting system.

- **Standard**: Refer to project specific documentation.

630 Modifying existing external lighting systems type A

Used by: 70-80-25/110 Roadway lighting system.

- **Existing luminaires**: Clean.
- **Existing lamps**: Replace.

630 Modifying existing external lighting systems type B

Used by: 70-80-25/120 Amenity lighting system.

- **Existing luminaires**: Clean.
- **Existing lamps**: Replace.

720 Cleaning type A

Used by: 70-80-25/110 Roadway lighting system.

- **Electrical equipment**: Clean immediately before handover.

720 Cleaning type B

Used by: 70-80-25/120 Amenity lighting system.

- **Electrical equipment**: Clean immediately before handover.

System completion

810 Inspection and testing of road lighting

Used by: 70-80-25/110 Roadway lighting system.

- **Standard**: To Highways EnglandSpecification for highways works Volume 1.

812 Commissioning type A

Used by: 70-80-25/110 Roadway lighting system.

- **Setting for control devices**: Submit.
- **Operation of control devices**: Verify.
- **Orientation of adjustable luminaires**: Adjust to give optimum performance.

812 Commissioning type B

Used by: 70-80-25/120 Amenity lighting system.

- **Setting for control devices**: Submit.
- **Operation of control devices**: Verify.
- **Orientation of adjustable luminaires**: Adjust to give optimum performance.

815 Photometric survey of road lighting systems

Used by: 70-80-25/110 Roadway lighting system.

- **Standard**: In accordance with BS EN 13201-4, Annex A.

817 Photometric survey of amenity lighting systems

Used by: 70-80-25/120 Amenity lighting system.

- **Standards**: In accordance with CIBSELighting Guide: LG 6.
- **Results**:
  - **Submit for the following**: Maintained average illuminance;
    Diversity;
    and Uniformity.
    Format: Refer to project specific documentation.

820 Documentation type A

Used by: 70-80-25/110 Roadway lighting 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.
- **Record drawings**:
  - **Content**: General arrangement drawings showing the location of columns, electrical cut outs, enclosures for remote control gear, luminaires, time switches, daylight sensors and cable distribution cabinets and Schematic diagram showing all final circuit cabling, the cable origin, 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, and number of cables in ducts, on tray or ladder.
  - **Format**: A1 paper print drawing and Electronic drawing.
- **Submittal date**: At handover.

820 Documentation type B

Used by: 70-80-25/120 Amenity lighting 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.

- **Record drawings**:
  - **Content**: Schematic diagram showing all final circuit cabling, the cable origin, 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, and number of cables in ducts, on tray or ladder.
  - **Format**: A1 paper print drawing and Electronic drawing.
- **Submittal date**: At handover.

830 Spares type A

Used by: 70-80-25/110 Roadway lighting system.

- **Sensors**: Refer to project specific documentation.
- **Lamps**:
  - **Quantity of each type to be supplied**: Refer to project specific documentation.
  - **Labelling**: Label the lamps with the corresponding luminaire reference.
- **Lighting column access door keys**: Refer to project specific documentation.
- **Padlock keys**: Refer to project specific documentation.

830 Spares type B

Used by: 70-80-25/120 Amenity lighting system.

- **Sensors**: Refer to project specific documentation.
- **Lamps**:
  - **Quantity of each type to be supplied**: Refer to project specific documentation.
  - **Labelling**: Label the lamps with the corresponding luminaire reference.
- **Lighting column access door keys**: Refer to project specific documentation.
- **Padlock keys**: Refer to project specific documentation.

840 Maintenance type A

Used by: 70-80-25/110 Roadway lighting system.

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

840 Maintenance type B

Used by: 70-80-25/120 Amenity lighting system.

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

Ω End of section

70-80-35 General lighting systems

System outline

110 Hard wired general lighting system

- **System performance**: 70-80-35/210 Design of general lighting systems type A;
  70-80-35/215 Design of emergency lighting systems type A;
  70-80-35/220 Escape route lighting type A;
  70-80-35/225 Open area lighting type A;
  70-80-35/230 High risk task area lighting type A;
  70-80-35/235 Standby lighting type A;
  70-80-35/240 Lighting performance type A;
  70-80-35/245 Maintenance factor calculations type A;
  70-80-35/250 Luminaire and lamp maintenance properties type A;
  70-80-35/270 Lighting cables generally type A;
  and 70-80-35/280 Conduit, trunking and ducting generally type A.
- **Final circuit cabling**: Refer to project specific documentation.
- **Containment**: Refer to project specific documentation.
- **Rewireable installation**: Required.
- **Concealed installation**: Required.
- **Luminaire types**: 90-60-50/405 General purpose luminaires type C and 90-60-50/410 Combined emergency luminaires type A.
- **Connections to luminaires**: 90-50-45/380 Lighting distribution boxes type A;
  90-60-25/430 Luminaire supporting couplers type A;
  90-60-25/435 Safety pendant lampholders;
  90-60-25/440 Safety pendant sets;
  90-60-50/365 Bayonet lampholders;
  and 90-60-50/370 Edison screw lampholders.
- **Lighting controls**: 90-60-25/325 Light switches type A;
  90-60-25/330 Dimmer switches and controls type A;
  90-60-25/420 Ceiling light switches;
  90-65-05/400 Automatic emergency lighting test panels type A;
  90-65-05/405 Lighting control modules type A;
  90-65-05/410 Combined daylight and occupancy detectors type A;
  90-65-05/415 Daylight sensors type A;
  90-65-05/420 Extra-low voltage occupancy detectors type A;
  90-65-05/425 Mains voltage occupancy detectors type A;
  90-65-05/430 Photoelectric control units type C;
  and 90-65-25/380 Time switches type B.
- **Accessories**: 90-60-40/440 Static inverter power supply units type A;
  90-60-50/430 Lighting tracks type A;

90-60-50/455 Luminaire smoke hoods type A;
and 90-60-50/470 Separated extra-low voltage lighting transformers type B.

- **Electrical identification**: 90-90-55/320 Electrical shock treatment signs type A;
  90-90-55/390 Equipment labels and warning notices;
  and 90-90-55/395 Electrical diagrams.
- **Execution**: 70-80-35/610 Removing lighting systems type A;
  70-80-35/620 Modifying existing lighting systems type A;
  70-80-35/630 Installing general lighting systems type A;
  70-80-35/640 Installing emergency lighting systems type A;
  70-80-35/650 Installing d.c. central battery and static inverter power supply units type A;
  70-80-35/660 Installing electrical low mounted way-guidance lighting systems type A;
  70-80-35/670 Installing photoluminescent low mounted way-guidance lighting systems type A;
  70-80-35/680 Installing optical fibre emergency lighting type A;
  70-80-35/690 Assembling ceiling roses, flex and lampholders type A;
  70-80-35/710 Installing safety signs type A;
  and 70-80-35/720 Labelling of lighting controls type A.
- **System completion**: 70-80-35/810 Testing and commissioning of general lighting systems type A;
  70-80-35/812 Testing and commissioning emergency lighting systems type A;
  70-80-35/812 Testing and commissioning emergency lighting systems type D;
  70-80-35/812 Testing and commissioning emergency lighting systems type E;
  70-80-35/815 Photometric survey of general lighting systems type A;
  70-80-35/817 Photometric survey of emergency lighting systems type A;
  70-80-35/820 Documentation relating to general lighting type A;
  70-80-35/822 Documentation relating to emergency lighting type A;
  70-80-35/830 Spares type A;
  70-80-35/830 Spares type C;
  and 70-80-35/840 Maintenance type A.

120 General lighting systems with prefabricated wiring

- **System performance**: 70-80-35/210 Design of general lighting systems type B;
  70-80-35/215 Design of emergency lighting systems type B;
  70-80-35/220 Escape route lighting type B;
  70-80-35/225 Open area lighting type B;
  70-80-35/230 High risk task area lighting type B;
  70-80-35/235 Standby lighting type B;
  70-80-35/240 Lighting performance type B;
  70-80-35/245 Maintenance factor calculations type B;
  70-80-35/250 Luminaire and lamp maintenance properties type B;
  70-80-35/270 Lighting cables generally type B;
  and 70-80-35/280 Conduit, trunking and ducting generally type B.
- **System components**: 90-50-45/360 Master distribution boxes;

90-50-45/380 Lighting distribution boxes type B;
90-55-15/465 Home run cables type A;
90-55-15/490 Starter leads type A;
90-55-15/470 Lighting extender leads;
90-55-15/475 Luminaire connection cables;
90-55-15/495 Switch connection leads;
90-55-15/450 T connectors;
and 90-60-25/415 Switch modules for prefabricated wiring.

- **Containment**: Refer to project specific documentation.
- **Rewireable installation**: Required.
- **Concealed installation**: Required.
- **Luminaire types**: 90-60-50/405 General purpose luminaires type D and 90-60-50/410 Combined emergency luminaires type B.
- **Lighting controls**: 90-60-25/325 Light switches type B;
  90-60-25/330 Dimmer switches and controls type B;
  90-65-05/400 Automatic emergency lighting test panels type B;
  90-65-05/405 Lighting control modules type B;
  90-65-05/410 Combined daylight and occupancy detectors type B;
  90-65-05/415 Daylight sensors type B;
  90-65-05/420 Extra-low voltage occupancy detectors type B;
  90-65-05/425 Mains voltage occupancy detectors type B;
  90-65-05/430 Photoelectric control units type D;
  and 90-65-25/380 Time switches type C.
- **Accessories**: 90-60-40/440 Static inverter power supply units type B;
  90-60-50/430 Lighting tracks type B;
  90-60-50/455 Luminaire smoke hoods type B;
  and 90-60-50/470 Separated extra-low voltage lighting transformers type C.
- **Electrical identification**: 90-90-55/320 Electrical shock treatment signs type A;
  90-90-55/390 Equipment labels and warning notices;
  and 90-90-55/395 Electrical diagrams.
- **Execution**: 70-80-35/610 Removing lighting systems type B;
  70-80-35/620 Modifying existing lighting systems type B;
  70-80-35/630 Installing general lighting systems type B;
  70-80-35/660 Installing electrical low mounted way-guidance lighting systems type B;
  70-80-35/670 Installing photoluminescent low mounted way-guidance lighting systems type B;
  70-80-35/680 Installing optical fibre emergency lighting type B;
  70-80-35/690 Assembling ceiling roses, flex and lampholders type B;
  70-80-35/700 Installing prefabricated wiring;
  70-80-35/710 Installing safety signs type B;
  and 70-80-35/720 Labelling of lighting controls type B.

- **System completion**: 70-80-35/810 Testing and commissioning of general lighting systems type B;
  70-80-35/812 Testing and commissioning emergency lighting systems type B;
  70-80-35/812 Testing and commissioning emergency lighting systems type F;
  70-80-35/815 Photometric survey of general lighting systems type B;
  70-80-35/817 Photometric survey of emergency lighting systems type B;
  70-80-35/820 Documentation relating to general lighting type B;
  70-80-35/822 Documentation relating to emergency lighting type B;
  70-80-35/830 Spares type B;
  and 70-80-35/840 Maintenance type B.

130 Central battery supplied emergency lighting system

- **System performance**: 70-80-35/215 Design of emergency lighting systems type C;
  70-80-35/220 Escape route lighting type C;
  70-80-35/225 Open area lighting type C;
  70-80-35/230 High risk task area lighting type C;
  70-80-35/235 Standby lighting type C;
  70-80-35/240 Lighting performance type C;
  70-80-35/245 Maintenance factor calculations type C;
  70-80-35/250 Luminaire and lamp maintenance properties type C;
  70-80-35/260 Operating conditions for d.c. central supply and static inverter power supply units;
  70-80-35/270 Lighting cables generally type C;
  and 70-80-35/280 Conduit, trunking and ducting generally type C.
- **Emergency power source**: Refer to project specific documentation.
- **Final circuit cabling**: Refer to project specific documentation.
- **Containment**: Refer to project specific documentation.
- **Rewireable installation**: Required.
- **Concealed installation**: Required.
- **Connections to luminaires**: 90-60-25/430 Luminaire supporting couplers type B.
- **Luminaire types**: 90-60-50/410 Combined emergency luminaires type C.
- **Lighting controls**: 90-60-25/325 Light switches type C and 90-65-05/400 Automatic emergency lighting test panels type C.
- **Accessories**: 90-60-50/430 Lighting tracks type C and 90-60-50/455 Luminaire smoke hoods type C.
- **Electrical identification**: 90-90-55/320 Electrical shock treatment signs type A;
  90-90-55/390 Equipment labels and warning notices;
  and 90-90-55/395 Electrical diagrams.
- **Execution**: 70-80-35/610 Removing lighting systems type C;
  70-80-35/620 Modifying existing lighting systems type C;
  70-80-35/640 Installing emergency lighting systems type B;
  70-80-35/650 Installing d.c. central battery and static inverter power supply units type B;

70-80-35/660 Installing electrical low mounted way-guidance lighting systems type C;
70-80-35/670 Installing photoluminescent low mounted way-guidance lighting systems type C;
70-80-35/680 Installing optical fibre emergency lighting type C;
70-80-35/690 Assembling ceiling roses, flex and lampholders type C;
70-80-35/710 Installing safety signs type C;
and 70-80-35/720 Labelling of lighting controls type C.

- **System completion**: 70-80-35/812 Testing and commissioning emergency lighting systems type C;
  70-80-35/812 Testing and commissioning emergency lighting systems type G;
  70-80-35/817 Photometric survey of emergency lighting systems type C;
  70-80-35/822 Documentation relating to emergency lighting type C;
  70-80-35/830 Spares type D;
  and 70-80-35/840 Maintenance type C.

System performance

210 Design of general lighting systems type A

Used by: 70-80-35/110 Hard wired general lighting system.

- **Design**: Refer to project specific documentation.
- **Standard**: Refer to project specific documentation.
- **Average power density energy consumption (maximum)**: Refer to project specific documentation.
- **Initial circuit luminous efficacy (minimum)**: Refer to project specific documentation.
- **Submit the following information**: Luminaire layout drawings.Luminaire photometric data, including flux fraction ratios, polar intensity curves and utilization factors.Luminaire spacing tables;
  Lamp and luminaire technical information.Computer generated point calculations with contribution from inter-reflected light showing isolux contour plots for working plane and room surfaces;
  Room surface reflectance values.Schedule of design and calculated maintained average illuminance values;
  and Schedule of design and calculated uniformity values.

210 Design of general lighting systems type B

Used by: 70-80-35/120 General lighting systems with prefabricated wiring.

- **Design**: Refer to project specific documentation.
- **Standard**: Refer to project specific documentation.
- **Average power density energy consumption (maximum)**: Refer to project specific documentation.
- **Initial circuit luminous efficacy (minimum)**: Refer to project specific documentation.

- **Submit the following information**: Luminaire layout drawings.Luminaire photometric data, including flux fraction ratios, polar intensity curves and utilization factors.Luminaire spacing tables;
  Lamp and luminaire technical information.Computer generated point calculations with contribution from inter-reflected light showing isolux contour plots for working plane and room surfaces;
  Room surface reflectance values.Schedule of design and calculated maintained average illuminance values;
  and Schedule of design and calculated uniformity values.

215 Design of emergency lighting systems type A

Used by: 70-80-35/110 Hard wired general lighting system.

- **Design**: Complete the design of the emergency lighting and signage systems.
- **Standards**: To BS EN 1838, BS EN 50172 and in accordance with BS 5266-1. accordance with BS 5266-2;
  In accordance with BS 5266-4;
  and In accordance with BS 5266-6.
- **Submit the following information**: Luminaire layout drawings;
  Luminaire photometric data, including lamp light output data at beginning and end of battery discharge;
  Luminaire spacing tables;
  Lamp and luminaire technical information;
  Isolux contour plots.Schedule of design and calculated maintained average illuminance values;
  and Schedule of design and calculated uniformity values.
- **Emergency lighting classification**:
  - **Type**: Refer to project specific documentation.
  - **Mode of operation**: Refer to project specific documentation.
  - **Facilities**: Refer to project specific documentation.
  - **Duration of emergency mode**: Refer to project specific documentation.

215 Design of emergency lighting systems type B

Used by: 70-80-35/120 General lighting systems with prefabricated wiring.

- **Design**: Complete the design of the emergency lighting and signage systems.
- **Standards**: To BS EN 1838, BS EN 50172 and in accordance with BS 5266-1. accordance with BS 5266-2;
  In accordance with BS 5266-4;
  and In accordance with BS 5266-6.
- **Submit the following information**: Luminaire layout drawings;
  Luminaire photometric data, including lamp light output data at beginning and end of battery discharge;
  Luminaire spacing tables;

Lamp and luminaire technical information;
Isolux contour plots.Schedule of design and calculated maintained average illuminance values; and Schedule of design and calculated uniformity values.

- **Emergency lighting classification**:
  - **Type**: Refer to project specific documentation.
  - **Mode of operation**: Refer to project specific documentation.
  - **Facilities**: Refer to project specific documentation.
  - **Duration of emergency mode**: Refer to project specific documentation.

215 Design of emergency lighting systems type C

Used by: 70-80-35/130 Central battery supplied emergency lighting system.

- **Design**: Complete the design of the emergency lighting and signage systems.
- **Standards**: To BS EN 1838, BS EN 50172 and in accordance with BS 5266-1. accordance with BS 5266-2;
  In accordance with BS 5266-4;
  and In accordance with BS 5266-6.
- **Submit the following information**: Luminaire layout drawings;
  Luminaire photometric data, including lamp light output data at beginning and end of battery discharge;
  Luminaire spacing tables;
  Lamp and luminaire technical information;
  Isolux contour plots.Schedule of design and calculated maintained average illuminance values; and Schedule of design and calculated uniformity values.
- **Emergency lighting classification**:
  - **Type**: Refer to project specific documentation.
  - **Mode of operation**: Refer to project specific documentation.
  - **Facilities**: Refer to project specific documentation.
  - **Duration of emergency mode**: Refer to project specific documentation.

220 Escape route lighting type A

Used by: 70-80-35/110 Hard wired general lighting system.

- **Position**: Refer to project specific documentation.
- **Minimum horizontal illuminance at floor level on centre line of escape route**: 1 lx.

220 Escape route lighting type B

Used by: 70-80-35/120 General lighting systems with prefabricated wiring.

- **Position**: Refer to project specific documentation.
- **Minimum horizontal illuminance at floor level on centre line of escape route**: 1 lx.

220 Escape route lighting type C

Used by: 70-80-35/130 Central battery supplied emergency lighting system.

- **Position**: Refer to project specific documentation.
- **Minimum horizontal illuminance at floor level on centre line of escape route**: 1 lx.

225 Open area lighting type A

Used by: 70-80-35/110 Hard wired general lighting system.

- **Position**: Refer to project specific documentation.

225 Open area lighting type B

Used by: 70-80-35/120 General lighting systems with prefabricated wiring.

- **Position**: Refer to project specific documentation.

225 Open area lighting type C

Used by: 70-80-35/130 Central battery supplied emergency lighting system.

- **Position**: Refer to project specific documentation.

230 High risk task area lighting type A

Used by: 70-80-35/110 Hard wired general lighting system.

- **Position**: Refer to project specific documentation.
- **Minimum maintained illuminance on the reference plane**: Refer to project specific documentation.

230 High risk task area lighting type B

Used by: 70-80-35/120 General lighting systems with prefabricated wiring.

- **Position**: Refer to project specific documentation.
- **Minimum maintained illuminance on the reference plane**: Refer to project specific documentation.

230 High risk task area lighting type C

Used by: 70-80-35/130 Central battery supplied emergency lighting system.

- **Position**: Refer to project specific documentation.
- **Minimum maintained illuminance on the reference plane**: Refer to project specific documentation.

235 Standby lighting type A

Used by: 70-80-35/110 Hard wired general lighting system.

- **Position**: Refer to project specific documentation.

- **Minimum illuminance on the working plane**: Refer to project specific documentation.

235 Standby lighting type B

Used by: 70-80-35/120 General lighting systems with prefabricated wiring.

- **Position**: Refer to project specific documentation.
- **Minimum illuminance on the working plane**: Refer to project specific documentation.

235 Standby lighting type C

Used by: 70-80-35/130 Central battery supplied emergency lighting system.

- **Position**: Refer to project specific documentation.
- **Minimum illuminance on the working plane**: Refer to project specific documentation.

240 Lighting performance type A

Used by: 70-80-35/110 Hard wired general lighting system.

- **Task area**: Refer to project specific documentation.
- **Maintained average illuminance level (lx)**: Refer to project specific documentation.
- **Uniformity (minimum)**: Refer to project specific documentation.
- **Glare index (maximum)**: Refer to project specific documentation.
- **Colour temperature (K)**: Refer to project specific documentation.
- **Colour rendering class (Ra)**: Refer to project specific documentation.
- **Means of control**: Refer to project specific documentation.

240 Lighting performance type B

Used by: 70-80-35/120 General lighting systems with prefabricated wiring.

- **Task area**: Refer to project specific documentation.
- **Maintained average illuminance level (lx)**: Refer to project specific documentation.
- **Uniformity (minimum)**: Refer to project specific documentation.
- **Glare index (maximum)**: Refer to project specific documentation.
- **Colour temperature (K)**: Refer to project specific documentation.
- **Colour rendering class (Ra)**: Refer to project specific documentation.
- **Means of control**: Refer to project specific documentation.

240 Lighting performance type C

Used by: 70-80-35/130 Central battery supplied emergency lighting system.

- **Task area**: Refer to project specific documentation.
- **Maintained average illuminance level (lx)**: Refer to project specific documentation.
- **Uniformity (minimum)**: Refer to project specific documentation.
- **Glare index (maximum)**: Refer to project specific documentation.
- **Colour temperature (K)**: Refer to project specific documentation.

- **Colour rendering class (Ra)**: Refer to project specific documentation.
- **Means of control**: Refer to project specific documentation.

245 Maintenance factor calculations type A

Used by: 70-80-35/110 Hard wired general lighting system.

- **Luminaire maintenance strategy**: Refer to project specific documentation.
- **Lamp replacement strategy**: Refer to project specific documentation.
- **Maintenance factors**: Refer to project specific documentation.

245 Maintenance factor calculations type B

Used by: 70-80-35/120 General lighting systems with prefabricated wiring.

- **Luminaire maintenance strategy**: Refer to project specific documentation.
- **Lamp replacement strategy**: Refer to project specific documentation.
- **Maintenance factors**: Refer to project specific documentation.

245 Maintenance factor calculations type C

Used by: 70-80-35/130 Central battery supplied emergency lighting system.

- **Luminaire maintenance strategy**: Refer to project specific documentation.
- **Lamp replacement strategy**: Refer to project specific documentation.
- **Maintenance factors**: Refer to project specific documentation.

250 Luminaire and lamp maintenance properties type A

Used by: 70-80-35/110 Hard wired general lighting system.

- **Lamp lumen maintenance factor**: Submit proposals.
- **Lamp survival factor**: Submit proposals.
- **Luminaire maintenance class**: Submit proposals.
- **Luminaire cleaning interval**: Refer to project specific documentation.
- **Luminaire maintenance factor**: Submit proposals.
- **Room surface cleaning interval**: Refer to project specific documentation.
- **Room surface maintenance factor**: Submit proposals.

250 Luminaire and lamp maintenance properties type B

Used by: 70-80-35/120 General lighting systems with prefabricated wiring.

- **Lamp lumen maintenance factor**: Submit proposals.
- **Lamp survival factor**: Submit proposals.
- **Luminaire maintenance class**: Submit proposals.
- **Luminaire cleaning interval**: Refer to project specific documentation.
- **Luminaire maintenance factor**: Submit proposals.
- **Room surface cleaning interval**: Refer to project specific documentation.

- **Room surface maintenance factor**: Submit proposals.

250 Luminaire and lamp maintenance properties type C

Used by: 70-80-35/130 Central battery supplied emergency lighting system.

- **Lamp lumen maintenance factor**: Submit proposals.
- **Lamp survival factor**: Submit proposals.
- **Luminaire maintenance class**: Submit proposals.
- **Luminaire cleaning interval**: Refer to project specific documentation.
- **Luminaire maintenance factor**: Submit proposals.
- **Room surface cleaning interval**: Refer to project specific documentation.
- **Room surface maintenance factor**: Submit proposals.

260 Operating conditions for d.c. central supply and static inverter power supply units

Used by: 70-80-35/130 Central battery supplied emergency lighting system.

- **Operating conditions**:
  - **Altitude**: Less than 1000 m above sea level.
  - **Ambient service temperature**:
    - **Minimum**: Refer to project specific documentation.
    - **Maximum**: Refer to project specific documentation.
  - **Ambient relative humidity**: Less than 85%, non-condensing.

270 Lighting cables generally type A

Used by: 70-80-35/110 Hard wired general lighting system.

- **Standard**: In accordance with BS 7671.
- **Proposed selection of low voltage cables**: Submit drawings, technical information, calculations and manufacturers' literature.
- **Conductor sizes (minimum)**:
  - **Lighting circuits**: Refer to project specific documentation.
  - **Final connection**: Refer to project specific documentation.
- **Cable sizes not stated**: Submit.
- **Format**: Amtech.

270 Lighting cables generally type B

Used by: 70-80-35/120 General lighting systems with prefabricated wiring.

- **Standard**: In accordance with BS 7671.
- **Proposed selection of low voltage cables**: Submit drawings, technical information, calculations and manufacturers' literature.
- **Conductor sizes (minimum)**:
  - **Lighting circuits**: Refer to project specific documentation.

  - **Final connection**: Refer to project specific documentation.
- **Cable sizes not stated**: Submit.
- **Format**: Amtech.

270 Lighting cables generally type C

Used by: 70-80-35/130 Central battery supplied emergency lighting system.

- **Standard**: In accordance with BS 7671.
- **Proposed selection of low voltage cables**: Submit drawings, technical information, calculations and manufacturers' literature.
- **Conductor sizes (minimum)**:
  - **Lighting circuits**: Refer to project specific documentation.
  - **Final connection**: Refer to project specific documentation.
- **Cable sizes not stated**: Submit.
- **Format**: Amtech.

280 Conduit, trunking and ducting generally type A

Used by: 70-80-35/110 Hard wired general lighting system.

- **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.

280 Conduit, trunking and ducting generally type B

Used by: 70-80-35/120 General lighting systems with prefabricated wiring.

- **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.

280 Conduit, trunking and ducting generally type C

Used by: 70-80-35/130 Central battery supplied emergency lighting system.

- **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.

Execution

610 Removing lighting systems type A

Used by: 70-80-35/110 Hard wired general lighting system.

- **Scope**: Refer to project specific documentation.
- **Disposal of batteries**: In accordance with manufacturer's recommended procedures.

610 Removing lighting systems type B

Used by: 70-80-35/120 General lighting systems with prefabricated wiring.

- **Scope**: Refer to project specific documentation.
- **Disposal of batteries**: In accordance with manufacturer's recommended procedures.

610 Removing lighting systems type C

Used by: 70-80-35/130 Central battery supplied emergency lighting system.

- **Scope**: Refer to project specific documentation.
- **Disposal of batteries**: In accordance with manufacturer's recommended procedures.

620 Modifying existing lighting systems type A

Used by: 70-80-35/110 Hard wired general lighting system.

- **Existing luminaires**: Clean.
- **Existing lamps**: Replace.

620 Modifying existing lighting systems type B

Used by: 70-80-35/120 General lighting systems with prefabricated wiring.

- **Existing luminaires**: Clean.
- **Existing lamps**: Replace.

620 Modifying existing lighting systems type C

Used by: 70-80-35/130 Central battery supplied emergency lighting system.

- **Existing luminaires**: Clean.
- **Existing lamps**: Replace.

630 Installing general lighting systems type A

Used by: 70-80-35/110 Hard wired general lighting system.

- **Standard**: In accordance with BS 7671 and CIBSECommissioning Code L.
- **Commissioning method statement**: Submit prior to commissioning.
- **Luminaire layout**: Refer to architectural reflected ceiling plan
- **Fixing master/ lighting distribution boxes**: Refer to project specific documentation.
- **Connection of luminaire supporting couplers**:
  - **General luminaires**: White plug with white cover.
  - **Flex length (maximum)**: Refer to project specific documentation.
- **Switches and controls**:
  - **Location**: Refer to general arrangements

  - **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.

630 Installing general lighting systems type B

Used by: 70-80-35/120 General lighting systems with prefabricated wiring.

- **Standard**: In accordance with BS 7671 and CIBSECommissioning Code L.
- **Commissioning method statement**: Submit prior to commissioning.
- **Luminaire layout**: Refer to architectural reflected ceiling plan
- **Fixing master/ lighting distribution boxes**: Refer to project specific documentation.
- **Connection of luminaire supporting couplers**:
  - **General luminaires**: White plug with white cover.
  - **Flex length (maximum)**: Refer to project specific documentation.
- **Switches and controls**:
  - **Location**: Refer to general arrangements
  - **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.

640 Installing emergency lighting systems type A

Used by: 70-80-35/110 Hard wired general lighting system.

- **Standards**: In accordance with BS 5266-1 and BS 7671.
- **Connection of luminaire supporting couplers**:
  - **Emergency luminaires**: Red plug with red cover.
  - **Flex length (maximum)**: Refer to project specific documentation.
- **Permanent electrical supplies to self contained emergency luminaires**: Derive from the closest general lighting circuit.

640 Installing emergency lighting systems type B

Used by: 70-80-35/130 Central battery supplied emergency lighting system.

- **Standards**: In accordance with BS 5266-1 and BS 7671.
- **Connection of luminaire supporting couplers**:
  - **Emergency luminaires**: Red plug with red cover.
  - **Flex length (maximum)**: Refer to project specific documentation.
- **Permanent electrical supplies to self contained emergency luminaires**: Derive from the closest general lighting circuit.

650 Installing d.c. central battery and static inverter power supply units type A

Used by: 70-80-35/110 Hard wired general lighting system.

- **Standards**: To BS EN 50171 and in accordance with BS 5266-1.
- **Mains power supply**: Connect incoming mains supply.
- **Arrangement**:
  - **Emergency luminaires**: Connect outgoing circuits to mains and emergency luminaires.
  - **Maintained systems**: Connect hold-off relays to monitor mains lighting circuits so that in the event of a sub circuit failure, a maintained supply is provided to energise the emergency luminaires.
  - **Non maintained systems**: Connect sub-circuit relays to local sub-circuits so that under healthy mains conditions, the emergency supply is held in standby mode. Failure of one or more sub-circuits to activate changeover contactor and emergency supply from the battery to be energized.
- **Remote monitoring**: Refer to project specific documentation.

650 Installing d.c. central battery and static inverter power supply units type B

Used by: 70-80-35/130 Central battery supplied emergency lighting system.

- **Standards**: To BS EN 50171 and in accordance with BS 5266-1.
- **Mains power supply**: Connect incoming mains supply.
- **Arrangement**:
  - **Emergency luminaires**: Connect outgoing circuits to mains and emergency luminaires.
  - **Maintained systems**: Connect hold-off relays to monitor mains lighting circuits so that in the event of a sub circuit failure, a maintained supply is provided to energise the emergency luminaires.
  - **Non maintained systems**: Connect sub-circuit relays to local sub-circuits so that under healthy mains conditions, the emergency supply is held in standby mode. Failure of one or more sub-circuits to activate changeover contactor and emergency supply from the battery to be energized.
- **Remote monitoring**: Refer to project specific documentation.

660 Installing electrical low mounted way-guidance lighting systems type A

Used by: 70-80-35/110 Hard wired general lighting system.

- **Standards**: In accordance with BS 5266-1 and BS 5266-2.
- **Position**: Refer to project specific documentation.

660 Installing electrical low mounted way-guidance lighting systems type B

Used by: 70-80-35/120 General lighting systems with prefabricated wiring.

- **Standards**: In accordance with BS 5266-1 and BS 5266-2.
- **Position**: Refer to project specific documentation.

660 Installing electrical low mounted way-guidance lighting systems type C

Used by: 70-80-35/130 Central battery supplied emergency lighting system.

- **Standards**: In accordance with BS 5266-1 and BS 5266-2.
- **Position**: Refer to project specific documentation.

670 Installing photoluminescent low mounted way-guidance lighting systems type A

Used by: 70-80-35/110 Hard wired general lighting system.

- **Standards**: In accordance with BS 5266-1 and BS 5266-6.
- **Position**: Refer to project specific documentation.

670 Installing photoluminescent low mounted way-guidance lighting systems type B

Used by: 70-80-35/120 General lighting systems with prefabricated wiring.

- **Standards**: In accordance with BS 5266-1 and BS 5266-6.
- **Position**: Refer to project specific documentation.

670 Installing photoluminescent low mounted way-guidance lighting systems type C

Used by: 70-80-35/130 Central battery supplied emergency lighting system.

- **Standards**: In accordance with BS 5266-1 and BS 5266-6.
- **Position**: Refer to project specific documentation.

680 Installing optical fibre emergency lighting type A

Used by: 70-80-35/110 Hard wired general lighting system.

- **Standards**: In accordance with BS 5266-1 and BS 5266-4.
- **Lamp source locations**: Refer to project specific documentation.
- **Remote fault indicators**:
  - **Location**: Refer to project specific documentation.
  - **Interconnecting wiring**: Refer to project specific documentation.
- **Lightguide installation**:
  - **Arrangement**: Position vertically and horizontally in line with equipment served, and parallel with building lines.
  - **Orientation**: Dress lightguides flat, free from twists, kinks and strain.
  - **Distance from other cables (minimum)**: 300 mm.
  - **Internal bending radius (minimum)**: Eight times the and outside diameter of the lightguide.
  - **Supports (minimum)**: 400 mm.
    150 mm either side of bends.
- **Lightguide termination**:
  - **Location**: Refer to project specific documentation.
  - **Covering and fibre bundle**: Permanently anchor to the connector body.
  - **Sealing**: Secure fibre bundle into the connector.
  - **End polishing**: Trim to provide surface finish better than 5 ± µm.

680 Installing optical fibre emergency lighting type B

Used by: 70-80-35/120 General lighting systems with prefabricated wiring.

- **Standards**: In accordance with BS 5266-1 and BS 5266-4.
- **Lamp source locations**: Refer to project specific documentation.
- **Remote fault indicators**:
  - **Location**: Refer to project specific documentation.
  - **Interconnecting wiring**: Refer to project specific documentation.
- **Lightguide installation**:
  - **Arrangement**: Position vertically and horizontally in line with equipment served, and parallel with building lines.
  - **Orientation**: Dress lightguides flat, free from twists, kinks and strain.
  - **Distance from other cables (minimum)**: 300 mm.
  - **Internal bending radius (minimum)**: Eight times the and outside diameter of the lightguide.
  - **Supports (minimum)**: 400 mm.
    150 mm either side of bends.
- **Lightguide termination**:
  - **Location**: Refer to project specific documentation.
  - **Covering and fibre bundle**: Permanently anchor to the connector body.
  - **Sealing**: Secure fibre bundle into the connector.
  - **End polishing**: Trim to provide surface finish better than 5 ± µm.

680 Installing optical fibre emergency lighting type C

Used by: 70-80-35/130 Central battery supplied emergency lighting system.

- **Standards**: In accordance with BS 5266-1 and BS 5266-4.
- **Lamp source locations**: Refer to project specific documentation.
- **Remote fault indicators**:
  - **Location**: Refer to project specific documentation.
  - **Interconnecting wiring**: Refer to project specific documentation.
- **Lightguide installation**:
  - **Arrangement**: Position vertically and horizontally in line with equipment served, and parallel with building lines.
  - **Orientation**: Dress lightguides flat, free from twists, kinks and strain.
  - **Distance from other cables (minimum)**: 300 mm.
  - **Internal bending radius (minimum)**: Eight times the and outside diameter of the lightguide.
  - **Supports (minimum)**: 400 mm.
    150 mm either side of bends.
- **Lightguide termination**:
  - **Location**: Refer to project specific documentation.

- **Covering and fibre bundle**: Permanently anchor to the connector body.
- **Sealing**: Secure fibre bundle into the connector.
- **End polishing**: Trim to provide surface finish better than 5 ± µm.

690 Assembling ceiling roses, flex and lampholders type A

Used by: 70-80-35/110 Hard wired general lighting system.

- **Connections**: Interconnect flex between ceiling rose and lampholder.
- **Flex length (maximum)**: Refer to project specific documentation.

690 Assembling ceiling roses, flex and lampholders type B

Used by: 70-80-35/120 General lighting systems with prefabricated wiring.

- **Connections**: Interconnect flex between ceiling rose and lampholder.
- **Flex length (maximum)**: Refer to project specific documentation.

690 Assembling ceiling roses, flex and lampholders type C

Used by: 70-80-35/130 Central battery supplied emergency lighting system.

- **Connections**: Interconnect flex between ceiling rose and lampholder.
- **Flex length (maximum)**: Refer to project specific documentation.

700 Installing prefabricated wiring

Used by: 70-80-35/120 General lighting systems with prefabricated wiring.

- **Connection arrangement**: Form circuits using a male connector working away from any master distribution boxes.
- **Fixing cabling**:
  - **Maximum distance between clips**:
    Prefabricated LSZH insulated singles in flexible conduit: 1500 mm.
    Prefabricated LSZH insulated and sheathed multi-core: 500 mm.
  - **Clips**: Within 100 mm of each connector.
  - **Bends**: Not permitted within 150 mm of connectors.

710 Installing safety signs type A

Used by: 70-80-35/110 Hard wired general lighting system.

- **Standard**: Escape route signs in accordance with BS 5499-4, other safety signs in accordance with BS 5499-10.
- **Position**: Refer to project specific documentation.
- **Fixing**: To building fabric so that the removal of the sign requires a special tool.
- **Orientation**: Plumb and level.

710 Installing safety signs type B

Used by: 70-80-35/120 General lighting systems with prefabricated wiring.

- **Standard**: Escape route signs in accordance with BS 5499-4, other safety signs in accordance with BS 5499-10.
- **Position**: Refer to project specific documentation.
- **Fixing**: To building fabric so that the removal of the sign requires a special tool.
- **Orientation**: Plumb and level.

710 Installing safety signs type C

Used by: 70-80-35/130 Central battery supplied emergency lighting system.

- **Standard**: Escape route signs in accordance with BS 5499-4, other safety signs in accordance with BS 5499-10.
- **Position**: Refer to project specific documentation.
- **Fixing**: To building fabric so that the removal of the sign requires a special tool.
- **Orientation**: Plumb and level.

720 Labelling of lighting controls type A

Used by: 70-80-35/110 Hard wired general lighting system.

- **Equipment and sensor identification labels**: Provide.
- **Lighting controls**: Label each component describing its purpose.
- **Output circuits**: Label each cable at point of connection to lighting distribution boxes, master distribution boxes and lighting control modules.

720 Labelling of lighting controls type B

Used by: 70-80-35/120 General lighting systems with prefabricated wiring.

- **Equipment and sensor identification labels**: Provide.
- **Lighting controls**: Label each component describing its purpose.
- **Output circuits**: Label each cable at point of connection to lighting distribution boxes, master distribution boxes and lighting control modules.

720 Labelling of lighting controls type C

Used by: 70-80-35/130 Central battery supplied emergency lighting system.

- **Equipment and sensor identification labels**: Provide.
- **Lighting controls**: Label each component describing its purpose.
- **Output circuits**: Label each cable at point of connection to lighting distribution boxes, master distribution boxes and lighting control modules.

System completion

810 Testing and commissioning of general lighting systems type A

Used by: 70-80-35/110 Hard wired general lighting system.

- **Commissioning**: In accordance with CIBSE Commissioning Code L.

- **Test results**: Submit two copies of system commissioning completion certificate.
- **Certificates of calibration for meters and instruments**: Submit.

810 Testing and commissioning of general lighting systems type B

Used by: 70-80-35/120 General lighting systems with prefabricated wiring.

- **Commissioning**: In accordance with CIBSE Commissioning Code L.
- **Test results**: Submit two copies of system commissioning completion certificate.
- **Certificates of calibration for meters and instruments**: Submit.

812 Testing and commissioning emergency lighting systems type A

Used by: 70-80-35/110 Hard wired general lighting system.

- **Commissioning**: In accordance with BS 5266-1, Annex H and In accordance with BS 5266-1, Annex I.
- **Results**: Refer to project specific documentation.
- **Certificates of calibration for meters and instruments**: Submit.

812 Testing and commissioning emergency lighting systems type B

Used by: 70-80-35/120 General lighting systems with prefabricated wiring.

- **Commissioning**: In accordance with BS 5266-1, Annex H and In accordance with BS 5266-1, Annex I.
- **Results**: Refer to project specific documentation.
- **Certificates of calibration for meters and instruments**: Submit.

812 Testing and commissioning emergency lighting systems type C

Used by: 70-80-35/130 Central battery supplied emergency lighting system.

- **Commissioning**: In accordance with BS 5266-1, Annex H and In accordance with BS 5266-1, Annex I.
- **Results**: Refer to project specific documentation.
- **Certificates of calibration for meters and instruments**: Submit.

812 Testing and commissioning emergency lighting systems type D

Used by: 70-80-35/110 Hard wired general lighting system.

- **Commissioning**: In accordance with BS 5266-1, Annex H and In accordance with BS 5266-1, Annex I.
- **Results**: Refer to project specific documentation.
- **Certificates of calibration for meters and instruments**: Submit.

812 Testing and commissioning emergency lighting systems type E

Used by: 70-80-35/110 Hard wired general lighting system.

- **Commissioning**: In accordance with BS 5266-1, Annex H and In accordance with BS 5266-1, Annex I.
- **Results**: Refer to project specific documentation.
- **Certificates of calibration for meters and instruments**: Submit.

812 Testing and commissioning emergency lighting systems type F

Used by: 70-80-35/120 General lighting systems with prefabricated wiring.

- **Commissioning**: In accordance with BS 5266-1, Annex H and In accordance with BS 5266-1, Annex I.
- **Results**: Refer to project specific documentation.
- **Certificates of calibration for meters and instruments**: Submit.

812 Testing and commissioning emergency lighting systems type G

Used by: 70-80-35/130 Central battery supplied emergency lighting system.

- **Commissioning**: In accordance with BS 5266-1, Annex H and In accordance with BS 5266-1, Annex I.
- **Results**: Refer to project specific documentation.
- **Certificates of calibration for meters and instruments**: Submit.

815 Photometric survey of general lighting systems type A

Used by: 70-80-35/110 Hard wired general lighting system.

- **Standard**: In accordance with CIBSESLL code for lighting.
- **Position**: Refer to project specific documentation.
- **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**: Refer to project specific documentation.
  - **Number of copies**: Refer to project specific documentation.
- **Survey photographs**: Submit for each location.

815 Photometric survey of general lighting systems type B

Used by: 70-80-35/120 General lighting systems with prefabricated wiring.

- **Standard**: In accordance with CIBSESLL code for lighting.
- **Position**: Refer to project specific documentation.
- **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**: Refer to project specific documentation.
  - **Number of copies**: Refer to project specific documentation.
- **Survey photographs**: Submit for each location.

817 Photometric survey of emergency lighting systems type A

Used by: 70-80-35/110 Hard wired general lighting system.

- **Standard**: In accordance with BS 5266-1, Annex D.
- **Position**: Refer to project specific documentation.
- **Test conditions**: Full blackout.
  Minimize extraneous light.
- **Results**:
  - **Format**: Refer to project specific documentation.
  - **Number of copies**: Refer to project specific documentation.

817 Photometric survey of emergency lighting systems type B

Used by: 70-80-35/120 General lighting systems with prefabricated wiring.

- **Standard**: In accordance with BS 5266-1, Annex D.
- **Position**: Refer to project specific documentation.
- **Test conditions**: Full blackout.
  Minimize extraneous light.
- **Results**:
  - **Format**: Refer to project specific documentation.
  - **Number of copies**: Refer to project specific documentation.

817 Photometric survey of emergency lighting systems type C

Used by: 70-80-35/130 Central battery supplied emergency lighting system.

- **Standard**: In accordance with BS 5266-1, Annex D.
- **Position**: Refer to project specific documentation.
- **Test conditions**: Full blackout.
  Minimize extraneous light.
- **Results**:
  - **Format**: Refer to project specific documentation.
  - **Number of copies**: Refer to project specific documentation.

820 Documentation relating to general lighting type A

Used by: 70-80-35/110 Hard wired general lighting 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**: Refer to project specific documentation.
- **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**: Refer to project specific documentation.
  - **Number of copies**: Refer to project specific documentation.
- **Submittal date**: At handover

820 Documentation relating to general lighting type B

Used by: 70-80-35/120 General lighting systems with prefabricated wiring.

- **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**: Refer to project specific documentation.
- **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**: Refer to project specific documentation.
  - **Number of copies**: Refer to project specific documentation.

- **Submittal date**: At handover

822 Documentation relating to emergency lighting type A

Used by: 70-80-35/110 Hard wired general lighting 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**: Refer to project specific documentation.
- **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**: Refer to project specific documentation.
  - **Number of copies**: Refer to project specific documentation.
- **Submittal date**: At handover.
- **Certification for re-engineered luminaires**: Submit completed ICEL 1004 model test record certificate.
- **Log book**: Submit, including the following information: Date of commissioning of the system, including any certificate relating to alterations;
  Date of each periodic inspection and test;
  Date and brief details of each service, inspection or test carried out;
  Dates and brief details of any defects and of remedial action taken;
  Date and brief details of any alteration to the emergency lighting installation;
  If any automatic testing device is employed, a description of the main characteristic and the mode of operation;
  Details of replacement components
  of luminaires such as lamp type, battery and fuses.

822 Documentation relating to emergency lighting type B

Used by: 70-80-35/120 General lighting systems with prefabricated wiring.

- **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**: Refer to project specific documentation.
- **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**: Refer to project specific documentation.
  - **Number of copies**: Refer to project specific documentation.
- **Submittal date**: At handover.
- **Certification for re-engineered luminaires**: Submit completed ICEL 1004 model test record certificate.
- **Log book**: Submit, including the following information: Date of commissioning of the system, including any certificate relating to alterations;
  Date of each periodic inspection and test;
  Date and brief details of each service, inspection or test carried out;
  Dates and brief details of any defects and of remedial action taken;
  Date and brief details of any alteration to the emergency lighting installation;
  If any automatic testing device is employed, a description of the main characteristic and the mode of operation;
  Details of replacement components
  of luminaires such as lamp type, battery and fuses.

822 Documentation relating to emergency lighting type C

Used by: 70-80-35/130 Central battery supplied emergency lighting 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**: Refer to project specific documentation.
- **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**: Refer to project specific documentation.
  - **Number of copies**: Refer to project specific documentation.
- **Submittal date**: At handover.
- **Certification for re-engineered luminaires**: Submit completed ICEL 1004 model test record certificate.
- **Log book**: Submit, including the following information: Date of commissioning of the system, including any certificate relating to alterations;
  Date of each periodic inspection and test;
  Date and brief details of each service, inspection or test carried out;
  Dates and brief details of any defects and of remedial action taken;
  Date and brief details of any alteration to the emergency lighting installation;
  If any automatic testing device is employed, a description of the main characteristic and the mode of operation;
  Details of replacement components
  of luminaires such as lamp type, battery and fuses.

830 Spares type A

Used by: 70-80-35/110 Hard wired general lighting system.

- **Test keys for secret keyswitches**: Three.
- **Sensors**: One of each type.
- **Lamps**:
  - **Labelling**: Label the lamps with the corresponding luminaire reference.

830 Spares type B

Used by: 70-80-35/120 General lighting systems with prefabricated wiring.

- **Test keys for secret keyswitches**: Three.
- **Sensors**: One of each type.
- **Lamps**:
  - **Labelling**: Label the lamps with the corresponding luminaire reference.

830 Spares type C

Used by: 70-80-35/110 Hard wired general lighting system.

- **Test keys for secret keyswitches**: Three.
- **Sensors**: One of each type.
- **Lamps**:

  - **Labelling**: Label the lamps with the corresponding luminaire reference.

830 Spares type D

Used by: 70-80-35/130 Central battery supplied emergency lighting system.

- **Test keys for secret keyswitches**: Three.
- **Sensors**: One of each type.
- **Lamps**:
  - **Labelling**: Label the lamps with the corresponding luminaire reference.

840 Maintenance type A

Used by: 70-80-35/110 Hard wired general lighting system.

- **Servicing and maintenance**: Undertake.
- **Duration**: Until 12 months after completion and Up to and including the first planned lamp replacement.

840 Maintenance type B

Used by: 70-80-35/120 General lighting systems with prefabricated wiring.

- **Servicing and maintenance**: Undertake.
- **Duration**: Until 12 months after completion and Up to and including the first planned lamp replacement.

840 Maintenance type C

Used by: 70-80-35/130 Central battery supplied emergency lighting system.

- **Servicing and maintenance**: Undertake.
- **Duration**: Until 12 months after completion and Up to and including the first planned lamp replacement.

Ω End of section

70-80-90 Underwater lighting systems

System outline

110 Underwater lighting system

- **System performance**: 70-80-90/210 Design of underwater lighting;
  70-80-90/270 Lighting cables generally;
  and 70-80-90/280 Conduit, trunking and ducting generally.
- **Cable type**: Refer to project specific documentation.
- **Containment**: Refer to project specific documentation.
- **Rewireable installation**: Required.
- **Concealed installation**: Required.
- **Luminaires**: 90-60-50/405 General purpose luminaires type E.
- **Connections to luminaires**: Refer to project specific documentation.
- **Controls**: 90-60-25/325 Light switches type D.
- **Accessories**: Refer to project specific documentation.
- **Electrical identification**: 90-90-55/320 Electrical shock treatment signs type A;
  90-90-55/390 Equipment labels and warning notices;
  and 90-90-55/395 Electrical diagrams.
- **Execution**: 70-80-90/610 Removing underwater lighting;
  70-80-90/615 Installation generally;
  70-80-90/620 Installing cable containment;
  and 70-80-90/630 Installing connection boxes.
- **System completion**: 70-80-90/810 Testing and commissioning;
  70-80-90/820 Documentation;
  70-80-90/830 Spares and consumables;
  and 70-80-90/840 Maintenance.

System performance

210 Design of underwater lighting

Used by: 70-80-90/110 Underwater lighting system.

- **Design**: Complete the design of the underwater lighting system.
- **Standards**: In accordance with BS 7671;
  In accordance with CIBSELighting Guide LG4;
  and In accordance with CIBSELighting Guide LG6.
- **Submit the following information**: Luminaire layout drawings.Luminaire photometric data including flux fraction ratios, polar intensity curves and utilization factors.Luminaire spacing tables;

Lamp and luminaire technical information.Computer generated point calculations with contribution from inter-reflected light showing isolux contour plots for working plane and room surfaces;
Schedule of design and calculated maintained average illuminance values;
and Schedule of design and calculated uniformity values.

270 Lighting cables generally

Used by: 70-80-90/110 Underwater lighting system.

- **Requirement**: Submit proposals including detailed design drawings, technical information, calculations and manufacturer's literature.
- **Conductor sizes (minimum)**:
  - **Lighting circuits**: Refer to project specific documentation.
  - **Final connection**: Refer to project specific documentation.
- **Cable sizes not stated**: Submit.
- **Format**: Amtech.

280 Conduit, trunking and ducting generally

Used by: 70-80-90/110 Underwater lighting system.

- **Requirement**: Submit proposals including detailed design drawings, technical information, calculations and manufacturers' literature.
- **Calculations for conduit, trunking and ducting sizes not stated**: Submit.

Execution

610 Removing underwater lighting

Used by: 70-80-90/110 Underwater lighting system.

- **Scope**: Refer to project specific documentation.

615 Installation generally

Used by: 70-80-90/110 Underwater lighting system.

- **Standard**: In accordance with BS 7671 and with CIBSECommissioning Code L.
- **Equipment**: Provide electrical supplies to equipment requiring power.
- **Luminaires**: Position to allow easy re-lamp and maintenance.
- **Transformer configuration**: Refer to project specific documentation.
- **Fixings**: Non-corrosive and compatible with the environment where they are installed.

620 Installing cable containment

Used by: 70-80-90/110 Underwater lighting system.

- **Timing**: Install concealed conduit and flush accessories before casting pool sides.
- **Protection of conduit**: Plug ends of conduits during pool structure installation works.

- **Integrity of concealed conduits**: Test and confirm all conduits undamaged after pool structure is completed.
- **Condition report**: Submit.

630 Installing connection boxes

Used by: 70-80-90/110 Underwater lighting system.

- **Position**: Refer to project specific documentation.
- **Fixing arrangement**: Set lid of box flush and coordinate with pool surround surface finish.

System completion

810 Testing and commissioning

Used by: 70-80-90/110 Underwater lighting system.

- **Standards**: In accordance with BS 7671 and CIBSE Commissioning Code L.
- **Installed length of cables**: Measure and submit report.
- **Separated extra low voltage (SELV) transformer tappings**: Calculate based upon installed cable length to underwater luminaire.
- **Setting for control devices**: Submit.
- **Operation of control devices**: Commission and verify correct operation.
- **Orientation of adjustable luminaires**: Adjust to give optimum performance.
- **Test and commissioning results**: Submit.

820 Documentation

Used by: 70-80-90/110 Underwater lighting 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, cleaning and maintenance requirements and manufacturers' instructions relating to the renewal of seals and gaskets.
  - **Format**: Paper copy.
  - **Number of copies**: Refer to project specific documentation.
- **Record drawings**:
  - **Content**: General arrangement drawings showing the location of luminaires, connection boxes, separated extra-low voltage lighting transformers, manual and automatic switches and controls including time switches;
    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;

and Tapping connections for each SELV transformer installed.
  - **Format**: Refer to project specific documentation.
  - **Number of copies**: Refer to project specific documentation.
- **Submittal date**: At handover.

830 Spares and consumables

Used by: 70-80-90/110 Underwater lighting system.

- **Supply the following spares**: Refer to project specific documentation.
- **Supply the following consumables**: Refer to project specific documentation.

840 Maintenance

Used by: 70-80-90/110 Underwater lighting system.

- **Servicing and maintenance**: Undertake.
- **Duration**: Until 12 months after Practical completion and Up to and including the first planned lamp replacement.

Ω End of section

75-45-20 Data distribution systems

System outline

110 Data distribution system

- **System performance**: 75-45-20/210 Design of data distribution systems;
  75-45-20/230 Channel performance;
  75-45-20/240 Telecommunications outlets;
  75-45-20/250 Resilience;
  and 75-45-20/260 Connections with other systems.
- **Applications**: Refer to project specific documentation.
- **Cabling hierarchy**:
  - **Campus distributors (CD)**: Refer to project specific documentation.
  - **Campus backbone cabling**: Refer to project specific documentation.
  - **Building distributors (BD)**: Refer to project specific documentation.
  - **Building backbone cabling**: 90-55-15/405 Balanced twisted-pair cables type A.
  - **Floor distributors (FD)**: Refer to project specific documentation.
  - **Horizontal cabling**: Refer to project specific documentation.
  - **Consolidation points (CP)**: Refer to project specific documentation.
  - **Consolidation point cabling**: Refer to project specific documentation.
  - **Telecommunications outlets (TO)**: Refer to project specific documentation.
  - **Work area cabling**: Refer to project specific documentation.
- **Cable Compliance**: In accordance with mandatory obligations and the introduction of the Construction Products Regulations (CPR) on 1st July 2017 under the UK Statutory Instrument no. 1387 all cables supplied for installation within the project associated with this specification must comply with this legal requirement. The contractor is to provide legitamate certification of the product installed ensuring compliance with the CPR.
- **Containment**: Refer to project specific documentation.
- **Containment accessories**: Refer to project specific documentation.
- **Rewireable installation**: Required.
- **Concealed installation**: Required.

- **System accessories**: 90-60-30/430 Surge protective devices for telecommunications and signalling networks type B.
- **Execution**: 75-45-20/610 Removing data distribution systems;
  75-45-20/615 System installer;
  75-45-20/625 Installing information technology cabling;
  75-45-20/635 Spare cabling;
  75-45-20/645 Installing connecting hardware;
  75-45-20/650 Installing cabinets;

75-45-20/660 Connection to the public telephone network;
and 75-45-20/670 Labelling.

- **System completion**: 75-45-20/810 Testing and inspection of data distribution systems;
  75-45-20/820 Documentation for data distribution systems;
  75-45-20/830 Spares and consumables;
  75-45-20/840 Maintenance;
  and 75-45-20/850 System manufacturer's warranty.

System performance

210 Design of data distribution systems

Used by: 75-45-20/110 Data distribution system.

- **Design**: Complete the design of the data distribution system.
- **Standards**: To BS EN 50173-1;
  To BS EN 50173-2;
  To BS EN 50173-3;
  To BS EN 50173-4;
  To BS EN 50173-5;
  To BS EN 50173-6;
  To BS EN 50174-1;
  To BS EN 50098-1;
  To BS EN 50098-2;
  To ISO/IEC 11801;
  and To TIA 568-C.0 and TIA 568-C.1.
- **Cabling topology**:
  - **Campus backbone**: Refer to project specific documentation.
  - **Building backbone cabling**: Refer to project specific documentation.
  - **Horizontal cabling**: Refer to project specific documentation.
- **Requirement**: Submit proposals including detailed design drawings indicating cabinet general arrangement, cabling topology schematics, distribution point layouts, equipment room layout, interconnection diagrams and work area layout drawings. Include technical information, calculations and manufacturers' literature.

230 Channel performance

Used by: 75-45-20/110 Data distribution system.

- **Standard**: To BS EN 50173-1.
- **Balanced twisted-pair cabling class (minimum)**: Refer to project specific documentation.
- **Optical fibre class (minimum)**: Refer to project specific documentation.

240 Telecommunications outlets

Used by: 75-45-20/110 Data distribution system.

- **Requirements**: Refer to project specific documentation.

250 Resilience

Used by: 75-45-20/110 Data distribution system.

- **Spare capacity**: Refer to project specific documentation.

260 Connections with other systems

Used by: 75-45-20/110 Data distribution system.

- **Requirements**: Refer to project specific documentation.

Execution

610 Removing data distribution systems

Used by: 75-45-20/110 Data distribution system.

- **Scope**: Refer to project specific documentation.

615 System installer

Used by: 75-45-20/110 Data distribution system.

- **Registration**: Corporate member of the Telecommunications Industry Association (TIA) and Registered installer of the Fibreoptic Industry Association (FIA).
- **Evidence of registration**: Submit.

625 Installing information technology cabling

Used by: 75-45-20/110 Data distribution system.

- **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**: Refer to project specific documentation.

  - **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**: Refer to project specific documentation.
  - **Maximum untwist at terminations**: 12 mm.

635 Spare cabling

Used by: 75-45-20/110 Data distribution system.

- **Spare cable length at termination points (minimum)**: 500 mm.

645 Installing connecting hardware

Used by: 75-45-20/110 Data distribution system.

- **Connecting hardware**: Consistent throughout system.

650 Installing cabinets

Used by: 75-45-20/110 Data distribution system.

- **Cable termination sequence**: Left to right and bottom to top.
- **Clear access (minimum)**:
  - **Cabinet front**: Refer to project specific documentation.
  - **Cabinet rear**: Refer to project specific documentation.
  - **Cabinet sides**: Refer to project specific documentation.
- **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**: Refer to project specific documentation.
  - **Colour**:
    Background: White.
    Lettering: Black.
  - **Typography**:
    Font: Refer to project specific documentation.
    Size: Refer to project specific documentation.

660 Connection to the public telephone network

Used by: 75-45-20/110 Data distribution system.

- **Public telephone network**: Connect to the main telecommunication cabinet.
- **Cable type**: BT specification CW1308.
- **Number of pairs (minimum)**: Refer to project specific documentation.

670 Labelling

Used by: 75-45-20/110 Data distribution system.

- **Standards**: To BS EN 50174-1, BS EN 50174-2 and BS EN 50174-3.
- **Equipment**: Label with unique identifier on face engraved rigid plastic laminate.
- **Cable schedules**:
  - **Location**: At each cabinet.
  - **Format**: Refer to project specific documentation.
  - **Size**: Refer to project specific documentation.
  - **Contents**: Refer to project specific documentation.
- **Patch panels**: Machine printed label with patch panel identifier.
- **Outlet ports**: Machine printed label with circuit description.
- **Cables**: Wrap around machine printed label with cable identifier within 100 mm of each termination and every 4 m throughout the cable length.
- **Outlets**: Machine printed label with circuit description.
- **Format**: Refer to project specific documentation.

System completion

810 Testing and inspection of data distribution systems

Used by: 75-45-20/110 Data distribution system.

- **Standards**: To BS EN 50346.
- **Testing and inspection agent**: Refer to project specific documentation.
- **Notice before commencing tests (minimum)**: Refer to project specific documentation.

- **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.

820 Documentation for data distribution systems

Used by: 75-45-20/110 Data distribution system.

- **Standard**: To BS EN 50174-1.
- **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**: Refer to project specific documentation.
- **Record drawings**:
  - **Content**: Point of entry of PABX cable into building;
    Route of incoming connection cable to the public telephone network from point of entry into building and PABX;
    For all data cabling, the cable origin, circuit designation, route, 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.Cabling topology schematics.Distribution point layout drawings;
    Equipment room layout drawings.Interconnection diagrams;
    and Work area layout drawings.
  - **Format**: A1 paper print drawing and Electronic drawing.
  - **Number of copies**: Refer to project specific documentation.
- **Submittal date**: At handover.
- **Cabling topology schematics**:
  - **Location**: Main server room.
  - **Format**: Laminated A1 size paper print.
  - **Installation**: Wall mounted with cup and screw fixings.

830 Spares and consumables

Used by: 75-45-20/110 Data distribution system.

- **Cable terminations**: Refer to project specific documentation.

- **Telecommunication outlets**: Refer to project specific documentation.
- **IDC punch down tool**: Refer to project specific documentation.
- **Patch cord loom spares**:
  - **Type**: Refer to project specific documentation.
  - **Quantity**: Refer to project specific documentation.
- **Cabinet keys**: Refer to project specific documentation.

840 Maintenance

Used by: 75-45-20/110 Data distribution system.

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

850 System manufacturer's warranty

Used by: 75-45-20/110 Data distribution system.

- **Performance warranty**: Required.
- **Warrant operation with the following applications**: Refer to project specific documentation.
- **Warranty period (minimum)**: Until 12 months after Practical Completion.

Ω End of section

75-45-40 Induction-loop listening systems

System outline

110 Audio-frequency-induction-loop system

- **System performance**: 75-45-40/210 Design of induction loop systems;
  75-45-40/220 System objectives;
  and 75-45-40/230 Multiple loops.
- **System manufacturer**: Refer to project specific documentation.
- **Source equipment**: Refer to project specific documentation.
- **Distribution equipment**: Refer to project specific documentation.
- **Equipment interconnectivity**: Wired.
- **Loop cabling**:
  - **Loop arrangement**: Refer to project specific documentation.
  - **Cable type**: Refer to project specific documentation.
  - **Containment**: Refer to project specific documentation.
  - **Rewireable installation**: Required.
  - **Concealed installation**: Required.
- **System accessories**: Refer to project specific documentation.
- **Execution**: 75-45-40/610 Removing induction loop systems;
  75-45-40/620 Site assessment;
  75-45-40/630 Installing induction-loop systems generally;
  75-45-40/670 Installing induction-loop cabling;
  75-45-40/700 Installing loop pads;
  75-45-40/720 Trial loops;
  75-45-40/760 Installing illuminated reassurance indicators;
  and 75-45-40/780 Installing signage.
- **System completion**: 75-45-40/810 Testing and commissioning induction-loop systems generally;
  75-45-40/815 Equipment labelling and system diagrams;
  75-45-40/820 Documentation;
  75-45-40/830 Spares;
  75-45-40/840 Maintenance;
  75-45-40/850 Verification certificate;
  75-45-40/860 Acceptance certificate;
  75-45-40/865 System re-commissioning;
  and 75-45-40/870 Subjective testing.

System performance

210 Design of induction loop systems

Used by: 75-45-40/110 Audio-frequency-induction-loop system.

- **Design**: Complete the design of the induction-loop system.
- **Qualifications of designer**: Member of the Institute of Sound and Communications Engineers and Member of the Professional Lighting and Sound Association Ltd (PLASA).
- **Standard**: Refer to project specific documentation.
- **Variations**: Refer to project specific documentation.
- **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.

220 System objectives

Used by: 75-45-40/110 Audio-frequency-induction-loop system.

- **Standard**: In accordance with BS 7594.
- **System objectives**: Refer to project specific documentation.
- **Environment**: Refer to project specific documentation.
- **Listening plane**: Horizontal plane 1450 mm above finished floor level.
- **Coverage area**: Refer to project specific documentation.
- **Working area**: Refer to project specific documentation.
- **Frequency response**: Maximum variation of ± 3 dB over the range 100 Hz–5 kHz.
- **Speech transmission index value (minimum)**: Refer to project specific documentation.

230 Multiple loops

Used by: 75-45-40/110 Audio-frequency-induction-loop system.

- **Objective**: Refer to project specific documentation.

Execution

610 Removing induction loop systems

Used by: 75-45-40/110 Audio-frequency-induction-loop system.

- **Scope**: Refer to project specific documentation.

620 Site assessment

Used by: 75-45-40/110 Audio-frequency-induction-loop system.

- **Site assessment**: Determine the suitability of the site for use with induction-loop systems.
- **Qualifications of assessor**: Member of the Institute of Sound and Communications Engineers and Member of the Professional Lighting and Sound Association Ltd (PLASA).
- **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: Refer to project specific documentation.

630 Installing induction-loop systems generally

Used by: 75-45-40/110 Audio-frequency-induction-loop system.

- **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.

670 Installing induction-loop cabling

Used by: 75-45-40/110 Audio-frequency-induction-loop system.

- **Position**: Refer to project specific documentation.
- **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.

700 Installing loop pads

Used by: 75-45-40/110 Audio-frequency-induction-loop system.

- **Position**: Refer to project specific documentation.
- **Fixing**: Refer to project specific documentation.

720 Trial loops

Used by: 75-45-40/110 Audio-frequency-induction-loop system.

- **Position**: Refer to project specific documentation.
- **Measurements**:
  - **Meter**: Loop field strength meter.
  - **Measurement grid**: Refer to project specific documentation.
  - **Magnetic field strength**: Measure.
  - **Coverage area**: Determine.

  - **Results**: Submit.

760 Installing illuminated reassurance indicators

Used by: 75-45-40/110 Audio-frequency-induction-loop system.

- **Position**: Refer to project specific documentation.

780 Installing signage

Used by: 75-45-40/110 Audio-frequency-induction-loop system.

- **Position**: Refer to project specific documentation.
- **Mounting**: Refer to project specific documentation.

System completion

810 Testing and commissioning induction-loop systems generally

Used by: 75-45-40/110 Audio-frequency-induction-loop system.

- **Standard**: In accordance with BS 7594.
- **System commissioning agent**: System manufacturer.
- **Notice before commencing tests (minimum)**: Refer to project specific documentation.
- **System commissioning**:
  - **Magnetic field strength**: Measure.
  - **Speech transmission index value (minimum)**: Measure in accordance with BS EN 60268-16.
- **Cable testing**: Measure the insulation resistance between conductors, between each conductor and earth, and between each conductor and any screen. Measure the continuity of loop cable, and earth continuity.
- **Loop circuit**: Measure the d.c. resistance.
- **Test results**: Submit at handover.

815 Equipment labelling and system diagrams

Used by: 75-45-40/110 Audio-frequency-induction-loop system.

- **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.

820 Documentation

Used by: 75-45-40/110 Audio-frequency-induction-loop 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**: Refer to project specific documentation.
- **Log book**: Submit one copy in accordance with BS 7594, Section 6, clause 27.
- **Record drawings**:
  - **Content**: General arrangement drawings showing the location of distribution equipment including equalizers, induction loop amplifiers or induction loop transformers, the type, c.s.a. and route of all induction loop cables, the position of induction loop pads, microphones and reassurance indicators or visual alarm signal devices.
  - **Format**: A1 paper print drawing and Electronic drawing.
  - **Number of copies**: Refer to project specific documentation.
- **Submittal date**: At handover.
- **Certification**:
  - **Design certificate**: Submit two copies in accordance with BS 7594, Annex D.1.
  - **Installation certificate**: Submit two copies in accordance with BS 7594, Annex D.2.
  - **Commissioning certificate**: Submit two copies in accordance with BS 7594, Annex D.3.

830 Spares

Used by: 75-45-40/110 Audio-frequency-induction-loop system.

- **Supply the following spares**: Refer to project specific documentation.

840 Maintenance

Used by: 75-45-40/110 Audio-frequency-induction-loop system.

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

850 Verification certificate

Used by: 75-45-40/110 Audio-frequency-induction-loop system.

- **System verification agent**: System manufacturer.
- **Verification certificate**: Submit two copies in accordance with BS 7594, Annex D.5.

860 Acceptance certificate

Used by: 75-45-40/110 Audio-frequency-induction-loop system.

- **Acceptance certificate**: Submit two copies in accordance with BS 7594, Annex D.4.

865 System re-commissioning

Used by: 75-45-40/110 Audio-frequency-induction-loop system.

- **Induction-loop system**: Re-commission.
- **Timing**: Refer to project specific documentation.

870 Subjective testing

Used by: 75-45-40/110 Audio-frequency-induction-loop system.

- **Area of test**: Refer to project specific documentation.
- **Objective**: Refer to project specific documentation.
- **Timing**: Refer to project specific documentation.
- **Panellists**: Refer to project specific documentation.
- **Results**: Submit.

Ω End of section

75-45-60 Sound systems

System outline

110 Sound system

- **System performance**: 75-45-60/210 Design of sound systems and 75-45-60/240 Connection to fire detection and alarm systems.
- **System manufacturer**: Refer to project specific documentation.
- **Environment**: Refer to project specific documentation.
- **Source equipment**: Refer to project specific documentation.
- **Equipment interconnectivity**: Wired.
- **Cable type**: Refer to project specific documentation.
- **Cable Compliance**: In accordance with mandatory obligations and the introduction of the Construction Products Regulations (CPR) on 1st July 2017 under the UK Statutory Instrument no. 1387 all cables supplied for installation within the project associated with this specification must comply with this legal requirement. The contractor is to provide legitamate certification of the product installed ensuring compliance with the CPR.
- **Containment**: Refer to project specific documentation.
- **Containment accessories**: Refer to project specific documentation.
- **Spare containment**: Required.
- **Rewirable installation**: Required.
- **Concealed installation**: Required.
- **Outlets**: Refer to project specific documentation.
- **Controls**: Refer to project specific documentation.
- **System accessories**: Refer to project specific documentation.
- **Execution**: 75-45-60/610 Removing sound systems;
  75-45-60/620 Installation of sound systems generally;
  75-45-60/630 Modifying existing sound systems;
  75-45-60/640 Samples;
  and 75-45-60/650 Equipment labelling and system diagrams.
- **System completion**: 75-45-60/810 Testing and commissioning sound systems;
  75-45-60/815 Calibration certificates;
  75-45-60/820 Documentation;
  75-45-60/830 Spares and consumables;
  75-45-60/840 Maintenance;
  75-45-60/850 Verification certificate;
  and 75-45-60/860 Acceptance certificate.

System performance

210 Design of sound systems

Used by: 75-45-60/110 Sound system.

- **Design**: Complete the design of the public address system and Complete the design of the sound reinforcement system.
- **Standard**: In accordance with BS 6259, type S1;
  In accordance with BS 6259, type S2;
  and In accordance with BS 6259, type S3.
- **System designer**: Member of the Association of Noise Consultants;
  Member of the Audio Engineering Society;
  Member of the Institute of Acoustics;
  Member of the Institute of Sound and Communications Engineers;
  and Member of the Professional Lighting and Sound Association Ltd (PLASA).
- **Signal transmission**: Refer to project specific documentation.
- **System frequency response**: Refer to project specific documentation.
- **Speech:background noise ratio (minimum)**: Refer to project specific documentation.
- **Sound pressure level (peak)**: Refer to project specific documentation.
- **Speech transmission index value (minimum)**: Refer to project specific documentation.
- **Zoning**: Refer to project specific documentation.
- **Volume restoration**: Required during paging.
- **Signal priorities**: Refer to project specific documentation.
- **Requirement**: Submit proposals including detailed design drawings, technical information indicating correct matching to ensure selected equipment works together satisfactorily, calculations and manufacturers' literature.
- **Spare capacity (minimum)**: Refer to project specific documentation.

240 Connection to fire detection and alarm systems

Used by: 75-45-60/110 Sound system.

- **Operation in the event of a fire signal**: Refer to project specific documentation.

Execution

610 Removing sound systems

Used by: 75-45-60/110 Sound system.

- **Scope**: Refer to project specific documentation.

620 Installation of sound systems generally

Used by: 75-45-60/110 Sound system.

- **Installation**: In accordance with BS 6259 and BS 7671.

- **Loudspeaker zones**: Refer to project specific documentation.
- **Equipment interconnectivity**: All components of the sound system to be derived from the same electrical phase.

630 Modifying existing sound systems

Used by: 75-45-60/110 Sound system.

- **Routes and arrangement**: Trace out.
- **Passive elements**: Identify and label.
- **Active elements**: Identify and label.
- **Loudspeakers**: Identify cabling route and label.
- **Record drawings**: Make good and update.
- **Site survey**:
  - **Location**: Refer to project specific documentation.
  - **Ambient noise**: Measure.
  - **Operational and occupied noise**: Measure.
  - **Reverberation times**: Measure in accordance with BS EN ISO 3382-1.
  - **Results**: Submit.

640 Samples

Used by: 75-45-60/110 Sound system.

- **Samples to be submitted**: Refer to project specific documentation.
- **Submittals**: Include manufacturer's technical information with each sample.
- **Identification**: Label samples with the public address system references.

650 Equipment labelling and system diagrams

Used by: 75-45-60/110 Sound system.

- **Equipment rack**: Label with a unique identification code.
- **Amplifiers**: Label with zone information.
- **Loudspeaker transformers**: Label the commissioned tapping setting.
- **System arrangement**:
  - **Record layout drawings**: Show the location and identity of system equipment and zones.
  - **Position**: Next to the equipment rack.

System completion

810 Testing and commissioning sound systems

Used by: 75-45-60/110 Sound system.

- **Standard**: In accordance with BS 6259.
- **System commissioning agent**: System manufacturer.

- **Notice before commencing tests (minimum)**: Refer to project specific documentation.
- **Cable testing**: Measure the insulation resistance between conductors, between each conductor and earth, and between each conductor and any screen.
- **Acoustic testing**:
  - **Location**: Refer to project specific documentation.
  - **Sound pressure levels**: Tabulate and submit results. Compare with design values.
  - **Speech transmission index value (minimum)**: Measure in accordance with BS EN 60268-16, Annex B.
- **System re-commissioning**:
  - **Re-commissioning**: Refer to project specific documentation.
  - **Timing**: Refer to project specific documentation.

815 Calibration certificates

Used by: 75-45-60/110 Sound system.

- **Certificates of calibration for meters and instruments**: Submit.

820 Documentation

Used by: 75-45-60/110 Sound 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**: Refer to project specific documentation.
- **Log book**: Submit one copy in accordance with BS 6259, Section 4, clause 10.5.
- **Record drawings**:
  - **Content**: Schematic diagram and General arrangement drawings showing the location of all sound equipment, the position of all microphones, loudspeakers and inputs, and the type, c.s.a. and route of all cables.
  - **Format**: A1 paper print drawing and Electronic drawing.
  - **Number of copies**: Refer to project specific documentation.
- **Submittal date**: At handover.
- **Certification**:
  - **Design certificate**: Submit two copies in accordance with BS 6259, Annex F.1.
  - **Installation certificate**: Submit two copies in accordance with BS 6259, Annex F.2.
  - **Commissioning certificate**: Submit two copies in accordance with BS 6259, Annex F.3.

830 Spares and consumables

Used by: 75-45-60/110 Sound system.

- **Supply the following spares**: Refer to project specific documentation.
- **Supply the following consumables**: Refer to project specific documentation.

840 Maintenance

Used by: 75-45-60/110 Sound system.

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

850 Verification certificate

Used by: 75-45-60/110 Sound system.

- **System verification agent**: System manufacturer.
- **Verification certificate**: Submit two copies in accordance with BS 6259, Annex F.5.

860 Acceptance certificate

Used by: 75-45-60/110 Sound system.

- **Acceptance certificate**: Submit two copies in accordance with BS 6259, Annex F.4.

Ω End of section

75-45-85 Telecommunications systems

System outline

110 Telecommunications system

- **System performance**: 75-45-85/210 Design of telecommunications systems;
  75-45-85/235 Capacity of system;
  75-45-85/240 Telecommunications outlets;
  75-45-85/250 Resilience;
  and 75-45-85/260 Interconnections with other systems.
- **System manufacturer**: Refer to project specific documentation.
- **Type of system**: Refer to project specific documentation.
- **Method of operation**: Refer to project specific documentation.
- **Cable type**: Refer to project specific documentation.
- **Cable Compliance**: In accordance with mandatory obligations and the introduction of the Construction Products Regulations (CPR) on 1st July 2017 under the UK Statutory Instrument no. 1387 all cables supplied for installation within the project associated with this specification must comply with this legal requirement. The contractor is to provide legitamate certification of the product installed ensuring compliance with the CPR.
- **Containment**: Refer to project specific documentation.
- **Containment accessories**: Refer to project specific documentation.
- **Concealed installation**: Required.
- **Rewireable installation**: Required.
- **System components**: 90-60-25/450 Telecommunication outlets.
- **System accessories**: 90-60-30/430 Surge protective devices for telecommunications and signalling networks type A.
- **Execution**: 75-45-85/610 Removing telecommunications systems;
  75-45-85/620 Connection to the public telephone network;
  and 75-45-85/660 Installing telecommunications cabling.
- **System completion**: 75-45-85/810 Testing and inspection of telecommunications systems;
  75-45-85/820 Documentation;
  75-45-85/830 Spares and consumables;
  and 75-45-85/840 Maintenance.

System performance

210 Design of telecommunications systems

Used by: 75-45-85/110 Telecommunications system.

- **Design**: Complete the design of the telecommunications system.
- **Standards**: To BS 6701 and BS EN 50174-1.

- **Cabling topology**:
  - **Backbone cabling**: Star.
  - **Horizontal cabling**: Star.
- **Requirement**: Submit proposals including cabinet general arrangement drawings, cabling topology schematics, distribution point layout drawing, equipment room layout drawings, interconnection diagrams and work area layout drawings, technical information, calculations and manufacturers' literature.

235 Capacity of system

Used by: 75-45-85/110 Telecommunications system.

- **External exchange lines**:
  - **Number available**: Refer to project specific documentation.
  - **Number connected**: Refer to project specific documentation.
- **External private lines**:
  - **Number available**: Refer to project specific documentation.
  - **Number connected**: Refer to project specific documentation.
- **Internal extensions**:
  - **Number available**: Refer to project specific documentation.
  - **Number connected**: Refer to project specific documentation.

240 Telecommunications outlets

Used by: 75-45-85/110 Telecommunications system.

- **Telecommunications outlets**: Refer to project specific documentation.

250 Resilience

Used by: 75-45-85/110 Telecommunications system.

- **Resilience**: Refer to project specific documentation.
- **Fall back facility**: Refer to project specific documentation.
- **Spare capacity**: Refer to project specific documentation.

260 Interconnections with other systems

Used by: 75-45-85/110 Telecommunications system.

- **Systems to interconnect**: Refer to project specific documentation.
- **Requirements**: Refer to project specific documentation.

Execution

610 Removing telecommunications systems

Used by: 75-45-85/110 Telecommunications system.

- **Scope**: Refer to project specific documentation.

620 Connection to the public telephone network

Used by: 75-45-85/110 Telecommunications system.

- **Public telephone network**: Connect to the main telecommunication distribution frame.

660 Installing telecommunications cabling

Used by: 75-45-85/110 Telecommunications system.

- **Standards**:
  - **Generally**: To BS 6701 and 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**: Refer to project specific documentation.
  - **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**: To BS 6701 and in accordance with BS EN 50174-2, clause 6.2.
- **Distance from steam and low temperature hot water systems running parallel**: 500 mm minimum.
- **Terminations**: Support cable within 150 mm of termination.

System completion

810 Testing and inspection of telecommunications systems

Used by: 75-45-85/110 Telecommunications system.

- **Standard**: To BS EN 50346.
- **Testing and inspection agent**: System manufacturer.
- **Notice before commencing tests (minimum)**: Refer to project specific documentation.
- **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 schedule of equipment and outlets, including total number of extensions, and a master directory (with a list of features available to each extension, and arrangement of hunt groups) and Submit in accordance with BS EN 50346, Annex A.
- **Certificates of calibration for meters and instruments**: Submit.

820 Documentation

Used by: 75-45-85/110 Telecommunications system.

- **Standard**: To BS EN 50174-1.
- **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**: Refer to project specific documentation.
- **Record drawings**:
  - **Content**: For all telecommunications cabling, the cable origin, circuit designation, route, conductor material and c.s.a., insulation type and colour, number of cores per cable, number of cables in ducts, on tray or ladder.
    Location of PABX, distribution panels, outlets, terminal devices, payphones, and operator consoles.
  - **Format**: A1 paper print drawing and Electronic drawing.
  - **Number of copies**: Refer to project specific documentation.
- **Submittal date**: At handover.
- **Cable schedules**:
  - **Location**: Refer to project specific documentation.
  - **Format**: Refer to project specific documentation.
  - **Size**: Refer to project specific documentation.

  - **Contents**: Incoming cable designation and origin and Outgoing cable designation and destination.
- **Cabling topology schematics**:
  - **Location**: Refer to project specific documentation.
  - **Format**: A1 paper print.

830 Spares and consumables

Used by: 75-45-85/110 Telecommunications system.

- **Terminal devices**: Refer to project specific documentation.
- **Telecommunication outlets**: Refer to project specific documentation.
- **Insulation displacement connection punch down tool**: Refer to project specific documentation.

840 Maintenance

Used by: 75-45-85/110 Telecommunications system.

- **Servicing and maintenance**: Undertake.
- **Duration**: Until 12 months after Practical Completion.
- **Level of maintenance**: Refer to project specific documentation.

Ω End of section

75-45-90 Television and radio distribution systems

System outline

110 Television and radio distribution system

- **System performance**: 75-45-90/210 Design of television and radio distribution systems;
  75-45-90/220 Performance of television distribution systems;
  75-45-90/230 Wind resistance of aerials and antennae;
  and 75-45-90/240 Interface to other services.
- **System manufacturer**: Refer to project specific documentation.
- **Arrangement**: Refer to project specific documentation.
- **Input signals**: Refer to project specific documentation.
- **Aerials and antennae**: Refer to project specific documentation.
- **Distribution equipment**: Refer to project specific documentation.
- **Outlets**: 90-60-25/445 Television outlets.
- **System accessories**: Refer to project specific documentation.
- **Cable type**: Refer to project specific documentation.
- **Cable Compliance**: In accordance with mandatory obligations and the introduction of the Construction Products Regulations (CPR) on 1st July 2017 under the UK Statutory Instrument no. 1387 all cables supplied for installation within the project associated with this specification must comply with this legal requirement. The contractor is to provide legitamate certification of the product installed ensuring compliance with the CPR.
- **Containment**: Refer to project specific documentation.
- **Containment accessories**: Refer to project specific documentation.
- **Rewireable installation**: Required.
- **Concealed installation**: Required.
- **Execution**: 75-45-90/610 Removing television and radio distribution systems;
  75-45-90/620 Installing aerials and antennae;
  75-45-90/630 Installing cabling;
  and 75-45-90/640 Installing amplifiers.
- **System completion**: 75-45-90/810 Testing and commissioning of television and radio distribution systems;
  75-45-90/820 Documentation;
  75-45-90/830 Spares and consumables;
  and 75-45-90/840 Maintenance.

System performance

210 Design of television and radio distribution systems

Used by: 75-45-90/110 Television and radio distribution system.

- **Design**: Complete the design of the television and radio distribution system.
- **System designer**: Member of the Confederation of Aerial Industries (CAI).
- **Standards**: To BS EN 60728-11, and in accordance with BS 7671, the requirements of the Digital Television Group (DTG) guide Installing digital television MATV and IRS, and Confederation of Aerial Industries (CAI) Code of Practice for the Installation of Terrestrial and Satellite TV Reception Systems (MDU & Commercial).
- **Requirement**: Submit proposals including detailed design drawings, technical information, calculations and manufacturers' literature. Include the location of all aerials and antennas, their types and methods of installation, the routes of cables and location of distribution equipment and outlets.

220 Performance of television distribution systems

Used by: 75-45-90/110 Television and radio distribution system.

- **ITU impairment grade**: Refer to project specific documentation.

230 Wind resistance of aerials and antennae

Used by: 75-45-90/110 Television and radio distribution system.

- **Wind resistance (minimum)**: Refer to project specific documentation.

240 Interface to other services

Used by: 75-45-90/110 Television and radio distribution system.

- **Interfaces to equipment not forming part of the television distribution system**: Design system to interact with the equipment in the event of a fire or fault signal.
- **Equipment and mode of operation**: Refer to project specific documentation.

Execution

610 Removing television and radio distribution systems

Used by: 75-45-90/110 Television and radio distribution system.

- **Scope**: Refer to project specific documentation.

620 Installing aerials and antennae

Used by: 75-45-90/110 Television and radio distribution system.

- **Installation**: In accordance with the CAI Code of Practice for the Installation of Terrestrial and Satellite TV Reception Systems (MDU & Commercial).
- **Position**: Refer to project specific documentation.
- **Mounting**: Refer to project specific documentation.
- **Planning permission**: Refer to project specific documentation.

630 Installing cabling

Used by: 75-45-90/110 Television and radio distribution system.

- **Standard**: In accordance with BS 7671 and the CAI Code of Practice for the Installation of Terrestrial and Satellite TV Reception Systems (MDU & Commercial).
- **Route**: Refer to project specific documentation.
- **Timing**: Do not start internal cabling until building enclosure provides permanently dry conditions.
- **Cables**: Install in one length.
- **Cable pulling**: Submit proposals.
- **Bending radius (minimum)**: 10 times outside diameter of cable.
- **Cable fixing**: Do not staple.
- **Cables passing through walls**: Sleeve with conduit or pipeduct. Bush at both ends.
- **Jointing**: At equipment and terminal fittings only.

640 Installing amplifiers

Used by: 75-45-90/110 Television and radio distribution system.

- **Position**: As close as practicable to aerial.

System completion

810 Testing and commissioning of television and radio distribution systems

Used by: 75-45-90/110 Television and radio distribution system.

- **Tests**:
  - **Standard**: In accordance with section 17 of CAI Code of Practice for the Installation of Terrestrial and Satellite TV Reception Systems (MDU & Commercial).
  - **Outlets to be tested**: Refer to project specific documentation.
- **Results**: Submit standard report form as CAI Code of Practice for the Installation of Terrestrial and Satellite TV Reception Systems (MDU & Commercial), Appendix F.

820 Documentation

Used by: 75-45-90/110 Television and radio distribution 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**: Refer to project specific documentation.
- **Record drawings**:

  - **Content**: Location and route of cables between antennae and cable outlets. Location of diplexers, equalizers, launch and masthead amplifiers, multiswitches and splitters.
  - **Format**: A1 paper print drawing and Electronic drawing.
  - **Number of copies**: Refer to project specific documentation.
- **Submittal date**: At handover.

830 Spares and consumables

Used by: 75-45-90/110 Television and radio distribution system.

- **Supply the following spares**: Refer to project specific documentation.

840 Maintenance

Used by: 75-45-90/110 Television and radio distribution system.

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

Ω End of section

75-60-05 Electronic access control systems

System outline

110 Electronic access control system

- **System performance**: 75-60-05/210 Design of electronic access control systems; 75-60-05/228 Standby power supplies type A; 75-60-05/230 Connection to fire detection and alarm systems; and 75-60-05/240 Integration with other alarm and security systems.
- **System supplier**: Refer to project specific documentation.
- **Registration**: A Gold member of National Security Inspectorate.
- **System type**: Refer to project specific documentation.
- **Equipment interconnectivity**: Refer to project specific documentation.
- **Control software**: Refer to project specific documentation.
- **Method of authorization**: Refer to project specific documentation.
- **Readers**: Refer to project specific documentation.
- **Locking mechanisms**: Refer to project specific documentation.
- **Controls**: Refer to project specific documentation.
- **Door status monitoring**: Refer to project specific documentation.
- **Cable type**: 90-55-15/405 Balanced twisted-pair cables type B.
- **Cable Compliance**: In accordance with mandatory obligations and the introduction of the Construction Products Regulations (CPR) on 1st July 2017 under the UK Statutory Instrument no. 1387 all cables supplied for installation within the project associated with this specification must comply with this legal requirement. The contractor is to provide legitamate certification of the product installed ensuring compliance with the CPR.
- **Containment**: Refer to project specific documentation.
- **Containment accessories**: Refer to project specific documentation.
- **Rewireable installation**: Required.
- **Concealed installation**: Required.
- **System accessories**: Refer to project specific documentation.
- **Execution**: 75-60-05/610 Removing electronic access control systems type A; 75-60-05/615 Modifying existing electronic access control systems type A; 75-60-05/620 Installing electronic access control systems; and 75-60-05/630 Equipment labelling and system diagrams type A.
- **System completion**: 75-60-05/810 Testing and commissioning electronic access control systems; 75-60-05/820 Documentation type A; 75-60-05/830 Spares and consumables type A; and 75-60-05/840 Maintenance type A.

120 Intercom system

- **System performance**: 75-60-05/225 Design of audio and video intercom systems and 75-60-05/228 Standby power supplies type B.
- **System supplier**: Refer to project specific documentation.
- **System type**: Refer to project specific documentation.
- **Control equipment**: Refer to project specific documentation.
- **Locking mechanisms**: Refer to project specific documentation.
- **Cable type**: 90-55-15/405 Balanced twisted-pair cables type C.
- **Cable Compliance**: In accordance with mandatory obligations and the introduction of the Construction Products Regulations (CPR) on 1st July 2017 under the UK Statutory Instrument no. 1387 all cables supplied for installation within the project associated with this specification must comply with this legal requirement. The contractor is to provide legitamate certification of the product installed ensuring compliance with the CPR.
- **Containment**: Refer to project specific documentation.
- **Rewireable installation**: Required.
- **Concealed installation**: Required.
- **Execution**: 75-60-05/610 Removing electronic access control systems type B;
  75-60-05/615 Modifying existing electronic access control systems type B;
  75-60-05/630 Equipment labelling and system diagrams type B;
  and 75-60-05/650 Installing intercom systems.
- **System completion**: 75-60-05/820 Documentation type B;
  75-60-05/830 Spares and consumables type B;
  75-60-05/840 Maintenance type B;
  75-60-05/870 Testing and commissioning audio intercom systems;
  ;
  and 75-60-05/880 Testing and commissioning video intercom systems.

System performance

210 Design of electronic access control systems

Used by: 75-60-05/110 Electronic access control system.

- **Design**: Complete the design of the electronic access control system.
- **Requirement**: Submit proposals including detailed design drawings, technical information, calculations and manufacturers' literature.
- **Standards**: BS EN 60839-11-1 and BS EN 60839-11-2.
- **Security grading**: Refer to project specific documentation.
- **Environmental classification**: Refer to project specific documentation.
- **Number of users (minimum)**: Refer to project specific documentation.
- **Number of transactions (minimum)**: Refer to project specific documentation.
- **Spare capacity**: Required.
- **Database**:

  - **Redundancy**: Required.
  - **Backup arrangements**: Refer to project specific documentation.
- **Operation in the event of mains failure**: Refer to project specific documentation.
- **Anti-passback**: Refer to project specific documentation.
- **Functional requirements**: Refer to project specific documentation.

225 Design of audio and video intercom systems

Used by: 75-60-05/120 Intercom system.

- **Calling method**: Refer to project specific documentation.
- **Method of authorization**: Refer to project specific documentation.
- **Remote handset intercommunication**: Refer to project specific documentation.
- **External calls**: Refer to project specific documentation.
- **Functional requirements**: Refer to project specific documentation.
- **Integration with other systems**: Refer to project specific documentation.

228 Standby power supplies type A

Used by: 75-60-05/110 Electronic access control system.

- **Standby capacity (minimum)**: Refer to project specific documentation.

228 Standby power supplies type B

Used by: 75-60-05/120 Intercom system.

- **Standby capacity (minimum)**: Refer to project specific documentation.

230 Connection to fire detection and alarm systems

Used by: 75-60-05/110 Electronic access control system.

- **Operation in the event of a fire signal**: Refer to project specific documentation.

240 Integration with other alarm and security systems

Used by: 75-60-05/110 Electronic access control system.

- **Objectives**: Refer to project specific documentation.
- **Systems to be integrated**: Refer to project specific documentation.

Execution

610 Removing electronic access control systems type A

Used by: 75-60-05/110 Electronic access control system.

- **Scope**: Refer to project specific documentation.

610 Removing electronic access control systems type B

Used by: 75-60-05/120 Intercom system.

- **Scope**: Refer to project specific documentation.

615 Modifying existing electronic access control systems type A

Used by: 75-60-05/110 Electronic access control system.

- **Existing access control systems**: Trace out cabling and identify equipment locations.
- **Database**: Ensure that the database is backed up prior to removing power.
- **Equipment and cabling to remain**: Test and check operation, make good, update operation and maintenance documentation.
- **Method**: Submit proposals.

615 Modifying existing electronic access control systems type B

Used by: 75-60-05/120 Intercom system.

- **Existing access control systems**: Trace out cabling and identify equipment locations.
- **Database**: Ensure that the database is backed up prior to removing power.
- **Equipment and cabling to remain**: Test and check operation, make good, update operation and maintenance documentation.
- **Method**: Submit proposals.

620 Installing electronic access control systems

Used by: 75-60-05/110 Electronic access control system.

- **Standards**: To BS EN 60839-11-1 and BS EN 60839-11-2 and In accordance with National Security Inspectorate NCP109.
- **Location of the access controller**: Refer to project specific documentation.
- **Installing cabling**:
  - **Standard**: In accordance with BS 7671.
  - **Routes**: Refer to project specific documentation.
  - **Security measures**: Suitably protect all cabling from inadvertent damage or tampering to avoid compromising the security of the system.

630 Equipment labelling and system diagrams type A

Used by: 75-60-05/110 Electronic access control system.

- **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.

630 Equipment labelling and system diagrams type B

Used by: 75-60-05/120 Intercom system.

- **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.

650 Installing intercom systems

Used by: 75-60-05/120 Intercom system.

- **Installing cabling**:
  - **Standard**: In accordance with BS 7671.
  - **Routes**: Refer to project specific documentation.
  - **Security measures**: Suitably protect all cabling from inadvertent damage or tampering to avoid compromising the security of the system.

System completion

810 Testing and commissioning electronic access control systems

Used by: 75-60-05/110 Electronic access control system.

- **Standards**: To BS EN 60839-11-1 and BS EN 60839-11-2.
- **System commissioning agent**: System manufacturer.
- **Notice before commencing tests (minimum)**: Refer to project specific documentation.
- **System programming**: Configure access permissions;
  Configure time grids, zones and slots;
  and Configure user database and credentials.
- **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.

820 Documentation type A

Used by: 75-60-05/110 Electronic access control system.

- **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.
- **Operating and maintenance instructions**:
  - **Scope**: Submit for the system, giving all configuration settings.
  - **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**: Refer to project specific documentation.
- **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.
  - **Format**: A1 paper print drawing and Electronic drawing.
  - **Number of copies**: Refer to project specific documentation.
- **Submittal date**: At handover.

820 Documentation type B

Used by: 75-60-05/120 Intercom system.

- **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.
- **Operating and maintenance instructions**:
  - **Scope**: Submit for the system, giving all configuration settings.
  - **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**: Refer to project specific documentation.
- **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.
  - **Format**: A1 paper print drawing and Electronic drawing.
  - **Number of copies**: Refer to project specific documentation.
- **Submittal date**: At handover.

830 Spares and consumables type A

Used by: 75-60-05/110 Electronic access control system.

- **Credentials to be supplied**: Refer to project specific documentation.
- **Spares to be supplied**:
  - **Fuses**: Refer to project specific documentation.
  - **Frangible elements**: Refer to project specific documentation.
  - **Printer ink cartridges**: Refer to project specific documentation.

830 Spares and consumables type B

Used by: 75-60-05/120 Intercom system.

- **Credentials to be supplied**: Refer to project specific documentation.
- **Spares to be supplied**:
  - **Fuses**: Refer to project specific documentation.
  - **Frangible elements**: Refer to project specific documentation.
  - **Printer ink cartridges**: Refer to project specific documentation.

840 Maintenance type A

Used by: 75-60-05/110 Electronic access control system.

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

840 Maintenance type B

Used by: 75-60-05/120 Intercom system.

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

870 Testing and commissioning audio intercom systems

Used by: 75-60-05/120 Intercom system.

- **Call button**: Verify the operation of call buttons.
- **Audio communication**: Verify two-way audio communication.
- **Remote release**: Verify the operation of remote door release facilities.
- **Visual indication**: Check that LCD information is correctly displayed. Check that all LEDs are operational and function at the correct stage of the call process.
- **Cables**: Check that all cables are correctly terminated and that connections are tight.
- **Voltage**: Verify that voltage levels for all items of equipment throughout the system are within the manufacturer's stated range.

880 Testing and commissioning video intercom systems

Used by: 75-60-05/120 Intercom system.

- **Call button**: Verify the operation of call buttons.
- **Audio communication**: Verify two-way audio communication.
- **Video image**: Verify the operation of the video camera and remote display. Adjust the image for contrast and brightness to suit the environmental conditions of the location.
- **Remote release**: Verify the operation of remote door release facilities.
- **Visual indication**: Check that LCD information is correctly displayed. Check that all LEDs are operational and function at the correct stage of the call process.
- **Cables**: Check that all cables are correctly terminated and that connections are tight.

- **Voltage**: Verify that voltage levels for all items of equipment throughout the system are within the manufacturer's stated range.

Ω End of section

75-60-10 Closed circuit television systems

System outline

110 CCTV system

- **System performance**: 75-60-10/210 Design of CCTV systems;
  75-60-10/212 Operational requirements;
  75-60-10/215 Remote monitoring;
  75-60-10/250 Integration with other alarm and security systems;
  and 75-60-10/260 Video motion detection software.
- **System manufacturer**: Refer to project specific documentation.
- **Automatic activation of cameras**: Refer to project specific documentation.
- **Surveillance equipment**: Refer to project specific documentation.
- **Control equipment**: Refer to project specific documentation.
- **Data storage**: Refer to project specific documentation.
- **Cable type**: 90-55-15/405 Balanced twisted-pair cables type D.
- **Cable Compliance**: In accordance with mandatory obligations and the introduction of the Construction Products Regulations (CPR) on 1st July 2017 under the UK Statutory Instrument no. 1387 all cables supplied for installation within the project associated with this specification must comply with this legal requirement. The contractor is to provide legitamate certification of the product installed ensuring compliance with the CPR.
- **Containment**: Refer to project specific documentation.
- **Containment accessories**: Refer to project specific documentation.
- **Rewireable installation**: Required.
- **Concealed installation**: Required.
- **System accessories**: Refer to project specific documentation.
- **Execution**: 75-60-10/610 Removing CCTV systems;
  75-60-10/620 Installing closed circuit television systems;
  and 75-60-10/700 Installing signage.
- **System completion**: 75-60-10/810 Closed circuit television system testing and commissioning;
  75-60-10/820 Documentation;
  75-60-10/830 Spares and consumables;
  75-60-10/840 Maintenance;
  and 75-60-10/850 Training.

System performance

210 Design of CCTV systems

Used by: 75-60-10/110 CCTV system.

- **Design**: Complete the design of the CCTV system.

- **Standards**: In accordance with BS 8418 and In accordance with BS EN 62676-4.
- **System type**: Refer to project specific documentation.
- **Security grading**: Refer to project specific documentation.
- **Requirement**: Submit proposals, including positions of cameras (including field of view), detectors (including range and coverage), areas designated for parking, control rooms, power supplies and interconnections. Include technical information, calculations and manufacturers' literature.

212 Operational requirements

Used by: 75-60-10/110 CCTV system.

- **Standard**: In accordance with BS EN 62676-4.
- **Objectives**: Refer to project specific documentation.
- **Limitations of surveillance**: Refer to project specific documentation.
- **Area under surveillance**: Refer to project specific documentation.
- **Activity to be captured**: Refer to project specific documentation.
- **Picture performance**: Refer to project specific documentation.
- **Period of operation**: Refer to project specific documentation.
- **Site conditions**: Refer to project specific documentation.
- **Resilience**: Refer to project specific documentation.
- **Image monitoring**: Refer to project specific documentation.
- **Image storage**: Refer to project specific documentation.
- **Image transfer**: Refer to project specific documentation.
- **Routine actions**: Refer to project specific documentation.
- **Operational response**: Refer to project specific documentation.
- **Training**: Refer to project specific documentation.
- **Future expansion**: Refer to project specific documentation.

215 Remote monitoring

Used by: 75-60-10/110 CCTV system.

- **Standard**: In accordance with BS 8418.
- **Remote video response centre (RVRC)**:
  - **Registration**: Refer to project specific documentation.
  - **Location**: Refer to project specific documentation.
- **Audio challenge facility**: Required.

250 Integration with other alarm and security systems

Used by: 75-60-10/110 CCTV system.

- **Objectives**: Refer to project specific documentation.
- **Systems to be integrated**: Refer to project specific documentation.

260 Video motion detection software

Used by: 75-60-10/110 CCTV system.

- **Operating system**: Refer to project specific documentation.
- **Functions**: Refer to project specific documentation.

Execution

610 Removing CCTV systems

Used by: 75-60-10/110 CCTV system.

- **Scope**: Refer to project specific documentation.

620 Installing closed circuit television systems

Used by: 75-60-10/110 CCTV system.

- **Standard**: Refer to project specific documentation.
- **Site survey**: Assess the site conditions and available artificial light.
- **Access**: Locate system to provide safe access for maintenance and testing.

700 Installing signage

Used by: 75-60-10/110 CCTV system.

- **Position**: Refer to project specific documentation.

System completion

810 Closed circuit television system testing and commissioning

Used by: 75-60-10/110 CCTV system.

- **Standard**: To BS EN 62676-4.
- **System commissioning agent**: Refer to project specific documentation.
- **Notice before commencing tests (minimum)**: Refer to project specific documentation.
- **Cable testing**:
  - **Insulation resistance**: Submit results.
  - **Earth continuity**: Submit results.
- **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.

- **Live and recorded images**: Demonstrate from each camera and provide digital copies for reference purposes.

820 Documentation

Used by: 75-60-10/110 CCTV system.

- **Standard**: In accordance with BS EN 62676-1-1.
- **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**: Refer to project specific documentation.
- **Secure recording area logbook**: Hard back cover embossed "CCTV LOG BOOK" with A4 lined paper, minimum 100 pages.
- **Number of copies**: Refer to project specific documentation.
- **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**: Refer to project specific documentation.
- **Submittal date**: At handover.

830 Spares and consumables

Used by: 75-60-10/110 CCTV system.

- **Supply the following spares**: Refer to project specific documentation.
- **Supply the following consumables**: Refer to project specific documentation.

840 Maintenance

Used by: 75-60-10/110 CCTV system.

- **Servicing and maintenance**: Undertake.
- **Duration**: Refer to project specific documentation.

850 Training

Used by: 75-60-10/110 CCTV system.

- **Operator training**:

- **Training provider**: System supplier.
- **Training period**: Refer to project specific documentation.
- **Training content**: Refer to project specific documentation.

Ω End of section

75-60-40 Intrusion and hold-up alarm systems

System outline

110 Intrusion and hold-up alarm system

- **System performance**: 75-60-40/210 Design of intrusion and hold-up alarm systems;
  75-60-40/220 System setting and unsetting;
  75-60-40/225 Protected area, zoning and device identification;
  75-60-40/230 Spare capacity;
  75-60-40/235 Connection to fire detection and alarm systems;
  75-60-40/236 Integration with CCTV systems;
  75-60-40/238 Integration with other alarm and security systems;
  75-60-40/240 Continuous monitoring;
  75-60-40/253 Prevention of setting for grade 1 systems;
  75-60-40/255 Prevention of setting for grade 2 systems;
  75-60-40/257 Prevention of setting for grade 3 systems;
  75-60-40/259 Supplementary processing of signals for grade 1 systems;
  75-60-40/261 Supplementary processing of signals for grade 2 systems;
  75-60-40/263 Supplementary processing of signals for grade 3 or 4 systems;
  75-60-40/264 Supplementary indications available to access level 1 users;
  75-60-40/265 Supplementary indications available to access level 2, 3 and 4 users;
  75-60-40/270 Notification requirements;
  75-60-40/278 Supplementary tamper detection;
  75-60-40/286 Monitoring of signals and substitution of system components in grade 1, 2 and 3 systems;
  75-60-40/288 Event recording for grade 1 systems;
  75-60-40/290 Event recording for grade 2 systems;
  75-60-40/292 Event recording for grade 3 systems;
  and 75-60-40/294 Event recording for grade 4 systems.
- **System manufacturer**: Refer to project specific documentation.
- **Control and indicating equipment (CIE)**: Refer to project specific documentation.
- **Notification equipment**: Refer to project specific documentation.
- **Detectors**: Refer to project specific documentation.
- **Cable type**: Refer to project specific documentation.
- **Cable Compliance**: In accordance with mandatory obligations and the introduction of the Construction Products Regulations (CPR) on 1st July 2017 under the UK Statutory Instrument no. 1387 all cables supplied for installation within the project associated with this specification must comply with this legal requirement. The contractor is to provide legitamate certification of the product installed ensuring compliance with the CPR.
- **Containment**: Refer to project specific documentation.
- **Containment accessories**: Refer to project specific documentation.

- **Rewireable installation**: Required.
- **Concealed installation**: Required.
- **Execution**: 75-60-40/610 Removing intrusion and hold-up alarm systems and 75-60-40/620 Installing intrusion and hold-up alarm systems.
- **System completion**: 75-60-40/810 Testing and commissioning intrusion and hold-up alarms systems;
  75-60-40/820 Documentation;
  75-60-40/830 Spares and consumables;
  75-60-40/840 Maintenance;
  75-60-40/850 Device identification and testing;
  75-60-40/860 System soak testing;
  75-60-40/870 Standby battery testing;
  75-60-40/880 Testing actuation, integration and interfacing with other alarm and security systems;
  and 75-60-40/890 Modifications to existing intrusion and hold-up alarm systems.

System performance

210 Design of intrusion and hold-up alarm systems

Used by: 75-60-40/110 Intrusion and hold-up alarm system.

- **Design**: Complete the design of the intrusion and hold-up alarm system.
- **Standard**: In accordance with PD 6662.
- **Security grading**: Refer to project specific documentation.
- **Environmental classification**: Refer to project specific documentation.
- **Power supply**: Refer to project specific documentation.
- **Confirmation of alarm condition**:
  - **Standard**: In accordance with BS 8243.
  - **Means of confirmation**: Refer to project specific documentation.
- **Requirement**: Submit proposals In accordance with DD CLC/TS 50131-7, Annex G.

220 System setting and unsetting

Used by: 75-60-40/110 Intrusion and hold-up alarm system.

- **Design the system to accommodate the following entry and exit routes**:
  - **Entry**: Refer to project specific documentation.
  - **Exit**: Refer to project specific documentation.

225 Protected area, zoning and device identification

Used by: 75-60-40/110 Intrusion and hold-up alarm system.

- **Areas to be protected**:
- **Perimeter protection**: All external doors.

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

230 Spare capacity

Used by: 75-60-40/110 Intrusion and hold-up alarm system.

- **Spare capacity (minimum)**: Refer to project specific documentation.

235 Connection to fire detection and alarm systems

Used by: 75-60-40/110 Intrusion and hold-up alarm system.

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

236 Integration with CCTV systems

Used by: 75-60-40/110 Intrusion and hold-up alarm system.

- **Integration**: In accordance with BS 8418.

238 Integration with other alarm and security systems

Used by: 75-60-40/110 Intrusion and hold-up alarm system.

- **Objectives**: Refer to project specific documentation.
- **Systems to be integrated**: Refer to project specific documentation.

240 Continuous monitoring

Used by: 75-60-40/110 Intrusion and hold-up alarm system.

- **Objective**: Refer to project specific documentation.
- **Continuous monitoring**: All plant room doors.

253 Prevention of setting for grade 1 systems

Used by: 75-60-40/110 Intrusion and hold-up alarm system.

- **Conditions preventing system setting**: Refer to project specific documentation.

255 Prevention of setting for grade 2 systems

Used by: 75-60-40/110 Intrusion and hold-up alarm system.

- **Conditions preventing system setting**: Refer to project specific documentation.

257 Prevention of setting for grade 3 systems

Used by: 75-60-40/110 Intrusion and hold-up alarm system.

- **Conditions preventing system setting**: Movement detector range reduction.

259 Supplementary processing of signals for grade 1 systems

Used by: 75-60-40/110 Intrusion and hold-up alarm system.

- **System status, set**:
  - **Response to hold-up signal or message**: Refer to project specific documentation.
  - **Response to fault signal or message**: Refer to project specific documentation.
  - **Response to tamper signal or message**: Refer to project specific documentation.
- **System status, unset**:
  - **Response to hold-up signal or message**: Refer to project specific documentation.
  - **Response to fault signal or message**: ATS message as fault.
  - **Response to tamper signal or message**: Refer to project specific documentation.

261 Supplementary processing of signals for grade 2 systems

Used by: 75-60-40/110 Intrusion and hold-up alarm system.

- **System status, set**:
  - **Response to hold-up signal or message**: Refer to project specific documentation.
  - **Response to fault signal or message**: Internal audible alarm.
  - **Response to tamper signal or message**: Refer to project specific documentation.
- **System status, unset**:
  - **Response to hold-up signal or message**: Refer to project specific documentation.
  - **Response to fault signal or message**: ATS message as fault.
  - **Response to tamper signal or message**: Refer to project specific documentation.

263 Supplementary processing of signals for grade 3 or 4 systems

Used by: 75-60-40/110 Intrusion and hold-up alarm system.

- **System status, set**:
  - **Response to hold-up signal or message**: Refer to project specific documentation.
  - **Response to tamper signal or message**: Refer to project specific documentation.
  - **Response to fault signal or message**: Internal audible alarm.
- **System status, unset**:
  - **Response to hold-up signal or message**: Refer to project specific documentation.
  - **Response to tamper signal or message**: Internal audible alarm.

264 Supplementary indications available to access level 1 users

Used by: 75-60-40/110 Intrusion and hold-up alarm system.

- **During setting**: Set state.
- **During unsetting**: Refer to project specific documentation.

265 Supplementary indications available to access level 2, 3 and 4 users

Used by: 75-60-40/110 Intrusion and hold-up alarm system.

- **System set**: Refer to project specific documentation.
- **During setting**: Refer to project specific documentation.

- **During unsetting**: Refer to project specific documentation.

270 Notification requirements

Used by: 75-60-40/110 Intrusion and hold-up alarm system.

- **Means of notification**: Refer to project specific documentation.

278 Supplementary tamper detection

Used by: 75-60-40/110 Intrusion and hold-up alarm system.

- **Tamper detection of hold-up devices**: Required.
- **Tamper detection of detectors and sensors**: Required.
- **Tamper detection of junction boxes**: Required.
- **Additional forms of tamper detection**: Refer to project specific documentation.

286 Monitoring of signals and substitution of system components in grade 1, 2 and 3 systems

Used by: 75-60-40/110 Intrusion and hold-up alarm system.

- **Substitution of system components**: Refer to project specific documentation.
- **Delay, modification, substitution or loss of signals or messages**: Refer to project specific documentation.

288 Event recording for grade 1 systems

Used by: 75-60-40/110 Intrusion and hold-up alarm system.

- **Endurance of memory after system power failure (minimum)**: Refer to project specific documentation.
- **Event recording functions**: Refer to project specific documentation.

290 Event recording for grade 2 systems

Used by: 75-60-40/110 Intrusion and hold-up alarm system.

- **Event recording functions**: Refer to project specific documentation.

292 Event recording for grade 3 systems

Used by: 75-60-40/110 Intrusion and hold-up alarm system.

- **Event recording functions**: Refer to project specific documentation.

294 Event recording for grade 4 systems

Used by: 75-60-40/110 Intrusion and hold-up alarm system.

- **Event recording functions**: Refer to project specific documentation.

Execution

610 Removing intrusion and hold-up alarm systems

Used by: 75-60-40/110 Intrusion and hold-up alarm system.

- **Scope**: Refer to project specific documentation.

620 Installing intrusion and hold-up alarm systems

Used by: 75-60-40/110 Intrusion and hold-up alarm system.

- **Standards**: To DD CLC/TS 50131-7.

System completion

810 Testing and commissioning intrusion and hold-up alarms systems

Used by: 75-60-40/110 Intrusion and hold-up alarm system.

- **Standard**: To DD CLC/TS 50131-7.
- **System commissioning agent**: System manufacturer.
- **Notice before commencing tests (minimum)**: Refer to project specific documentation.
- **Cable testing**:
  - **Insulation resistance**: Submit results.
  - **Earth continuity**: Submit results.
- **Charger**: Verify operation.
- **Detection devices**: Verify the operation, and adjust to provide maximum coverage.
- **Device voltage**: Submit details of the voltage at powered devices.
- **Local warning devices**: Verify operation.
- **Remote signalling**: Verify operation.
- **Standby supply**: Verify operation in the event of a mains failure. Check capacity and submit results.
- **Tamper detection**: Verify operation.
- **Timers**: Set up and adjust entry and exit timers.
- **User codes**: Set up and commission.

820 Documentation

Used by: 75-60-40/110 Intrusion and hold-up alarm system.

- **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**: Refer to project specific documentation.
- **Log book**: Hardback cover embossed 'INTRUDER AND ALARM SYSTEM LOG BOOK' with A4 lined paper, minimum 100 pages.
- **Number of copies**: Refer to project specific documentation.
- **Record drawings**:
  - **Content**: General arrangement drawings showing the location of all control and indicating equipment, remote key pads, detectors,;
    sounders, visual indicators, 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, 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**: Refer to project specific documentation.
- **Submittal date**: At handover.

830 Spares and consumables

Used by: 75-60-40/110 Intrusion and hold-up alarm system.

- **Supply the following spares**:
  - **Deliberately operated devices**: Refer to project specific documentation.
  - **Detectors**: Refer to project specific documentation.
  - **Protective switches.**: Refer to project specific documentation.

840 Maintenance

Used by: 75-60-40/110 Intrusion and hold-up alarm system.

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

850 Device identification and testing

Used by: 75-60-40/110 Intrusion and hold-up alarm system.

- **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.

860 System soak testing

Used by: 75-60-40/110 Intrusion and hold-up alarm system.

- **Soak test**: Undertake when construction works are complete, but before handover and before connection to a remote alarm receiving centre.
- **Period**: Refer to project specific documentation.
- **Re-test after remedial works**: Required.

870 Standby battery testing

Used by: 75-60-40/110 Intrusion and hold-up alarm system.

- **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.

880 Testing actuation, integration and interfacing with other alarm and security systems

Used by: 75-60-40/110 Intrusion and hold-up alarm system.

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

890 Modifications to existing intrusion and hold-up alarm systems

Used by: 75-60-40/110 Intrusion and hold-up alarm system.

- **Modification certificate**: Submit.
- **Existing operation and maintenance manuals and record drawings**: Update.

Ω End of section

75-65-30 Fire detection and alarm systems

System outline

110 Fire detection and alarm systems in non-domestic premises type A

- **System performance**: 75-65-30/210 Design of fire detection and alarm systems in non-domestic premises;
  75-65-30/230 Performance of fire detection and alarm systems type A;
  75-65-30/245 Detection zones type A;
  75-65-30/250 Alarm zones type A;
  75-65-30/255 Actuation of fire protection systems type A;
  75-65-30/260 Integration with other alarm and security systems type A;
  75-65-30/265 Interfaces to equipment type A;
  75-65-30/270 Interface isolation for testing purposes type A;
  75-65-30/275 Alarm filtering type A;
  75-65-30/280 External alarm signalling type A;
  and 75-65-30/285 Automatic transmission of alarm signals type A.
- **System manufacturer**: Refer to project specific documentation.
- **System type**: Refer to project specific documentation.
- **Detection devices**:
  - **Atmosphere**: Refer to project specific documentation.
  - **Types**: 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;
    and 90-75-30/350 Point smoke detectors.
- **Equipment interconnectivity**: 90-75-30/311 Radio based equipment type A.
- **Cable Compliance**: In accordance with mandatory obligations and the introduction of the Construction Products Regulations (CPR) on 1st July 2017 under the UK Statutory Instrument no. 1387 all cables supplied for installation within the project associated with this specification must comply with this legal requirement. The contractor is to provide legitamate certification of the product installed ensuring compliance with the CPR.
- **Cable containment**: Refer to project specific documentation.
- **Containment accessories**: Refer to project specific documentation.
- **Rewireable installation**: Required.
- **Concealed installation**: Required.
- **Internal alarms**:
  - **Primary**: Refer to project specific documentation.
  - **Secondary**: 90-75-30/370 Vibrating radio pagers and 90-75-30/415 Visual alarm signal devices.

- **External alarms**: 90-75-30/360 Sounders.
- **Controls**: 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.
- **System accessories**: 75-65-30/560 Zone diagrams type A;
  75-65-30/560 Zone diagrams type B;
  90-75-30/405 Automatic door release mechanisms;
  and 90-75-30/410 Remote indicators.
- **Execution**: 75-65-30/605 Removing fire detection and alarm systems type A;
  75-65-30/610 Installing fire detection and alarm systems in non-domestic premises;
  75-65-30/615 Modifying existing fire detection and alarm systems in non-domestic premises;
  75-65-30/620 Working in areas protected by fire detection and alarm systems in non-domestic premises;
  75-65-30/630 Installing cabling for fire detection and alarm systems in non-domestic premises type A;
  75-65-30/685 Radio communications survey type A;
  75-65-30/685 Radio communications survey type C;
  75-65-30/695 Installing interfaces to other equipment and systems type A;
  and 75-65-30/700 Installing all zone evacuation controls.
- **System completion**: 75-65-30/805 System information;
  75-65-30/806 Device identification and testing type A;
  75-65-30/807 Standby battery testing type A;
  75-65-30/808 System soak testing type A;
  75-65-30/809 Measurement of sound pressure levels type A;
  75-65-30/810 Testing and commissioning fire detection and alarm systems in non-domestic premises;
  75-65-30/818 Modifications to existing fire detection and alarm systems type A;
  75-65-30/819 Testing actuation, integration and interfacing with alarm and security systems type A;
  75-65-30/820 Documentation for fire detection and alarm systems in non-domestic premises;
  75-65-30/830 Spares and consumables type A;
  75-65-30/840 Maintenance type A;
  75-65-30/850 Verification certificate for fire detection and alarm systems in non-domestic premises;
  and 75-65-30/860 Acceptance certificate for fire detection and alarm systems in non-domestic premises.

110 Fire detection and alarm systems in non-domestic premises type B

- **System performance**:
- **System manufacturer**:
- **System type**:
- **Detection devices**:

  - **Atmosphere**:
  - **Types**:
- **Equipment interconnectivity**:
- **Cable containment**:
- **Containment accessories**:
- **Rewireable installation**: Required.
- **Concealed installation**: Required.
- **Internal alarms**:
  - **Primary**:
  - **Secondary**:
- **External alarms**:
- **Controls**:
- **System accessories**:
- **Execution**:
- **System completion**:

115 Fire detection and alarm systems in domestic premises

- **System performance**: 75-65-30/215 Design of fire detection and alarm systems in domestic premises;
  75-65-30/216 Design of fire alarm and carbon monoxide alarm systems in dwellings intended to warn deaf or hard of hearing people;
  75-65-30/230 Performance of fire detection and alarm systems type B;
  75-65-30/245 Detection zones type B;
  75-65-30/250 Alarm zones type B;
  75-65-30/255 Actuation of fire protection systems type B;
  75-65-30/260 Integration with other alarm and security systems type B;
  75-65-30/265 Interfaces to equipment type B;
  75-65-30/270 Interface isolation for testing purposes type B;
  75-65-30/275 Alarm filtering type B;
  75-65-30/280 External alarm signalling type B;
  and 75-65-30/285 Automatic transmission of alarm signals type B.
- **Detection devices**: Refer to project specific documentation.
- **Supplementary warning devices**: Refer to project specific documentation.
- **Equipment interconnectivity**: 90-75-30/311 Radio based equipment type B.
- **Cable containment**: Refer to project specific documentation.
- **Containment accessories**: Refer to project specific documentation.
- **Rewireable installation**: Required.
- **Concealed installation**: Required.
- **Execution**: 75-65-30/605 Removing fire detection and alarm systems type B;
  75-65-30/650 Installing fire detection and alarm systems in domestic premises;
  75-65-30/685 Radio communications survey type B;

75-65-30/695 Installing interfaces to other equipment and systems type B;
and 75-65-30/695 Installing interfaces to other equipment and systems type C.

- **System completion**: 75-65-30/806 Device identification and testing type B;
  75-65-30/807 Standby battery testing type B;
  75-65-30/808 System soak testing type B;
  75-65-30/809 Measurement of sound pressure levels type B;
  75-65-30/811 Testing and commissioning fire detection and alarm systems in domestic premises;
  75-65-30/818 Modifications to existing fire detection and alarm systems type B;
  75-65-30/819 Testing actuation, integration and interfacing with alarm and security systems type B;
  75-65-30/821 Documentation for fire detection and alarm systems in domestic premises;
  75-65-30/830 Spares and consumables type B;
  75-65-30/840 Maintenance type B;
  and 75-65-30/861 Acceptance certificate for Grade A fire detection and alarm systems in domestic premises.

120 Aspirating smoke detector system

- **System performance**: 75-65-30/220 Design of aspirating smoke detector systems;
  75-65-30/235 Performance of aspirating smoke detector systems;
  75-65-30/245 Detection zones type C;
  75-65-30/250 Alarm zones type C;
  75-65-30/255 Actuation of fire protection systems type C;
  75-65-30/260 Integration with other alarm and security systems type C;
  75-65-30/265 Interfaces to equipment type C;
  75-65-30/270 Interface isolation for testing purposes type C;
  75-65-30/275 Alarm filtering type C;
  75-65-30/280 External alarm signalling type C;
  75-65-30/280 External alarm signalling type D;
  and 75-65-30/285 Automatic transmission of alarm signals type C.
- **System manufacturer**: Refer to project specific documentation.
- **System type**: Refer to project specific documentation.
- **Detector type**: Refer to project specific documentation.
- **Pipe and fittings**: Refer to project specific documentation.
- **Execution**: 75-65-30/630 Installing cabling for fire detection and alarm systems in non-domestic premises type B;
  75-65-30/695 Installing interfaces to other equipment and systems type D;
  and 75-65-30/750 Installing aspirating smoke detector systems.
- **System completion**: 75-65-30/809 Measurement of sound pressure levels type C;
  75-65-30/815 Testing and commissioning of aspirating smoke detector systems;
  75-65-30/819 Testing actuation, integration and interfacing with alarm and security systems type C;

75-65-30/825 Documentation for aspirating smoke detector systems;
75-65-30/830 Spares and consumables type C;
75-65-30/840 Maintenance type C;
and 75-65-30/840 Maintenance type D.

130 Duct smoke detector system

- **System performance**: 75-65-30/225 Design of duct smoke detector systems;
  75-65-30/240 Performance of duct smoke detector systems;
  75-65-30/245 Detection zones type D;
  75-65-30/250 Alarm zones type D;
  75-65-30/255 Actuation of fire protection systems type D;
  75-65-30/260 Integration with other alarm and security systems type D;
  75-65-30/265 Interfaces to equipment type D;
  75-65-30/270 Interface isolation for testing purposes type D;
  75-65-30/275 Alarm filtering type D;
  75-65-30/280 External alarm signalling type E;
  and 75-65-30/285 Automatic transmission of alarm signals type D.
- **System manufacturer**: Refer to project specific documentation.
- **Detector type**: Refer to project specific documentation.
- **Execution**: 75-65-30/755 Installing duct smoke detector systems
- **System completion**: 75-65-30/809 Measurement of sound pressure levels type D;
  75-65-30/817 Testing and commissioning of duct smoke detector systems;
  75-65-30/819 Testing actuation, integration and interfacing with alarm and security systems type D;
  75-65-30/827 Documentation for duct smoke detector systems;
  75-65-30/830 Spares and consumables type D;
  and 75-65-30/840 Maintenance type E.

System performance

210 Design of fire detection and alarm systems in non-domestic premises

Used by: 75-65-30/110 Fire detection and alarm systems in non-domestic premises type A.

- **System designer**: System manufacturer.
- **Standards**: Complete the design of the fire detection and alarm system in accordance with BS 5839-1;
  Complete the design of the fire detection and alarm system in accordance with BS 5839-1 and HTM 05-03, Part B;
  and Complete the design of the fire detection and alarm system in accordance with BS 5839-1 and BS 6266.
- **Category**: Refer to project specific documentation.
- **Coverage**: Refer to project specific documentation.

- **Requirement**: Submit proposals including detailed design drawings, technical information, calculations and manufacturers' literature.
- **System design certificate**: Submit with design proposals.

215 Design of fire detection and alarm systems in domestic premises

Used by: 75-65-30/115 Fire detection and alarm systems in domestic premises.

- **System designer**: System manufacturer.
- **Standard**: Complete the design of the fire detection and alarm system in accordance with BS 5839-6.
- **Category**: Refer to project specific documentation.
- **Grade**: Refer to project specific documentation.
- **Coverage**: Refer to project specific documentation.
- **Requirement**: Submit proposals including detailed design drawings, technical information, calculations and manufacturers' literature.
- **System design certificate**: Submit with design proposals.

216 Design of fire alarm and carbon monoxide alarm systems in dwellings intended to warn deaf or hard of hearing people

Used by: 75-65-30/115 Fire detection and alarm systems in domestic premises.

- **Standard**: To BS 5446-3.
- **Grade**: Refer to project specific documentation.

220 Design of aspirating smoke detector systems

Used by: 75-65-30/120 Aspirating smoke detector system.

- **System designer**: System manufacturer.
- **Design**: Complete the design of the aspirating smoke detector system in accordance with FIACode of Practice for Design, Installation, Commissioning and Maintenance of Aspirating Smoke Detector (ASD) systems.
- **Requirement**: Submit proposals, including detailed 3D design drawings indicating sampling pipe layout, product technical information and calculations produced via the ASD manufacturer's BS EN 54-20 compliant software tool which indicate system design class, transport time, hole sensitivity, sample air flow rate, sample point location and sample air pressure.
- **System design certificate**: Submit with design proposals.

225 Design of duct smoke detector systems

Used by: 75-65-30/130 Duct smoke detector system.

- **System designer**: System manufacturer.
- **Design**: Complete the design of the duct smoke detector system in accordance with FIACode of practice for design, installation, commissioning and maintenance of duct smoke detector (DSD) systems.

- **Requirement**: Submit proposals, including detailed design drawings, technical information, calculations and manufacturers' literature.
- **System design certificate**: Submit with design proposals.

230 Performance of fire detection and alarm systems type A

Used by: 75-65-30/110 Fire detection and alarm systems in non-domestic premises type A.

- **Spare system capacity**: Refer to project specific documentation.
- **Number of devices per zone (maximum)**: Refer to project specific documentation.

230 Performance of fire detection and alarm systems type B

Used by: 75-65-30/115 Fire detection and alarm systems in domestic premises.

- **Spare system capacity**: Refer to project specific documentation.
- **Number of devices per zone (maximum)**: Refer to project specific documentation.

235 Performance of aspirating smoke detector systems

Used by: 75-65-30/120 Aspirating smoke detector system.

- **System objectives**: Refer to project specific documentation.
- **Areas to be protected**: Refer to project specific documentation.

240 Performance of duct smoke detector systems

Used by: 75-65-30/130 Duct smoke detector system.

- **System objectives**: Refer to project specific documentation.
- **Areas to be protected**: Refer to project specific documentation.

245 Detection zones type A

Used by: 75-65-30/110 Fire detection and alarm systems in non-domestic premises type A.

- **Zoning**: Refer to project specific documentation.

245 Detection zones type B

Used by: 75-65-30/115 Fire detection and alarm systems in domestic premises.

- **Zoning**: Refer to project specific documentation.

245 Detection zones type C

Used by: 75-65-30/120 Aspirating smoke detector system.

- **Zoning**: Refer to project specific documentation.

245 Detection zones type D

Used by: 75-65-30/130 Duct smoke detector system.

- **Zoning**: Refer to project specific documentation.

250 Alarm zones type A

Used by: 75-65-30/110 Fire detection and alarm systems in non-domestic premises type A.

- **Alarm zoning**: Refer to project specific documentation.
- **Mode of operation**: Refer to project specific documentation.
- **All zone evacuate control**: Refer to project specific documentation.

250 Alarm zones type B

Used by: 75-65-30/115 Fire detection and alarm systems in domestic premises.

- **Alarm zoning**: Refer to project specific documentation.
- **Mode of operation**: Refer to project specific documentation.
- **All zone evacuate control**: Refer to project specific documentation.

250 Alarm zones type C

Used by: 75-65-30/120 Aspirating smoke detector system.

- **Alarm zoning**: Refer to project specific documentation.
- **Mode of operation**: Refer to project specific documentation.
- **All zone evacuate control**: Refer to project specific documentation.

250 Alarm zones type D

Used by: 75-65-30/130 Duct smoke detector system.

- **Alarm zoning**: Refer to project specific documentation.
- **Mode of operation**: Refer to project specific documentation.
- **All zone evacuate control**: Refer to project specific documentation.

255 Actuation of fire protection systems type A

Used by: 75-65-30/110 Fire detection and alarm systems in non-domestic premises type A.

- **Standard**: In accordance with BS 7273-1;
  In accordance with BS 7273-3;
  and In accordance with BS 7273-4.
- **Objectives**: Refer to project specific documentation.

255 Actuation of fire protection systems type B

Used by: 75-65-30/115 Fire detection and alarm systems in domestic premises.

- **Standard**: Refer to project specific documentation.
- **Objectives**: Refer to project specific documentation.

255 Actuation of fire protection systems type C

Used by: 75-65-30/120 Aspirating smoke detector system.

- **Standard**: Refer to project specific documentation.

- **Objectives**: Refer to project specific documentation.

255 Actuation of fire protection systems type D

Used by: 75-65-30/130 Duct smoke detector system.

- **Standard**: Refer to project specific documentation.
- **Objectives**: Refer to project specific documentation.

260 Integration with other alarm and security systems type A

Used by: 75-65-30/110 Fire detection and alarm systems in non-domestic premises type A.

- **Objectives**: Refer to project specific documentation.
- **Systems to be integrated**: Refer to project specific documentation.

260 Integration with other alarm and security systems type B

Used by: 75-65-30/115 Fire detection and alarm systems in domestic premises.

- **Objectives**: Refer to project specific documentation.
- **Systems to be integrated**: Refer to project specific documentation.

260 Integration with other alarm and security systems type C

Used by: 75-65-30/120 Aspirating smoke detector system.

- **Objectives**: Refer to project specific documentation.
- **Systems to be integrated**: Refer to project specific documentation.

260 Integration with other alarm and security systems type D

Used by: 75-65-30/130 Duct smoke detector system.

- **Objectives**: Refer to project specific documentation.
- **Systems to be integrated**: Refer to project specific documentation.

265 Interfaces to equipment type A

Used by: 75-65-30/110 Fire detection and alarm systems in non-domestic premises type A.

- **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**: Refer to project specific documentation.

265 Interfaces to equipment type B

Used by: 75-65-30/115 Fire detection and alarm systems in domestic premises.

- **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**: Refer to project specific documentation.

265 Interfaces to equipment type C

Used by: 75-65-30/120 Aspirating smoke detector system.

- **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**: Refer to project specific documentation.

265 Interfaces to equipment type D

Used by: 75-65-30/130 Duct smoke detector system.

- **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**: Refer to project specific documentation.

270 Interface isolation for testing purposes type A

Used by: 75-65-30/110 Fire detection and alarm systems in non-domestic premises type A.

- **Isolation of systems and equipment**: Design system so that the actuation, integration and interfacing can be isolated during fire alarm testing.
- **Means of isolation**: Refer to project specific documentation.

270 Interface isolation for testing purposes type B

Used by: 75-65-30/115 Fire detection and alarm systems in domestic premises.

- **Isolation of systems and equipment**: Design system so that the actuation, integration and interfacing can be isolated during fire alarm testing.
- **Means of isolation**: Refer to project specific documentation.

270 Interface isolation for testing purposes type C

Used by: 75-65-30/120 Aspirating smoke detector system.

- **Isolation of systems and equipment**: Design system so that the actuation, integration and interfacing can be isolated during fire alarm testing.
- **Means of isolation**: Refer to project specific documentation.

270 Interface isolation for testing purposes type D

Used by: 75-65-30/130 Duct smoke detector system.

- **Isolation of systems and equipment**: Design system so that the actuation, integration and interfacing can be isolated during fire alarm testing.
- **Means of isolation**: Refer to project specific documentation.

275 Alarm filtering type A

Used by: 75-65-30/110 Fire detection and alarm systems in non-domestic premises type A.

- **Objective**: Refer to project specific documentation.

- **Arrangement**: Refer to project specific documentation.

275 Alarm filtering type B

Used by: 75-65-30/115 Fire detection and alarm systems in domestic premises.

- **Objective**: Refer to project specific documentation.
- **Arrangement**: Refer to project specific documentation.

275 Alarm filtering type C

Used by: 75-65-30/120 Aspirating smoke detector system.

- **Objective**: Refer to project specific documentation.
- **Arrangement**: Refer to project specific documentation.

275 Alarm filtering type D

Used by: 75-65-30/130 Duct smoke detector system.

- **Objective**: Refer to project specific documentation.
- **Arrangement**: Refer to project specific documentation.

280 External alarm signalling type A

Used by: 75-65-30/110 Fire detection and alarm systems in non-domestic premises type A.

- **Objective**: Refer to project specific documentation.

280 External alarm signalling type B

Used by: 75-65-30/115 Fire detection and alarm systems in domestic premises.

- **Objective**: Refer to project specific documentation.

280 External alarm signalling type C

Used by: 75-65-30/120 Aspirating smoke detector system.

- **Objective**: Refer to project specific documentation.

280 External alarm signalling type D

Used by: 75-65-30/120 Aspirating smoke detector system.

- **Objective**: Refer to project specific documentation.

280 External alarm signalling type E

Used by: 75-65-30/130 Duct smoke detector system.

- **Objective**: Refer to project specific documentation.

285 Automatic transmission of alarm signals type A

Used by: 75-65-30/110 Fire detection and alarm systems in non-domestic premises type A.

- **Means of signal transmission**:
  - **Primary**: Refer to project specific documentation.
  - **Secondary**: Refer to project specific documentation.
- **Transmission path monitoring**: Required.
- **Signals to be transmitted to ARC**: Separately identifiable signals for pre-alarm, alarm, fault, device isolated and zone isolated.

285 Automatic transmission of alarm signals type B

Used by: 75-65-30/115 Fire detection and alarm systems in domestic premises.

- **Means of signal transmission**:
  - **Primary**: Refer to project specific documentation.
  - **Secondary**: Refer to project specific documentation.
- **Transmission path monitoring**: Required.
- **Signals to be transmitted to ARC**: Separately identifiable signals for pre-alarm, alarm, fault, device isolated and zone isolated.

285 Automatic transmission of alarm signals type C

Used by: 75-65-30/120 Aspirating smoke detector system.

- **Means of signal transmission**:
  - **Primary**: Refer to project specific documentation.
  - **Secondary**: Refer to project specific documentation.
- **Transmission path monitoring**: Required.
- **Signals to be transmitted to ARC**: Separately identifiable signals for pre-alarm, alarm, fault, device isolated and zone isolated.

285 Automatic transmission of alarm signals type D

Used by: 75-65-30/130 Duct smoke detector system.

- **Means of signal transmission**:
  - **Primary**: Refer to project specific documentation.
  - **Secondary**: Refer to project specific documentation.
- **Transmission path monitoring**: Required.
- **Signals to be transmitted to ARC**: Separately identifiable signals for pre-alarm, alarm, fault, device isolated and zone isolated.

Custom made products

560 Zone diagrams type A

Used by: 75-65-30/110 Fire detection and alarm systems in non-domestic premises type A.

- **Style**: Paper print mounted in a glazed frame.
- **Size**: Refer to project specific documentation.

- **Layout**: Submit proposals.

560 Zone diagrams type B

Used by: 75-65-30/110 Fire detection and alarm systems in non-domestic premises type A.

- **Style**: Paper print mounted in a glazed frame.
- **Size**: A3.
- **Layout**: Submit proposals.

Execution

605 Removing fire detection and alarm systems type A

Used by: 75-65-30/110 Fire detection and alarm systems in non-domestic premises type A.

- **Scope**: Refer to project specific documentation.

605 Removing fire detection and alarm systems type B

Used by: 75-65-30/115 Fire detection and alarm systems in domestic premises.

- **Scope**: Refer to project specific documentation.

610 Installing fire detection and alarm systems in non-domestic premises

Shared by: 75-65-30/110 Fire detection and alarm systems in non-domestic premises type A; 75-65-30/615 Modifying existing fire detection and alarm systems in non-domestic premises; 75-65-30/630 Installing cabling for fire detection and alarm systems in non-domestic premises; type A and type B; 75-65-30/695 Installing interfaces to other equipment and systems; type A; type B; type C and type D; and 75-65-30/700 Installing all zone evacuation controls.

- **Standard**: In accordance with BS 5839-1.

615 Modifying existing fire detection and alarm systems in non-domestic premises

Used by: 75-65-30/110 Fire detection and alarm systems in non-domestic premises type A.

- **General requirements**: 75-65-30/610 Installing fire detection and alarm systems in non-domestic premises.
- **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.

620 Working in areas protected by fire detection and alarm systems in non-domestic premises

Used by: 75-65-30/110 Fire detection and alarm systems in non-domestic premises type A.

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

630 Installing cabling for fire detection and alarm systems in non-domestic premises type A

Used by: 75-65-30/110 Fire detection and alarm systems in non-domestic premises type A.

- **General requirements**: 75-65-30/610 Installing fire detection and alarm systems in non-domestic premises.
- **Standard**: In accordance with BS 7671.
- **Cable route**: Segregate from other cabling. Where installed in trunking, locate in a dedicated fire cabling compartment.
- **Cable topology**: Refer to project specific documentation.
- **Mechanical protection**: Refer to project specific documentation.
- **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 and seal to prevent transmission of gas and dust.
- **Jointing**: At equipment terminals.
- **Cable terminals**: Use ceramic terminal blocks.
- **Maximum circuit resistance**: Measure before concealment. Submit results.

630 Installing cabling for fire detection and alarm systems in non-domestic premises type B

Used by: 75-65-30/120 Aspirating smoke detector system.

- **General requirements**: 75-65-30/610 Installing fire detection and alarm systems in non-domestic premises.
- **Standard**: In accordance with BS 7671.
- **Cable route**: Segregate from other cabling. Where installed in trunking, locate in a dedicated fire cabling compartment.
- **Cable topology**: Refer to project specific documentation.
- **Mechanical protection**: Refer to project specific documentation.
- **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 and seal to prevent transmission of gas and dust.
- **Jointing**: At equipment terminals.

- **Cable terminals**: Use ceramic terminal blocks.
- **Maximum circuit resistance**: Measure before concealment. Submit results.

650 Installing fire detection and alarm systems in domestic premises

Used by: 75-65-30/115 Fire detection and alarm systems in domestic premises.

- **Standard**: In accordance with BS 5839-6.
- **Detectors**: Locate to provide safe access for maintenance and testing.

685 Radio communications survey type A

Used by: 75-65-30/110 Fire detection and alarm systems in non-domestic premises type A.

- **Survey method**: Submit proposals.
- **Reliability and integrity of proposed communications paths**: Determine.
- **Results**: Submit.

685 Radio communications survey type B

Used by: 75-65-30/115 Fire detection and alarm systems in domestic premises.

- **Survey method**: Submit proposals.
- **Reliability and integrity of proposed communications paths**: Determine.
- **Results**: Submit.

685 Radio communications survey type C

Used by: 75-65-30/110 Fire detection and alarm systems in non-domestic premises type A.

- **Survey method**: Submit proposals.
- **Reliability and integrity of proposed communications paths**: Determine.
- **Results**: Submit.

695 Installing interfaces to other equipment and systems type A

Used by: 75-65-30/110 Fire detection and alarm systems in non-domestic premises type A.

- **General requirements**: 75-65-30/610 Installing fire detection and alarm systems in non-domestic premises.
- **Connection to equipment**: Install interconnecting wiring between interface unit and equipment controlled.
- **Interface units**: Label, describing their function.

695 Installing interfaces to other equipment and systems type B

Used by: 75-65-30/115 Fire detection and alarm systems in domestic premises.

- **General requirements**: 75-65-30/610 Installing fire detection and alarm systems in non-domestic premises.

- **Connection to equipment**: Install interconnecting wiring between interface unit and equipment controlled.
- **Interface units**: Label, describing their function.

695 Installing interfaces to other equipment and systems type C

Used by: 75-65-30/115 Fire detection and alarm systems in domestic premises.

- **General requirements**: 75-65-30/610 Installing fire detection and alarm systems in non-domestic premises.
- **Connection to equipment**: Install interconnecting wiring between interface unit and equipment controlled.
- **Interface units**: Label, describing their function.

695 Installing interfaces to other equipment and systems type D

Used by: 75-65-30/120 Aspirating smoke detector system.

- **General requirements**: 75-65-30/610 Installing fire detection and alarm systems in non-domestic premises.
- **Connection to equipment**: Install interconnecting wiring between interface unit and equipment controlled.
- **Interface units**: Label, describing their function.

700 Installing all zone evacuation controls

Used by: 75-65-30/110 Fire detection and alarm systems in non-domestic premises type A.

- **General requirements**: 75-65-30/610 Installing fire detection and alarm systems in non-domestic premises.
- **Position**: Refer to project specific documentation.

750 Installing aspirating smoke detector systems

Used by: 75-65-30/120 Aspirating smoke detector system.

- **Standard**: In accordance with FIACode of Practice for Design, Installation, Commissioning and Maintenance of Aspirating Smoke Detector (ASD) Systems.
- **Pipework**:
  - **Pipe location**: Refer to project specific documentation.
  - **Fixings**: Refer to project specific documentation.
  - **Joints**: Solvent welded.
  - **Bends**: Long radius.
  - **Labelling**: Refer to project specific documentation.
- **Connection to sampling point**: Refer to project specific documentation.
- **Sampling points**: Refer to project specific documentation.

755 Installing duct smoke detector systems

Used by: 75-65-30/130 Duct smoke detector system.

- **Standard**: In accordance with FIACode of practice for design, installation, commissioning and maintenance of duct smoke detector (DSD) systems.

System completion

805 System information

Used by: 75-65-30/110 Fire detection and alarm systems in non-domestic premises type A.

- **Device list**: Before commissioning, Submit proposals, including proposed device, zone and group names.
- **Zone diagram**: Before commissioning Submit proposals.

806 Device identification and testing type A

Used by: 75-65-30/110 Fire detection and alarm systems in non-domestic premises type A.

- **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.

806 Device identification and testing type B

Used by: 75-65-30/115 Fire detection and alarm systems in domestic premises.

- **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.

807 Standby battery testing type A

Used by: 75-65-30/110 Fire detection and alarm systems in non-domestic premises type A.

- **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.

807 Standby battery testing type B

Used by: 75-65-30/115 Fire detection and alarm systems in domestic premises.

- **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.

808 System soak testing type A

Used by: 75-65-30/110 Fire detection and alarm systems in non-domestic premises type A.

- **Soak test**: Undertake when construction works are complete, but before handover.
- **Period**: 14 days.
- **Re-test after remedial works**: Required.

808 System soak testing type B

Used by: 75-65-30/115 Fire detection and alarm systems in domestic premises.

- **Soak test**: Undertake when construction works are complete, but before handover.
- **Period**: 14 days.
- **Re-test after remedial works**: Required.

809 Measurement of sound pressure levels type A

Used by: 75-65-30/110 Fire detection and alarm systems in non-domestic premises type A.

- **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 and Submit room schedule with results.

809 Measurement of sound pressure levels type B

Used by: 75-65-30/115 Fire detection and alarm systems in domestic premises.

- **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 and Submit room schedule with results.

809 Measurement of sound pressure levels type C

Used by: 75-65-30/120 Aspirating smoke detector system.

- **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 and Submit room schedule with results.

809 Measurement of sound pressure levels type D

Used by: 75-65-30/130 Duct smoke detector system.

- **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 and Submit room schedule with results.

810 Testing and commissioning fire detection and alarm systems in non-domestic premises

Used by: 75-65-30/110 Fire detection and alarm systems in non-domestic premises type A.

- **Standard**: In accordance with BS 5839-1.
- **System commissioning agent**: System manufacturer.
- **Notice before commencing tests (minimum)**: Two weeks.

811 Testing and commissioning fire detection and alarm systems in domestic premises

Used by: 75-65-30/115 Fire detection and alarm systems in domestic premises.

- **Standard**: In accordance with BS 5839-6.
- **System commissioning agent**: System manufacturer.
- **Notice before commissioning (minimum)**: Two weeks.

815 Testing and commissioning of aspirating smoke detector systems

Used by: 75-65-30/120 Aspirating smoke detector system.

- **Standard**: In accordance with FIACode of Practice for Design, Installation, Commissioning and Maintenance of Aspirating Smoke Detector (ASD) systems.

817 Testing and commissioning of duct smoke detector systems

Used by: 75-65-30/130 Duct smoke detector system.

- **Standard**: In accordance with FIACode of practice for design, installation, commissioning and maintenance of duct smoke detector (DSD) systems.

818 Modifications to existing fire detection and alarm systems type A

Used by: 75-65-30/110 Fire detection and alarm systems in non-domestic premises type A.

- **Modification certificate**: Submit.
- **Existing operation and maintenance manuals and record drawings**: Update.

818 Modifications to existing fire detection and alarm systems type B

Used by: 75-65-30/115 Fire detection and alarm systems in domestic premises.

- **Modification certificate**: Submit.
- **Existing operation and maintenance manuals and record drawings**: Update.

819 Testing actuation, integration and interfacing with alarm and security systems type A

Used by: 75-65-30/110 Fire detection and alarm systems in non-domestic premises type A.

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

819 Testing actuation, integration and interfacing with alarm and security systems type B

Used by: 75-65-30/115 Fire detection and alarm systems in domestic premises.

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

819 Testing actuation, integration and interfacing with alarm and security systems type C

Used by: 75-65-30/120 Aspirating smoke detector system.

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

819 Testing actuation, integration and interfacing with alarm and security systems type D

Used by: 75-65-30/130 Duct smoke detector system.

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

820 Documentation for fire detection and alarm systems in non-domestic premises

Used by: 75-65-30/110 Fire detection and alarm systems in non-domestic premises type A.

- **Standard**: In accordance with BS 5839-1.
- **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**: Refer to project specific documentation.
- **Log book**: Submit one copy in accordance with BS 5839-1 Annex G.
- **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**: Refer to project specific documentation.
  - **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 H.1.
  - **Installation certificate**: Submit two copies in accordance with BS 5839-1 Annex H.2.
  - **Commissioning certificate**: Submit two copies in accordance with BS 5839-1 Annex H.3.

821 Documentation for fire detection and alarm systems in domestic premises

Used by: 75-65-30/115 Fire detection and alarm systems in domestic premises.

- **Standard**: In accordance with BS 5839-6.
- **Record drawings**:
  - **Content**: General arrangement drawings showing the location of all control, indicating and power supply equipment, manual call points, fire detectors, and fire alarm 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**: Refer to project specific documentation.
  - **Submittal date**: At handover.
- **Certification**:
  - **Grade A systems**:

Design certificate: Submit two copies in accordance with BS 5839-6, Annex E.1.
Installation certificate: Submit two copies in accordance with BS 5839-6, Annex E.2.
Commissioning certificate: Submit two copies in accordance with BS 5839-6, Annex E.3.

- **Grade B, C, D, and E systems**: Submit two copies in accordance with BS 5839-6, Annex F.

825 Documentation for aspirating smoke detector systems

Used by: 75-65-30/120 Aspirating smoke detector 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**: Refer to project specific documentation.
- **Log book**: Submit one copy in accordance with BS 5839-1, Annex G.
- **Record drawings**:
  - **Content**: General arrangement drawings showing the location of ASDs, sampling pipe, sampling points, and interface units connecting to other equipment.
  - **Drawing format**: A1 paper print drawing and Electronic drawing.
  - **Number of copies**: Refer to project specific documentation.
  - **Submittal date**: At handover.
- **Certification**:
  - **Design certificate**: Submit in accordance with FIACode of Practice for Design, Installation, Commissioning and Maintenance of Aspirating Smoke Detector (ASD) systems, Annex I.2.
  - **Installation certificate**: Submit in accordance with FIACode of Practice for Design, Installation, Commissioning and Maintenance of Aspirating Smoke Detector (ASD) systems, Annex I.3.
  - **Commissioning certificate**: Submit in accordance with FIACode of Practice for Design, Installation, Commissioning and Maintenance of Aspirating Smoke Detector (ASD) systems, Annex I.4.

827 Documentation for duct smoke detector systems

Used by: 75-65-30/130 Duct smoke detector 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**: Refer to project specific documentation.
- **Log book**: Submit one copy in accordance with FIACode of practice for design, installation, commissioning and maintenance of duct smoke detector (DSD) systems.
- **Record drawings**:
  - **Content**: General arrangement drawings showing the location of all control and indicating equipment, sensors, sampling pipe, and interface units connecting to other equipment.
  - **Drawing format**: A1 paper print drawing and Electronic drawing.
  - **Number of copies**: Refer to project specific documentation.
  - **Submittal date**: At handover.
- **Certification**:
  - **Design certificate**: Submit in accordance with FIACode of practice for design, installation, commissioning and maintenance of duct smoke detector (DSD) systems, Annex B.2.
  - **Installation certificate**: Submit in accordance with FIACode of practice for design, installation, commissioning and maintenance of duct smoke detector (DSD) systems, Annex B.3.
  - **Commissioning certificate**: Submit in accordance with FIACode of practice for design, installation, commissioning and maintenance of duct smoke detector (DSD) systems, Annex B.4.

830 Spares and consumables type A

Used by: 75-65-30/110 Fire detection and alarm systems in non-domestic premises type A.

- **Supply the following spares**:
  - **Detectors**: Two of each type.
- **Printer ink and paper roll**: Replace immediately before handover.

830 Spares and consumables type B

Used by: 75-65-30/115 Fire detection and alarm systems in domestic premises.

- **Supply the following spares**:
  - **Frangible elements for manual call points**: Refer to project specific documentation.
  - **Detectors**: Two of each type.
- **Printer ink and paper roll**: Replace immediately before handover.

830 Spares and consumables type C

Used by: 75-65-30/120 Aspirating smoke detector system.

- **Supply the following spares**:
  - **Frangible elements for manual call points**: Refer to project specific documentation.
  - **Detectors**: Two of each type.
- **Printer ink and paper roll**: Replace immediately before handover.

830 Spares and consumables type D

Used by: 75-65-30/130 Duct smoke detector system.

- **Supply the following spares**:
  - **Frangible elements for manual call points**: Refer to project specific documentation.
  - **Detectors**: Two of each type.
- **Printer ink and paper roll**: Replace immediately before handover.

840 Maintenance type A

Used by: 75-65-30/110 Fire detection and alarm systems in non-domestic premises type A.

- **Standard**: In accordance with BS 5839-1 and In accordance with BS 5839-6.
- **Duration**: Until 12 months after Practical Completion.

840 Maintenance type B

Used by: 75-65-30/115 Fire detection and alarm systems in domestic premises.

- **Standard**: In accordance with BS 5839-1 and In accordance with BS 5839-6.
- **Duration**: Until 12 months after Practical Completion.

840 Maintenance type C

Used by: 75-65-30/120 Aspirating smoke detector system.

- **Standard**: In accordance with BS 5839-1 and In accordance with BS 5839-6.
- **Duration**: Until 12 months after Practical Completion.

840 Maintenance type D

Used by: 75-65-30/120 Aspirating smoke detector system.

- **Standard**: In accordance with BS 5839-1 and In accordance with BS 5839-6.
- **Duration**: Until 12 months after Practical Completion.

840 Maintenance type E

Used by: 75-65-30/130 Duct smoke detector system.

- **Standard**: In accordance with BS 5839-1 and In accordance with BS 5839-6.
- **Duration**: Until 12 months after Practical Completion.

850 Verification certificate for fire detection and alarm systems in non-domestic premises

Used by: 75-65-30/110 Fire detection and alarm systems in non-domestic premises type A.

- **System verification agent**: System Manufacturer or approved agent.
- **Verification certificate**: Submit two copies in accordance with BS 5839-1, Annex H.5.

860 Acceptance certificate for fire detection and alarm systems in non-domestic premises

Used by: 75-65-30/110 Fire detection and alarm systems in non-domestic premises type A.

- **Acceptance certificate**: Submit two copies in accordance with BS 5839-1, Annex H.4.

861 Acceptance certificate for Grade A fire detection and alarm systems in domestic premises

Used by: 75-65-30/115 Fire detection and alarm systems in domestic premises.

- **Acceptance certificate**: Submit two copies in accordance with BS 5839-6, Annex E.4.

Ω End of section

75-70-05 Assistance call systems

System outline

110 Assistance call system

- **System performance**: 75-70-05/210 Design of assistance call systems and 75-70-05/230 Integration with other alarm and security systems type A.
- **System manufacturer**: Refer to Schedule of Manufacturers
- **Operating voltage**: 12 V d.c.
- **Zones**: Refer to project specific documentation.
- **Equipment interconnectivity**: 90-70-05/310 Radio based equipment for emergency voice communication type A.
- **Call actuator**: 90-70-05/320 Pull cord units and 90-70-05/330 Press button units.
- **Alarm indication**: 90-70-05/350 Overdoor indicators and 90-70-05/360 Remote indicators.
- **Reset unit**: 90-70-05/380 Reset units.
- **Power supply unit**: 90-70-05/390 Power supply units type A.
- **Circuit monitoring**: Refer to project specific documentation.
- **Cable type**: Refer to project specific documentation.
- **Cable Compliance**: In accordance with mandatory obligations and the introduction of the Construction Products Regulations (CPR) on 1st July 2017 under the UK Statutory Instrument no. 1387 all cables supplied for installation within the project associated with this specification must comply with this legal requirement. The contractor is to provide legitamate certification of the product installed ensuring compliance with the CPR.
- **Containment**: Refer to project specific documentation.
- **Rewireable installation**: Required.
- **Concealed installation**: Required.
- **Execution**: 75-70-05/610 Removing assistance call systems type A;
  75-70-05/620 Radio communications surveys type A;
  and 75-70-05/630 Installing assistance call systems.
- **System completion**: 75-70-05/810 Testing and commissioning assistance call systems generally type A;
  75-70-05/825 Calibration certificates type A;
  75-70-05/830 Documentation for assistance call systems;
  ;
  and 75-70-05/840 Maintenance type A.

120 Emergency voice communication system

- **System performance**: 75-70-05/220 Design of emergency voice communication systems and 75-70-05/230 Integration with other alarm and security systems type B.
- **System manufacturer**: Refer to project specific documentation.
- **Operating voltage**: Refer to project specific documentation.

- **Zones**: Refer to project specific documentation.
- **Equipment interconnectivity**: 90-70-05/310 Radio based equipment for emergency voice communication type B.
- **Call actuator**: Refer to project specific documentation.
- **Disabled refuge master station**: Refer to project specific documentation.
- **Alarm indication**: Refer to project specific documentation.
- **Power supply unit**: 90-70-05/390 Power supply units type B.
- **Circuit monitoring**: Open circuit and short circuit.
- **Cable type**: Refer to project specific documentation.
- **Cable Compliance**: In accordance with mandatory obligations and the introduction of the Construction Products Regulations (CPR) on 1st July 2017 under the UK Statutory Instrument no. 1387 all cables supplied for installation within the project associated with this specification must comply with this legal requirement. The contractor is to provide legitamate certification of the product installed ensuring compliance with the CPR.
- **Containment**: Refer to project specific documentation.
- **Rewireable installation**: Required.
- **Concealed installation**: Required.
- **System accessories**: Refer to project specific documentation.
- **Execution**: 75-70-05/610 Removing assistance call systems type B;
  75-70-05/620 Radio communications surveys type B;
  and 75-70-05/640 Installing emergency voice communication systems.
- **System completion**: 75-70-05/810 Testing and commissioning assistance call systems generally type B;
  75-70-05/825 Calibration certificates type B;
  75-70-05/835 Documentation for emergency voice communication systems;
  75-70-05/840 Maintenance type B;
  75-70-05/850 Verification certificate;
  and 75-70-05/860 Acceptance certificate.

System performance

210 Design of assistance call systems

Used by: 75-70-05/110 Assistance call system.

- **Design**: Complete the design of the assistance call system.
- **Requirement**: Submit proposals including detailed design drawings, technical information, calculations and manufacturers' literature.

220 Design of emergency voice communication systems

Used by: 75-70-05/120 Emergency voice communication system.

- **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**: Refer to project specific documentation.
- **System design certificate**: Submit with design proposals.

230 Integration with other alarm and security systems type A

Used by: 75-70-05/110 Assistance call system.

- **Objectives**: Refer to project specific documentation.
- **Systems to be integrated**: Refer to project specific documentation.

230 Integration with other alarm and security systems type B

Used by: 75-70-05/120 Emergency voice communication system.

- **Objectives**: Refer to project specific documentation.
- **Systems to be integrated**: Refer to project specific documentation.

Execution

610 Removing assistance call systems type A

Used by: 75-70-05/110 Assistance call system.

- **Scope**: Refer to project specific documentation.

610 Removing assistance call systems type B

Used by: 75-70-05/120 Emergency voice communication system.

- **Scope**: Refer to project specific documentation.

620 Radio communications surveys type A

Used by: 75-70-05/110 Assistance call system.

- **Survey method**: Submit proposals.
- **Reliability and integrity of proposed communications paths**: Determine.
- **Results**: Submit.

620 Radio communications surveys type B

Used by: 75-70-05/120 Emergency voice communication system.

- **Survey method**: Submit proposals.
- **Reliability and integrity of proposed communications paths**: Determine.
- **Results**: Submit.

630 Installing assistance call systems

Used by: 75-70-05/110 Assistance call system.

- **Standard**: In accordance with BS 7671.

640 Installing emergency voice communication systems

Used by: 75-70-05/120 Emergency voice communication system.

- **Standard**: In accordance with BS 7671 and BS 5839-9.
- **Wiring arrangement**: Until 12 months after Practical Completion.

System completion

810 Testing and commissioning assistance call systems generally type A

Used by: 75-70-05/110 Assistance call system.

- **Standards**: In accordance with BS 7671 and In accordance with BS 5839-9.
- **Notice before commencing commissioning**: 7 d.
- **System commissioning agent**: System manufacturer.
- **Controls**: Verify operation.
- **Alarm signalling**: Verify operation.
- **Results**: Submit.

810 Testing and commissioning assistance call systems generally type B

Used by: 75-70-05/120 Emergency voice communication system.

- **Standards**: In accordance with BS 7671 and In accordance with BS 5839-9.
- **Notice before commencing commissioning**: 7 d.
- **System commissioning agent**: System manufacturer.
- **Controls**: Verify operation.
- **Alarm signalling**: Verify operation.
- **Results**: Submit.

825 Calibration certificates type A

Used by: 75-70-05/110 Assistance call system.

- **Certificates of calibration for meters and instruments**: Submit.

825 Calibration certificates type B

Used by: 75-70-05/120 Emergency voice communication system.

- **Certificates of calibration for meters and instruments**: Submit.

830 Documentation for assistance call systems

Used by: 75-70-05/110 Assistance call 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**: Refer to project specific documentation.
- **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**: Refer to project specific documentation.
- **Submittal date**: At handover.

835 Documentation for emergency voice communication systems

Used by: 75-70-05/120 Emergency voice communication 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**: Refer to project specific documentation.
- **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**: Refer to project specific documentation.
- **Submittal date**: At handover.
- **Test certificates**:
  - **Design certificate**: Refer to project specific documentation.
  - **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.

840 Maintenance type A

Used by: 75-70-05/110 Assistance call system.

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

840 Maintenance type B

Used by: 75-70-05/120 Emergency voice communication system.

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

850 Verification certificate

Used by: 75-70-05/120 Emergency voice communication system.

- **System verification agent**: System manufacturer.
- **Verification certificate**: Submit two copies in accordance with BS 5839-9, Annex C.5.

860 Acceptance certificate

Used by: 75-70-05/120 Emergency voice communication system.

- **Acceptance certificate**: Submit two copies in accordance with BS 5839-9, Annex C.4.

Ω End of section

75-70-55 Nurse call systems

System outline

110 Nurse call system

- **System performance**: 75-70-55/210 Design of nurse call systems
- **System manufacturer**: Refer to project specific documentation.
- **Call initiation devices**:
  - **Patient handsets**: Refer to project specific documentation.
  - **Patient pull cords**: Refer to project specific documentation.
  - **Patient call buttons**: Refer to project specific documentation.
  - **Nurse emergency pull-switches**: Refer to project specific documentation.
  - **Combined nurse emergency/ patient call buttons**: Refer to project specific documentation.
- **Patient call reset buttons**: Refer to project specific documentation.
- **Visual indicators**: Refer to project specific documentation.
- **Audible signals**: Refer to project specific documentation.
- **Operating voltage**: Refer to project specific documentation.
- **Power supply units**: Refer to project specific documentation.
- **Call indicator panels**: Refer to project specific documentation.
- **Cable type**: Refer to project specific documentation.
- **Cable Compliance**: In accordance with mandatory obligations and the introduction of the Construction Products Regulations (CPR) on 1st July 2017 under the UK Statutory Instrument no. 1387 all cables supplied for installation within the project associated with this specification must comply with this legal requirement. The contractor is to provide legitamate certification of the product installed ensuring compliance with the CPR.
- **Containment**: Refer to project specific documentation.
- **Containment accessories**: Refer to project specific documentation.
- **Rewireable installation**: Required.
- **Concealed installation**: Required.
- **Execution**: 75-70-55/610 Removing nurse call systems and 75-70-55/620 Installing nurse call systems.
- **System completion**: 75-70-55/810 Testing and commissioning nurse call systems;
  75-70-55/820 Documentation;
  75-70-55/830 Spares and consumables;
  and 75-70-55/840 Maintenance.

System performance

210 Design of nurse call systems

Used by: 75-70-55/110 Nurse call system.

- **Design**: Complete the design of the nurse call system.
- **Standard**: In accordance with DOH publication HTM 08-03.
- **Spare capacity**: Refer to project specific documentation.
- **Proposals**: Submit detailed design drawings, technical information, calculations and manufacturers' literature.
- **Equipment electrical power**: Provide electrical supplies to equipment requiring power.

Execution

610 Removing nurse call systems

Used by: 75-70-55/110 Nurse call system.

- **Scope**: Refer to project specific documentation.

620 Installing nurse call systems

Used by: 75-70-55/110 Nurse call system.

- **Installation**: In accordance with DOH publication HTM 08-03.

System completion

810 Testing and commissioning nurse call systems

Used by: 75-70-55/110 Nurse call system.

- **Notice before commencing tests (minimum)**: Refer to project specific documentation.
- **Testing and commissioning**: In accordance with DOH publication HTM 08-03.
- **Controls**: Verify operation.
- **Alarm signalling**: Verify operation.
- **Audible signal sound level output**: Measure.
- **Results**: Submit.
- **Certificates of calibration for meters and instruments**: Submit.

820 Documentation

Used by: 75-70-55/110 Nurse call 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**: Refer to project specific documentation.
- **Record drawings**:
  - **Content**: Locations of all equipment;

Location and routes of all cables;
and Schematic diagram of connections.
  - **Format**: A1 paper print drawing and Electronic drawing.
  - **Number of copies**: Refer to project specific documentation.
- **Submittal date**: At handover.

830 Spares and consumables

Used by: 75-70-55/110 Nurse call system.

- **Supply the following spares**:
  - **Patient handsets**: Refer to project specific documentation.
  - **Patient pull cords**: Refer to project specific documentation.
  - **Visual indicators**: Refer to project specific documentation.
  - **Dummy call device plugs**: Refer to project specific documentation.
- **Supply the following consumables**: Refer to project specific documentation.

840 Maintenance

Used by: 75-70-55/110 Nurse call system.

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

Ω End of section

75-70-95 Voice alarm systems

System outline

110 Voice alarm system

- **System performance**: 75-70-95/210 Design of voice alarm systems;
  75-70-95/220 Performance of voice alarm systems;
  75-70-95/230 Alarm system type V2;
  75-70-95/240 Alarm system type V3;
  75-70-95/250 Alarm system type V4;
  75-70-95/260 Alarm system type V5;
  75-70-95/270 Emergency loudspeaker zones;
  75-70-95/280 Integration with fire detection and alarm system;
  and 75-70-95/290 Integration with other alarm and security systems.
- **System manufacturer**: Refer to project specific documentation.
- **Voice alarm control and indicating equipment**:
  - **Power supplies**:
    Primary: Refer to project specific documentation.
    Secondary: Refer to project specific documentation.
  - **Controls**: Refer to project specific documentation.
  - **Message source**: Refer to project specific documentation.
- **Equipment interconnectivity**: .
- **Cable containment**: Refer to project specific documentation.
- **Cable Compliance**: In accordance with mandatory obligations and the introduction of the Construction Products Regulations (CPR) on 1st July 2017 under the UK Statutory Instrument no. 1387 all cables supplied for installation within the project associated with this specification must comply with this legal requirement. The contractor is to provide legitamate certification of the product installed ensuring compliance with the CPR.
- **Containment accessories**: Refer to project specific documentation.
- **Rewireable installation**: Required.
- **Concealed installation**: Required.
- **Loudspeakers**: Refer to project specific documentation.
- **System accessories**: Refer to project specific documentation.
- **Execution**: 75-70-95/610 Removing voice alarm systems;
  75-70-95/615 Radio communications surveys;
  75-70-95/620 Modifying existing voice alarm systems;
  75-70-95/630 Installing voice alarm systems generally;
  75-70-95/640 Installing voice alarm system cabling;
  75-70-95/650 Installing voice alarm control and indicating equipment;
  75-70-95/660 Installing equipment racks;

75-70-95/670 Installing voice alarm emergency microphones;
75-70-95/680 Samples;
and 75-70-95/690 Labelling.

- **System completion**: 75-70-95/807 Standby battery testing;
  75-70-95/808 Measurement of non-speech broadcast sound pressure levels;
  75-70-95/809 Measurement of message intelligibility;
  75-70-95/810 Testing and commissioning voice alarm systems generally;
  75-70-95/811 System re-commissioning;
  75-70-95/812 Testing actuation, integration and interfacing with other systems;
  75-70-95/820 Documentation;
  75-70-95/830 Spares and consumables;
  75-70-95/840 Maintenance;
  75-70-95/860 Verification certificate;
  75-70-95/870 Acceptance certificate;
  and 75-70-95/880 Modification certificate.

System performance

210 Design of voice alarm systems

Used by: 75-70-95/110 Voice alarm system.

- **System designer**: System manufacturer.
- **Standards**: Complete the design of the voice alarm system in accordance with BS 5839-8 and to BS EN 60849 and Complete the design of the voice alarm system in accordance with BS 5839-8 and BS 7827 and to BS EN 60849.
- **System type**: Refer to project specific documentation.
- **Audio signal distribution**: Refer to project specific documentation.
- **Requirement**: Submit proposals including detailed design drawings, technical information, calculations and manufacturers' literature.
- **System design certificate**: Submit with design proposals.

220 Performance of voice alarm systems

Used by: 75-70-95/110 Voice alarm system.

- **Spare system capacity**: Refer to project specific documentation.
- **Alarm message zones**: Refer to project specific documentation.
- **Loudspeaker circuits**: Refer to project specific documentation.
- **Secondary power supply capacity**: Calculate in accordance with BS 5839-8 Annex C, and Submit proposals.
- **Voice message audibility**: In accordance with BS 5839-8.
- **Ambient noise levels**: Refer to project specific documentation.
- **Voice message intelligibility**:
  - **Method of measurement**: To BS EN 60268-16.

  - **Speech transmission index (STI) (minimum)**: 0.5.
- **Amplifier failure**: Refer to project specific documentation.
- **System frequency response**: Refer to project specific documentation.

230 Alarm system type V2

Used by: 75-70-95/110 Voice alarm system.

- **Objectives of the evacuation plan**: Refer to project specific documentation.
- **Supplementary emergency microphones**: Refer to project specific documentation.

240 Alarm system type V3

Used by: 75-70-95/110 Voice alarm system.

- **Objectives of the evacuation plan**: Refer to project specific documentation.
- **Supplementary emergency microphones**: Refer to project specific documentation.

250 Alarm system type V4

Used by: 75-70-95/110 Voice alarm system.

- **Objectives of the evacuation plan**: Refer to project specific documentation.
- **Control panel**: Refer to project specific documentation.
- **Supplementary emergency microphones**: Refer to project specific documentation.

260 Alarm system type V5

Used by: 75-70-95/110 Voice alarm system.

- **Objectives of the evacuation plan**: Refer to project specific documentation.

270 Emergency loudspeaker zones

Used by: 75-70-95/110 Voice alarm system.

- **Zoning requirements**:
  - **Zone**: Refer to project specific documentation.
  - **Position**: Refer to project specific documentation.
  - **Ambient noise levels**: Refer to project specific documentation.
- **Mode of operation**: Refer to project specific documentation.

280 Integration with fire detection and alarm system

Used by: 75-70-95/110 Voice alarm system.

- **Response in the event of a fire signal**: Refer to project specific documentation.

290 Integration with other alarm and security systems

Used by: 75-70-95/110 Voice alarm system.

- **Objectives**: Refer to project specific documentation.

- **Systems to be integrated**: Refer to project specific documentation.

Execution

610 Removing voice alarm systems

Used by: 75-70-95/110 Voice alarm system.

- **Scope**: Refer to project specific documentation.

615 Radio communications surveys

Used by: 75-70-95/110 Voice alarm system.

- **Survey method**: Submit proposals.
- **Reliability and integrity of proposed communications paths**: Determine.
- **Results**: Submit.

620 Modifying existing voice alarm systems

Used by: 75-70-95/110 Voice alarm system.

- **Existing voice alarm system**:
  - **Passive elements**: Identify and label.
  - **Active elements**: Identify and label.
  - **Loudspeakers**: Identify cabling route and label.
- **Record drawings**: Make good and update.
- **Site survey**: .
- **Ambient noise**: Measure.
- **Operational and occupied noise**: Measure.
- **Reverberation times**: Refer to project specific documentation.
- **Results**: Submit.
- **Method of modification**: Submit proposals.

630 Installing voice alarm systems generally

Used by: 75-70-95/110 Voice alarm system.

- **Standard**: In accordance with BS 5839-8.
- **Equipment**: Provide electrical supplies to equipment requiring power. Derive from a dedicated circuit from the main switchboard with the same electrical phase.
- **Fire detection and alarm system**: Interconnect.
- **Metallic parts of the system**: Separate in accordance with BS EN 62305-3, from metalwork forming part of a lightning protection system.

640 Installing voice alarm system cabling

Used by: 75-70-95/110 Voice alarm system.

- **Cable route**: Segregate from other cabling. Where installed in trunking, locate in a dedicated fire cabling compartment.
- **Cable topology**: Loop or individual radial circuits.
- **Loudspeaker wiring**:
  - **Connection arrangement**: Parallel.
  - **Distribution of loudspeaker circuits**: Refer to project specific documentation.
  - **Zone wiring**: Refer to project specific documentation.
- **Timing**: Do not start internal cabling until building enclosure provides permanently dry conditions.
- **Cables**: Install in one length.
- **Cable pulling**: Submit proposals.
- **Cables passing through walls**: Sleeve with conduit or pipeduct. Bush at both ends.
- **Jointing**: At equipment and terminal fittings only.

650 Installing voice alarm control and indicating equipment

Used by: 75-70-95/110 Voice alarm system.

- **Position**: Integral within equipment rack.

660 Installing equipment racks

Used by: 75-70-95/110 Voice alarm system.

- **Position**: Refer to project specific documentation.
- **Power supply**:
  - **Primary source**: Refer to project specific documentation.
  - **Connection**: Unswitched fused connection unit.
  - **Secondary source**: Standby battery.
- **Clear access (minimum)**:
  - **Rack front**: Refer to project specific documentation.
  - **Rack rear**: Refer to project specific documentation.
  - **Rack sides**: Refer to project specific documentation.

670 Installing voice alarm emergency microphones

Used by: 75-70-95/110 Voice alarm system.

- **Position**: Refer to project specific documentation.

680 Samples

Used by: 75-70-95/110 Voice alarm system.

- **Samples to be submitted**: Refer to project specific documentation.
- **Submittals**: Include manufacturer's technical information with each sample.
- **Identification**: Label samples with the voice alarm system references.

690 Labelling

Used by: 75-70-95/110 Voice alarm system.

- **Equipment list**: Before commissioning submit system information proposals, including proposed equipment and zone identification.
- **Equipment rack**: Label with unique identification code.
- **Amplifiers**: Label with zone information.
- **Loudspeaker transformers**: Label the commissioned tapping setting.
- **Zone diagram**: Provide next to equipment racks and fire microphones. Show the location and identity of system equipment and zones.

System completion

807 Standby battery testing

Used by: 75-70-95/110 Voice alarm system.

- **Mains power supply**: Isolate.
- **Quiescent mode**: Measure current supplied by standby source when the voice alarm system is operating in the quiescent mode. Submit results.
- **Evacuate mode**: Measure current supplied by standby source when voice alarm system is operating in the full evacuate mode. Submit results.

808 Measurement of non-speech broadcast sound pressure levels

Used by: 75-70-95/110 Voice alarm system.

- **Sound pressure levels**: Measure throughout the building during worst case building operation with all doors shut.
- **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. Submit room schedule with results.

809 Measurement of message intelligibility

Used by: 75-70-95/110 Voice alarm system.

- **Test method**: Refer to project specific documentation.
- **Voice message intelligibility**: Measure throughout the building during worst case building operation with all doors shut.
- **Minimum speech transmission index (STI)**: To BS EN 60268-16.
- **Results**: Submit electronic layout drawing showing location of measurements with results. Submit tabulated room schedule with results.

810 Testing and commissioning voice alarm systems generally

Used by: 75-70-95/110 Voice alarm system.

- **Standard**: In accordance with BS 5839-8.
- **System commissioning agent**: System manufacturer.
- **Notice before commencing tests (minimum)**: Refer to project specific documentation.

811 System re-commissioning

Used by: 75-70-95/110 Voice alarm system.

- **Voice alarm system**: Re-commission.
- **Timing**: Refer to project specific documentation.

812 Testing actuation, integration and interfacing with other systems

Used by: 75-70-95/110 Voice alarm system.

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

820 Documentation

Used by: 75-70-95/110 Voice alarm system.

- **Standard**: In accordance with BS 5839-8.
- **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**: Refer to project specific documentation.
- **Log book**: Submit one copy in accordance with BS 5839-8, clause 44.
- **Record drawings**:
  - **Content**: Schematic diagram listing all equipment provided and its configuration, including any radio-linked equipment indicating background RF noise levels and achieved signal strengths and General arrangement drawings indicating the positions of all control, indicating and power supply equipment, the positions of all emergency microphones, loudspeakers and other fire alarm devices, the positions of microphones, the power tappings of all loudspeakers and the type of cable, including conductor material and c.s.a., insulation type and colour, number of cores per cable, number of cables in ducts, on tray or ladder sizes and actual routes of cables.
  - **Format**: A1 paper print drawing and Electronic drawing.
  - **Number of copies**: Refer to project specific documentation.
- **Submittal date**: At handover.

- **Certification**:
  - **Design certificate**: Submit two copies in accordance with BS 5839-8, Annex D.1.
  - **Installation certificate**: Submit two copies in accordance with BS 5839-8, Annex D.2.
  - **Commissioning certificate**: Submit two copies in accordance with BS 5839-8, Annex D.3.

830 Spares and consumables

Used by: 75-70-95/110 Voice alarm system.

- **Supply the following spares**: Refer to project specific documentation.

840 Maintenance

Used by: 75-70-95/110 Voice alarm system.

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

860 Verification certificate

Used by: 75-70-95/110 Voice alarm system.

- **System verification agent**: System manufacturer.
- **Verification certificate**: Submit two copies in accordance with BS 5839-8, Annex D.5.

870 Acceptance certificate

Used by: 75-70-95/110 Voice alarm system.

- **Acceptance certificate**: Submit two copies in accordance with BS 5839-8, Annex D.4.

880 Modification certificate

Used by: 75-70-95/110 Voice alarm system.

- **Modification certificate**: Submit two copies in accordance with BS 5839-8, Annex D.7.

Ω End of section

75-85-45 Lightning protection systems

System outline

110 Lightning protection system

- **System performance**: 75-85-45/210 Design of lightning protection systems and 75-85-45/220 Building construction for information.
- **System manufacturer**: Refer to project specific documentation.
- **Air termination system**: 90-75-50/370 Air terminals.
- **Down conductor system**: 90-75-50/380 Aluminium tape;
  90-75-50/390 Copper tape;
  90-75-50/400 Aluminium solid circular conductors;
  and 90-75-50/420 Copper solid circular conductors.
- **Earth termination system**: 90-75-50/320 Earth plates type B and 90-75-50/330 Earth rods type B.
- **Accessories**: 90-55-15/305 Anti-vandal capping;
  90-60-30/410 Surge protective devices for low voltage power supplies type C;
  ;
  90-75-50/340 Earth rod inspection pits;
  90-75-50/430 Lightning protection conductor clamps;
  and 90-75-50/460 Soil conditioning agents type B.
- **Electrical identification**: Refer to project specific documentation.
- **Execution**: 75-85-45/610 Removing lightning protection systems;
  75-85-45/620 Existing installations;
  75-85-45/630 Installing lightning protection systems;
  75-85-45/640 Installing ring earth electrodes;
  75-85-45/650 Installing test joints;
  75-85-45/660 Lightning equipotential bonding;
  75-85-45/670 Dissimilar metals;
  and 75-85-45/680 Installing notices and labels.
- **System completion**: 75-85-45/810 Inspection and testing of lightning protection systems;
  75-85-45/820 Documentation;
  and 75-85-45/840 Maintenance.

System performance

210 Design of lightning protection systems

Used by: 75-85-45/110 Lightning protection system.

- **Design**: Complete the design of the lightning protection system.
- **System designer**: A member of the Association of Technical Lightning and Access Specialists.

- **Standards**: To BS EN 62305-1, BS EN 62305-2, class I, BS EN 62305-3 and BS EN 62305-4;
  To BS EN 62305-1, BS EN 62305-2, class II, BS EN 62305-3 and BS EN 62305-4;
  To BS EN 62305-1, BS EN 62305-2, class III, BS EN 62305-3 and BS EN 62305-4;
  and To BS EN 62305-1, BS EN 62305-2, class IV, BS EN 62305-3 and BS EN 62305-4.
- **External LPS type**: Refer to project specific documentation.
- **Earth termination system**: Refer to project specific documentation.
- **Internal LPS type**: Lightning equipotential bonding by direct connections, surge protective devices, and electrical insulation.
- **Requirement**: Submit proposals including detailed design drawings, technical information, calculations and manufacturers' literature.

220 Building construction for information

Used by: 75-85-45/110 Lightning protection system.

- **Substructure**: Refer to project specific documentation.
- **Superstructure**: Refer to project specific documentation.
- **Roof structure**: Refer to project specific documentation.
- **Roof coverings**: Refer to project specific documentation.

Execution

610 Removing lightning protection systems

Used by: 75-85-45/110 Lightning protection system.

- **Scope**: Refer to project specific documentation.

620 Existing installations

Used by: 75-85-45/110 Lightning protection system.

- **Visual inspection**: Check and report on the condition of the air termination network, the down conductors and the connections to the earth termination network. Identify any evidence of corrosion or conditions likely to lead to corrosion.
- **Measure**:
  - **Isolated resistance to earth of each earth rod.**: Refer to project specific documentation.
  - **Isolated resistance to earth of the earth termination network.**: Refer to project specific documentation.
- **Results**: Submit.
- **Remedial works**: Where remedial works are necessary Submit proposals.

630 Installing lightning protection systems

Used by: 75-85-45/110 Lightning protection system.

- **Standards**: In accordance with BS EN 62305-3 and BS EN 62305-4.
- **Position**:

  - **Air termination components**: Refer to project specific documentation.
  - **Down conductors**: Refer to project specific documentation.
- **Substructure**: When used as the earth terminal network measure its resistance to earth during the construction period.
- **Results**: Submit.

640 Installing ring earth electrodes

Used by: 75-85-45/110 Lightning protection system.

- **Ring earth electrodes**:
  - **Depth**: Refer to project specific documentation.
  - **Mesh size**: Refer to project specific documentation.
  - **Arrangement**: Refer to project specific documentation.
- **Jointing method**: Refer to project specific documentation.

650 Installing test joints

Used by: 75-85-45/110 Lightning protection system.

- **Position**: Refer to project specific documentation.

660 Lightning equipotential bonding

Used by: 75-85-45/110 Lightning protection system.

- **Standards**: To BS EN 62305-3 and BS EN 62305-4.
- **Bond the following to the lightning protection system**: Refer to project specific documentation.
- **Bonding conductor sizes**: To BS EN 62305-3, Tables 8 and 9.
- **Location of bonds**: Refer to project specific documentation.

670 Dissimilar metals

Used by: 75-85-45/110 Lightning protection system.

- **Connecting dissimilar metals**: Prevent electrolytic action.

680 Installing notices and labels

Used by: 75-85-45/110 Lightning protection system.

- **Warning notices**: Refer to project specific documentation.

System completion

810 Inspection and testing of lightning protection systems

Used by: 75-85-45/110 Lightning protection system.

- **Standards**: To BS EN 62305-3 and BS EN 62305-4.
- **Results**: Include within inspection guide.

820 Documentation

Used by: 75-85-45/110 Lightning protection system.

- **Standards**: To BS EN 62305-3, Annex E and to BS EN 62305-4.
- **Inspection guide**:
  - **Submit including the following information**: The general status of the LPS including conditions of air termination components, down conductors and earth system components;
    Any deviation from the technical documentation;
    and The result of any measurements performed.
  - **Format**: A4 paper print and Electronic.
  - **Number of copies**: Refer to project specific documentation.
- **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**: Refer to project specific documentation.
- **Submittal date**: At handover.

840 Maintenance

Used by: 75-85-45/110 Lightning protection system.

- **Servicing and maintenance**: Undertake, in accordance with BS EN 62305-3 and BS EN 62305-4.
- **Duration**: Until 12 months after Practical completion.

Ω End of section

90-10-65 Pipelines

Products

445 Plastic ducts for buried electric cables type A

Used by: 70-70-35/110 High voltage distribution system.

- **Manufacturer**: Refer to project specific documentation.
- **Standard**: In accordance with ENA Technical Specification 12-24.
- **Third party certification**: British Board of Agrement approved.
- **Arrangement**: Refer to project specific documentation.
- **Material**: Refer to project specific documentation.
- **Colours**: Refer to project specific documentation.
- **Classification**: Refer to project specific documentation.
- **Inside diameter (nominal)**: Refer to project specific documentation.
- **Jointing**:
  - **Arrangement**: Manufacturer's standard.
  - **Ingress protection (minimum)**: To BS EN 60529, IP4X.
- **Execution**: 90-10-65/720 Laying pipeducts and 90-10-65/740 Laying pipeducts near foundations.

445 Plastic ducts for buried electric cables type B

Used by: 70-70-45/110 Low voltage distribution system type A.

- **Manufacturer**: Refer to project specific documentation.
- **Standard**: In accordance with ENA Technical Specification 12-24.
- **Third party certification**: British Board of Agrement approved.
- **Arrangement**: Refer to project specific documentation.
- **Material**: Unplasticized polyvinyl chloride (PVC-U).
- **Colours**: Black and Red.
- **Classification**: Refer to project specific documentation.
- **Inside diameter (nominal)**: 25 mm;
  32 mm;
  38 mm;
  42 mm;
  50 mm;
  90 mm;
  100 mm;
  117 mm;
  125 mm;
  150 mm;
  188 mm;

205 mm;
225 mm;
and 236 mm.

- **Jointing**:
  - **Arrangement**: Manufacturer's standard.
  - **Ingress protection (minimum)**: To BS EN 60529, IP4X.
- **Execution**: 90-10-65/720 Laying pipeducts and 90-10-65/740 Laying pipeducts near foundations.

Execution

720 Laying pipeducts

Shared by: 90-10-65/445 Plastic ducts for buried electric cables; type A and type B.

- **General**: Lay straight to line, true to gradient or level, fully supported on an even continuous bed.
- **Standard**: In accordance with National Joint Utilities Group guidelines volumes 1 to 6;
  In accordance with MCHW Volume 1: Specification for highway works (SHW), series 500;
  and In accordance with MCHW Volume 1: Specification for highway works (SHW), series 1500.
- **Depth to crown (minimum)**: 910 mm.
- **Tolerance**: ±20 mm from any specified level.
- **Bedding**:
  - **Material**: Fine aggregate.
  - **Thickness**: 150 mm.
- **Clearance between pipeducts where they cross (minimum)**: 50 mm.
- **Drawlines**:
  - **Material**: Refer to project specific documentation.
  - **Requirements**: During laying thread through pipeducts. Leave in place for future pulling through of services.
  - **Length**: As specified by service undertaker.
- **Ends of pipeducts terminating inside buildings**: Seal.
- **Protection**: Protect from ingress of debris. During construction, temporarily seal exposed ends.

740 Laying pipeducts near foundations

Shared by: 90-10-65/445 Plastic ducts for buried electric cables; type A and type B.

Ω End of section

90-25-50 Liquid fuel tanks

Products

315 Drip trays

Used by: 70-65-35/110 Reciprocating internal combustion engine driven alternating current generator system.

- **Manufacturer**: Refer to project specific documentation
- **Arrangement**: Removable.
- **Capacity**: At least 25% of the total storage capacity.

330 Generator day tanks

Used by: 70-65-35/110 Reciprocating internal combustion engine driven alternating current generator system.

- **Manufacturer**: Refer to project specific documentation.
- **Capacity**: Refer to project specific documentation.
- **Arrangement**: Refer to project specific documentation.
- **Fuel transfer**: Refer to project specific documentation.
- **Low level indicator and alarm**: Required.
- **Fittings**: Refer to project specific documentation.
- **Execution**: 90-25-50/610 Installing tanks.

340 Carbon steel liquid fuel tanks

Used by: 70-65-35/110 Reciprocating internal combustion engine driven alternating current generator system.

- **Manufacturer**: Refer to project specific documentation
- **Standard**: To BS EN 12285-1;
  To BS EN 12285-2;
  and To BS EN 14015.
- **Tank type**: Refer to project specific documentation.
- **Orientation**: Refer to project specific documentation.
- **Tank class**: Refer to project specific documentation.
- **Corrosion protection**: Refer to project specific documentation.
- **Tank capacity**: Refer to project specific documentation.
- **External diameter of tank (maximum)**: Refer to specalist design details.
- **Overall length of tank (maximum)**: Refer to specalist design details
- **Manhole diameter**: 1000 mm.
- **Fittings**: Drain valve;
  Fill pipe;

Isolating valves;
and Vent pipe.

- **Execution**: 90-25-50/610 Installing tanks.

345 Glass reinforced plastics liquid fuel tanks

Used by: 70-65-35/110 Reciprocating internal combustion engine driven alternating current generator system.

- **Manufacturer**: Refer to project specific documentation.
- **Standard**: To BS EN 13923 and BS EN 13121-1, -2 and -3 and To BS EN 976-1 and BS EN 976-2.
- **Tank type**: Refer to project specific documentation.
- **Orientation**: Refer to project specific documentation.
- **Tank capacity**: Refer to project specific documentation.
- **External diameter of tank (maximum)**: Refer to project specific documentation.
- **Overall length of tank (maximum)**: Refer to project specific documentation.
- **Manhole diameter**: 1000 mm.
- **Fittings**: Drain valve;
  Fill pipe;
  Isolating valves;
  and Vent pipe.
- **Execution**: 90-25-50/610 Installing tanks.

Execution

610 Installing tanks

Shared by: 90-25-50/330 Generator day tanks; 90-25-50/340 Carbon steel liquid fuel tanks; and 90-25-50/345 Glass reinforced plastics liquid fuel tanks.

- **Standards**: Refer to project specific documentation.
- **Above ground steel tanks**: Support on plinths built on concrete foundations. Run plinths across the shortest base dimension of the tanks. Plinth width to be slightly wider than the tank.
- **Above ground plastics tanks**: Support on a firm level base. Provide restraining straps in exposed conditions.
- **Fall**: Arrange horizontal tanks to slope slightly to drain off valve end.

Ω End of section

90-50-35 Generators, engines and packaged CHP units

Products

310 Generator set

Used by: 70-65-35/110 Reciprocating internal combustion engine driven alternating current generator system.

- **Manufacturer**: Refer to project specific documentation.
- **Standard**: To BS ISO 8528-1.
- **Internal combustion engine**:
  - **Standards**: To BS ISO 8528-2.
- **Battery**: Manufacturer's standard.
- **Battery charger**: Manufacturer's standard.
- **Governor**: To BS ISO 3046-4.
- **Alternator**: To BS 5000-3, and BS ISO 8528-3 or BS EN 60034-22.
- **Automatic voltage regulators**: To BS 4999-140.
- **Control panel**: To BS ISO 8528-4.

370 Generator enclosures

Used by: 70-65-35/110 Reciprocating internal combustion engine driven alternating current generator system.

- **Manufacturer**: Refer to project specific documentation.
- **Format**: Refer to project specific documentation.
- **Material**: Refer to project specific documentation.
- **Finish**: Refer to project specific documentation.
- **Colour**: Refer to project specific documentation.
- **Size (l x w x d)**: Refer to project specific documentation.
- **Personnel access doors**: Required.
- **Removable side panels**: Required.
- **Louvres**:
  - **Type**: Screen to prevent bird and rodent ingress.
  - **Dampers**: Refer to project specific documentation.
- **Anti-condensation heaters**: Thermostatically controlled to provide internal air temperature of 10 °C.
- **Acoustic performance (maximum under full load)**: Refer to project specific documentation.

380 Load banks

Used by: 70-65-35/110 Reciprocating internal combustion engine driven alternating current generator system.

- **Manufacturer**: Refer to project specific documentation.
- **Format**: Permanent resistive load.
- **Rating**: Refer to project specific documentation.
- **Enclosure**:
  - **Ingress protection (minimum)**: Refer to project specific documentation.
  - **Anti-condensation heaters**: Thermostatically controlled.
- **Mounting**: Refer to project specific documentation.
- **Controls**:
  - **Type**: Refer to project specific documentation.
  - **Status indicators**: Refer to project specific documentation.
- **Arrangement**: Switch in equal load steps controlled from the generator system control panel.
- **Number of load steps**: Refer to project specific documentation.
- **Forced air cooling with run on timer**: Required.
- **Selective load control and load indicator**: Required.
- **Load step size**: Refer to project specific documentation.

Ω End of section

90-50-40 High voltage switchgear and transformers

Products

310 High voltage modular switchboards

Used by: 70-70-35/110 High voltage distribution system.

- **Manufacturer**: Refer to project specific documentation.
- **Standards**: To BS EN 62271-1, BS EN 62271-200 and IEC 60466.
- **Third party certification**: To ENA TS 41-36.
- **Format**: Metal enclosed.
- **Internal arc classification**: Refer to project specific documentation.
- **Switchgear cubicles**: Refer to project specific documentation.
- **Switchgear arrangement**: Refer to project specific documentation.
- **Rated voltage (Ur)**: Refer to project specific documentation.
- **Rated frequency**: Refer to project specific documentation.
- **Number of phases**: Three.
- **Rated insulation levels**:
  - **Rated short duration power frequency withstand voltage(Ud)**: Refer to project specific documentation.
  - **Rated lightning impulse withstand voltage (Up)**: Refer to project specific documentation.
- **Rated short time withstand current (Ik)**: Refer to project specific documentation.
- **Loss of service continuity category**: Refer to project specific documentation.
- **Partition class**: Refer to project specific documentation.
- **Execution**: 90-50-40/610 Installing switchgear.

320 Ring main units

Used by: 70-70-35/110 High voltage distribution system.

- **Manufacturer**: Refer to project specific documentation.
- **Standards**: To BS EN 62271-1, BS EN 62271-200 and IEC 60466.
- **Third party certification**: To ENA TS 41-36.
- **Internal arc classification**: Refer to project specific documentation.
- **Mounting arrangement**: Refer to project specific documentation.
- **Switchgear arrangement**: Refer to project specific documentation.
- **Rated voltage (Ur)**: Refer to project specific documentation.
- **Rated frequency**: Refer to project specific documentation.
- **Number of phases**: Three.
- **Rated insulation levels**:

  - **Rated short duration power frequency withstand voltage(Ud)**: Refer to project specific documentation.
  - **Rated lightning impulse withstand voltage (Up)**: Refer to project specific documentation.
- **Rated short time withstand current (Ik)**: Refer to project specific documentation.
- **Enclosure**:
  - **Ingress protection (minimum)**: Refer to project specific documentation.
  - **Mechanical protection (minimum)**: Refer to project specific documentation.
  - **Colour**: Refer to project specific documentation.
  - **Cable entry**: Refer to project specific documentation.
- **Dimensions**:
  - **Width (maximum)**: Refer to project specific documentation.
  - **Height (maximum)**: Refer to project specific documentation.
  - **Depth (maximum)**: Refer to project specific documentation.
- **Busbars**:
  - **Standard**: To BS 159.
  - **Material**: Refer to project specific documentation.
  - **Supports**: Refer to project specific documentation.
  - **Rated normal current (Ir)**: Refer to project specific documentation.
- **Ring switches**:
  - **Standard**: To BS EN 62271-102 and BS EN 62271-103.
  - **Format**: SF6 with integral fault making earth switch.
  - **Enclosure**: Refer to project specific documentation.
  - **Rated normal current (Ir)**: Refer to project specific documentation.
  - **Rated short circuit making current (Ima)**: Refer to project specific documentation.
  - **Switch class**: Refer to project specific documentation.
  - **Operating mechanism**: Refer to project specific documentation.
  - **Auxiliary switch**: Two normally open and two normally closed contacts.
  - **Mechanical interlocking**: Mechanically interlocked to prevent operation unless the main switching device is in the 'off' position.
  - **Locking mechanisms**: Refer to project specific documentation.
- **Circuit breaker**:
  - **Standard**: To BS EN 62271-100.
  - **Format**: Refer to project specific documentation.
  - **Method of installation**: Fixed.
  - **Rated normal current (Ir)**: Refer to project specific documentation.
  - **Rated short circuit breaking current (Isc)**: Refer to project specific documentation.
  - **Rated short circuit making current (Ima)**: Refer to project specific documentation.
  - **Rated operating sequence**: Refer to project specific documentation.
  - **Circuit breaker class**: Refer to project specific documentation.

  - **Operating mechanism**: Refer to project specific documentation.
  - **Controls**: Refer to project specific documentation.
  - **Mechanical interlocking**: Selection between 'Main' and 'Earth' to be mechanically interlocked and means provided to allow for padlocking in either position.
- **Display of operation**: Colour coded pictograms.
- **Voltage detection system**: Refer to project specific documentation.
- **Execution**: 90-50-40/610 Installing switchgear.

400 Protection and control module

Used by: 70-70-35/110 High voltage distribution system.

- **Manufacturer**: Refer to project specific documentation.
- **Ingress protection (minimum)**: IP3X.
- **Format**: Refer to project specific documentation.
- **Protection**: Refer to project specific documentation.
- **Measurement**: Refer to project specific documentation.
- **Control functions**: Refer to project specific documentation.

450 Liquid immersed transformers

Used by: 70-70-35/110 High voltage distribution system.

- **Manufacturer**: Refer to project specific documentation.
- **Standards**: To the BS EN 60076 series.
- **Third party certification**: To ENA TS 35-1.
- **Liquid preservation**: Refer to project specific documentation.
- **Rated apparent power**: Refer to project specific documentation.
- **Core material**: Refer to project specific documentation.
- **Cooling arrangement**:
  - **Internal dielectric cooling medium**: Refer to project specific documentation.
  - **Circulation method for internal cooling medium**: Refer to project specific documentation.
  - **External cooling medium**: Refer to project specific documentation.
  - **Circulation method for external cooling medium**: Refer to project specific documentation.
- **Highest voltage for equipment windings (Um)**: Refer to project specific documentation.
- **Rated frequency**: Refer to project specific documentation.
- **Number of phases**: Three.
- **Rated insulation levels**:
  - **Rated short duration power frequency withstand voltage(Ud)**: Refer to project specific documentation.
  - **Rated lightning impulse withstand voltage (Up)**: Refer to project specific documentation.

- **Rated primary voltage (Uprim)**: 11000 V.
- **Rated secondary voltage (Usec)**: 433 V at no-load.
- **Primary voltage tappings**:
  - **Tap change facility**: Refer to project specific documentation.
  - **Tapping range**: Refer to project specific documentation.
  - **Number of steps**: Refer to project specific documentation.
  - **Tap change operation**: Refer to project specific documentation.
- **Vector group**: To BS EN 60076-1, Dyn11.
- **Sound pressure level (maximum)**: Refer to project specific documentation.
- **Indicators and alarms**:
  - **Thermal protection**: Refer to project specific documentation.
  - **Local audible alarm systems**: Refer to project specific documentation.
- **Pressure relief device**: Refer to project specific documentation.
- **High voltage and low voltage cable terminations**:
  - **Position**: Refer to project specific documentation.
  - **Cable terminations**: Refer to project specific documentation.
- **High voltage connection arrangement**:
  - **Cable entry**: Refer to project specific documentation.
  - **Type of enclosure**: Refer to project specific documentation.
- **Low voltage connection arrangement**:
  - **Cable entry**: Refer to project specific documentation.
  - **Type of enclosure**: Refer to project specific documentation.
- **Accessories**: Refer to project specific documentation.
- **Execution**: 90-50-40/620 Installing transformers.

455 Dry-type transformers

Used by: 70-70-35/110 High voltage distribution system.

- **Manufacturer**: Refer to project specific documentation.
- **Standards**: To BS EN 50541-1 and To the BS EN 60076 series.
- **Third party certification**: To ENA TS 35-1.
- **Rated apparent power**: Refer to project specific documentation.
- **Enclosure**:
  - **Ingress protection (minimum)**: Refer to project specific documentation.
  - **Mechanical protection (minimum)**: Refer to project specific documentation.
  - **Colour**: Refer to project specific documentation.
- **Core material**: Vacuum cast resin.
- **Cooling medium**: Air (A).
- **Circulation method**: Refer to project specific documentation.
- **Temperature class**: HV and LV windings, to class F.
- **Climatic class**: Refer to project specific documentation.

- **Environmental classification**: Refer to project specific documentation.
- **Fire behaviour class**: Refer to project specific documentation.
- **Highest voltage for equipment windings (Um)**: Refer to project specific documentation.
- **Rated frequency**: Refer to project specific documentation.
- **Number of phases**: Three.
- **Rated insulation levels**:
  - **Rated short duration power frequency withstand voltage(Ud)**: Refer to project specific documentation.
  - **Rated lightning impulse withstand voltage (Up)**: Refer to project specific documentation.
- **Rated primary voltage (Uprim)**: 11000 V.
- **Rated secondary voltage (Usec)**: 433 V at no-load.
- **Primary voltage tappings**:
  - **Tap change facility**: De-energized.
  - **Tapping range**: Refer to project specific documentation.
  - **Number of steps**: Refer to project specific documentation.
  - **Tap change operation**: Refer to project specific documentation.
- **Vector group**: To BS EN 60076-1, Dyn11.
- **Sound pressure level (maximum)**: Refer to project specific documentation.
- **Indicators and alarms**:
  - **Thermal protection**: Refer to project specific documentation.
  - **Local audible alarm systems**: Refer to project specific documentation.
- **High voltage and low voltage cable terminations**:
  - **Position**: Refer to project specific documentation.
  - **Cable terminations**: Refer to project specific documentation.
- **High voltage connection arrangement**:
  - **Cable entry**: Refer to project specific documentation.
- **Low voltage connection arrangement**:
  - **Cable entry**: Refer to project specific documentation.
- **Accessories**: Refer to project specific documentation.
- **Execution**: 90-50-40/620 Installing transformers.

460 Current transformers

Used by: 70-70-35/110 High voltage distribution system.

- **Manufacturer**: Refer to project specific documentation.
- **Standards**: To BS EN 61869-1 and BS EN 61869-2.
- **Equipment type**: Refer to project specific documentation.
- **Format**: Refer to project specific documentation.
- **Rated voltage**: Refer to project specific documentation.

- **Rated short duration power frequency withstand voltage(Ud)**: Refer to project specific documentation.
- **Rated lightning impulse withstand voltage (Up)**: Refer to project specific documentation.
- **Rated primary current**: Refer to project specific documentation.
- **Rated secondary current**: Refer to project specific documentation.
- **Number of secondary windings**: Refer to project specific documentation.
- **Rated short time current**: Refer to project specific documentation.
- **Instrument function**:
  - **Measuring current transformer**:
    Accuracy class: Refer to project specific documentation.
    Instrument security factor: Refer to project specific documentation.
  - **Protective current transformer**:
    Accuracy class: Refer to project specific documentation.
    Accuracy limit factor: Refer to project specific documentation.
- **Rated output**: Refer to project specific documentation.
- **Rated frequency**: Refer to project specific documentation.
- **Operating temperature range**: Refer to project specific documentation.
- **Creepage distance (minimum)**: Refer to project specific documentation.
- **Dimensions**: Refer to project specific documentation.
- **Winding lead length (minimum)**: Refer to project specific documentation.
- **Label information**: Refer to project specific documentation.
- **Execution**: 90-50-40/620 Installing transformers.

465 Inductive voltage transformers

Used by: 70-70-35/110 High voltage distribution system.

- **Manufacturer**: Refer to project specific documentation.
- **Standards**: To BS EN 61869-1 and BS EN 61869-3.
- **Equipment type**: Refer to project specific documentation.
- **Format**: Refer to project specific documentation.
- **Rated primary voltage (Uprim)**: Refer to project specific documentation.
- **Rated voltage factor**: Refer to project specific documentation.
- **Rated voltage factor duration**: Refer to project specific documentation.
- **Highest voltage for equipment windings (Um)**: Refer to project specific documentation.
- **Rated short duration power frequency withstand voltage(Ud)**: Refer to project specific documentation.
- **Rated lightning impulse withstand voltage (Up)**: Refer to project specific documentation.
- **Rated secondary voltage (Usec)**: Refer to project specific documentation.
- **Number of secondary windings**: Refer to project specific documentation.
- **Residual voltage winding**: Refer to project specific documentation.
- **Rated residual winding voltage**: Refer to project specific documentation.

- **Instrument function**:
  - **Measuring voltage transformer**:
    Accuracy class: Refer to project specific documentation.
  - **Protective voltage transformer**:
    Accuracy class: Refer to project specific documentation.
  - **Residual winding**:
    Accuracy class: Refer to project specific documentation.
- **Rated output**: Refer to project specific documentation.
- **Rated output residual winding**: Refer to project specific documentation.
- **Rated frequency**: Refer to project specific documentation.
- **Operating temperature range**: Refer to project specific documentation.
- **Creepage distance (minimum)**: Refer to project specific documentation.
- **Dimensions**: Refer to project specific documentation.
- **Label information**: Refer to project specific documentation.
- **Execution**: Refer to project specific documentation.

Execution

610 Installing switchgear

Shared by: 90-50-40/310 High voltage modular switchboards; and 90-50-40/320 Ring main units.

- **Required inspections**: Refer to project specific documentation.
- **Switchgear cubicles**: Align in all directions ensuring inter-panel connections on busbars and earth bars are stress free.
- **Cable terminations**: Refer to project specific documentation.
- **Intertripping**: Interconnect auxiliary contacts to open low voltage circuit breaker when HV circuit breaker opens.
- **Insulating medium filling**: Refer to project specific documentation.
- **Site tests**: Refer to project specific documentation.

620 Installing transformers

Shared by: 90-50-40/450 Liquid immersed transformers; 90-50-40/455 Dry-type transformers; and 90-50-40/460 Current transformers.

- **Required inspections**: Refer to project specific documentation.
- **Cable terminations**: Refer to project specific documentation.
- **Site tests**: Refer to project specific documentation.

Ω End of section

90-50-45 Low voltage switchgear

Products

320 Power busbar trunking

Shared by: 70-70-45/110 Low voltage distribution system type A; and 70-70-75/110 Hard wired low voltage small power system.

- **Manufacturer**: Refer to Schedule of Manufacturers
- **Standards**: To BS EN 61439-1 and BS EN 61439-6.
- **Third party certification**: ASTA Type test certification.
- **Nominal voltage**: 230 V a.c and 400 V a.c.
- **Rated current**: Refer to project specific documentation.
- **Configuration**: Refer to project specific documentation.
- **Tap-off points**: Manufacturer's standard.
- **Place of installation**: Refer to project specific documentation.
- **Mounting orientation**: Refer to project specific documentation.
- **Rated peak withstand current**: Refer to project specific documentation.
- **Rated short-time withstand current (1 s)**: Refer to project specific documentation.
- **Enclosure**:
  - **Ingress protection (minimum)**: To BS EN 60529, IP55.
  - **Mechanical loads**: Heavy.
  - **Material**: Aluminium;
    GRP;
    Stainless steel;
    and Steel.
  - **Finish**: Corrosion-resistant paint;
    Epoxy enamel;
    Hot dipped galvanized;
    Paint;
    Self finished;
    and Stove enamel paint.
  - **Colour**: Submit proposals.
- **Conductors**: Refer to project specific documentation.
- **Supports**: Refer to project specific documentation.
- **Accessories**: Elbows;
  End covers;
  Fire barrier units;
  Flexible connections;
  Joint covers;
  Tap-off unit covers;

Tees;
and Thrust units.

- **Execution**: 90-50-45/620 Installing busbar trunking and 90-50-45/660 Testing and commissioning of site-assembled busbar trunking.

330 Tap-off units

Used by: 70-70-75/110 Hard wired low voltage small power system.

- **Manufacturer**: Refer to project specific documentation.
- **Standards**: To BS EN 61439-1 and BS EN 61439-6.
- **Unit type**: Refer to project specific documentation.
- **Rated current**: Refer to project specific documentation.
- **Enclosure**:
  - **Ingress protection (minimum)**: Refer to project specific documentation.
  - **Material**: Manufacturer's standard.
  - **Finish**: Manufacturer's standard.
  - **Colour**: Manufacturer's standard.
- **Configuration**: Refer to project specific documentation.
- **Protective device**: Refer to project specific documentation.
- **Execution**: 90-50-45/640 Installing tap off units.

340 Feed units

Used by: 70-70-75/110 Hard wired low voltage small power system.

- **Manufacturer**: Refer to project specific documentation.
- **Standards**: To BS EN 61439-1 and BS EN 61439-6.
- **Unit type**: Refer to project specific documentation.
- **Rated current**: Refer to project specific documentation.
- **Enclosure**:
  - **Ingress protection (minimum)**: Refer to project specific documentation.
  - **Material**: Manufacturer's standard.
  - **Finish**: Manufacturer's standard.
  - **Colour**: Manufacturer's standard.
- **Configuration**: Refer to project specific documentation.
- **Protective device**: Refer to project specific documentation.
- **Execution**: 90-50-45/645 Installing feed units.

350 Fire barrier units

Used by: 70-70-75/110 Hard wired low voltage small power system.

- **Manufacturer**: Refer to project specific documentation.
- **Standards**: To BS EN 61439-1 and BS EN 61439-6.
- **Fire resistance**: Refer to project specific documentation.

- **Circuits**: Match busbar trunking.
- **Execution**: 90-50-45/650 Installing fire barrier units.

360 Master distribution boxes

Used by: 70-80-35/120 General lighting systems with prefabricated wiring.

- **Manufacturer**: Refer to Schedule of Manufacturers
- **Standard**: To BS 5733;
  To BS EN 61439-2;
  and To BS EN 61535.
- **Distribution box**: Galvanized sheet steel with recessed input and outgoing connections.
- **Rating**: Refer to project specific documentation.
- **Connectors**:
  - **Power input connection**: Hard wired via home run cable.
  - **Power output connector type**: Fully shrouded female connector.
- **Outgoing connections**:
  - **Quantity**: Refer to project specific documentation.
  - **Poles**: Refer to project specific documentation.

380 Lighting distribution boxes type A

Used by: 70-80-35/110 Hard wired general lighting system.

- **Manufacturer**: Refer to Schedule of Manufacturers
- **Standards**: To BS 5733.
- **Distribution box**: Galvanized sheet steel with recessed input and outgoing connections.
- **Rating**: Refer to project specific documentation.
- **Connectors**:
  - **Power input connection**: Refer to project specific documentation.
  - **Power output connector type**: Refer to project specific documentation.
- **Outgoing connections**:
  - **Quantity**: Refer to project specific documentation.
  - **Poles**: Refer to project specific documentation.

380 Lighting distribution boxes type B

Used by: 70-80-35/120 General lighting systems with prefabricated wiring.

- **Manufacturer**: Refer to Schedule of Manufacturers
- **Standards**: To BS 5733.
- **Distribution box**: Galvanized sheet steel with recessed input and outgoing connections.
- **Rating**: Refer to project specific documentation.
- **Connectors**:
  - **Power input connection**: Refer to project specific documentation.
  - **Power output connector type**: Refer to project specific documentation.

- **Outgoing connections**:
  - **Quantity**: Refer to project specific documentation.
  - **Poles**: Refer to project specific documentation.

390 Cable distribution cabinets

Shared by: 70-70-45/110 Low voltage distribution system type A; 70-80-25/110 Roadway lighting system; and 70-80-25/120 Amenity lighting system.

- **Manufacturer**: Refer to Schedule of Manufacturers
- **Standards**: To BS EN 61439-1 and BS EN 61439-5.
- **Third party certification**: ASTA Type test certification.
- **Rated operational voltage (Ue)**: Refer to project specific documentation.
- **Rated operational frequency**: 50 Hz.
- **Number of phases**: Refer to project specific documentation.
- **Incoming device**: Refer to project specific documentation.
- **Outgoing devices**:
  - **Type**: Refer to project specific documentation.
  - **Quantity**: Refer to project specific documentation.
- **Busbars and connections**:
  - **Type**: Fully shrouded.
  - **Rated operational current (Ie)**: Refer to project specific documentation.
  - **Rated short-time withstand current (Icw) for 1 s**: Refer to project specific documentation.
- **Neutral and earth bars**: Individual terminal for each outgoing circuit.
- **Spare ways**: Refer to project specific documentation.
- **Identification**: Label L, N and E cable terminations with push on plastic markers identifying circuit reference.
- **Spare outgoing devices**: Two of each size and rating used mounted within cabinet.
- **Enclosure**:
  - **Ingress protection (minimum)**: Refer to project specific documentation.
  - **Impact protection (minimum)**: To BS EN 62262, IK10.
  - **Dimensions**: Manufacturer's standard.
  - **Material**: Manufacturer's standard.
  - **Finish**: Manufacturer's standard.
  - **Colour**: Manufacturer's standard.
  - **Doors**: Manufacturer's standard.
  - **Backboard**: Manufacturer's standard.
- **Accessories**: Manufacturer's standard.
  Refer to project specific documentation.

392 Electrical cut outs

Used by: 70-80-25/120 Amenity lighting system.

- **Manufacturer**: Refer to project specific documentation.
- **Standard**: To BS 7654.
- **Arrangement**: Refer to project specific documentation.
- **Classification**: Refer to project specific documentation.
- **Current rating**: Refer to project specific documentation.
- **Final connection circuit protection**:
  - **Type**: Refer to project specific documentation.
  - **Outgoing device rating**: Refer to project specific documentation.
- **Incoming cable capacity (minimum)**: 16 mm² for stranded copper conductors.
  25 mm² for solid aluminium conductors.
- **Final connection cable capacity (minimum)**: Refer to project specific documentation.
- **Cable entry plate**:
  - **Type**: Refer to project specific documentation.
  - **Cable termination**: Refer to project specific documentation.
- **Accessories**: Refer to project specific documentation.
- **Execution**: Refer to project specific documentation.

394 Enclosures

Used by: 90-60-30/410 Surge protective devices for low voltage power supplies type A.

- **Standard**: To BS EN 62208.
- **Ingress protection (minimum)**: Located within the building to BS EN 60529, IP41;
  Located within another panel to BS EN 60529, IP54;
  and located externally to BS EN 60529, IP65.

  Where a control panel is mounted in an external location and exposed to the elements it is to have a lockable outer weatherproof door with a toughened glass observation window to allow lamps on the inner door to be seen. In addition, the panel is to be provided with a sloping top to prevent water accumulation. The top is to extend beyond the front face of the panel by a distance equivalent to 1.5 times the depth of the panel.
- **Impact protection (minimum)**: To BS EN 62262, IK10.
- **Material**: Polycarbonate.
- **Finish**: Manufacturer's standard.
- **Access**: Bolted cover and Screwed cover.
- **Handles**: Manufacturer's standard.
- **Internal mounting plate**: 35 mm rail.
- **Cable gland plate**: Fixed.
- **Mounting**: Surface mounted.
- **Arrangement**: Floor and Wall.

Ensure that floor mounted panels are provided with a 150mm minimum depth steel plinth on which they are to sit.

Ensure that each floor mounted panel is securely bolted down onto the slab or base on which it sits with a compressible waterproof packing membrane sandwiched between the panel and the slab or base.

- **Labelling**: Describe controlgear purpose.

396 PV generator junction boxes

Used by: 70-65-60/110 Grid connected photovoltaic system.

- **Standard**: To BS EN 61439-2.
- **Enclosure**:
  - **Ingress protection (minimum)**: To BS EN 60529, IP 65.
  - **Impact protection (minimum)**: To BS EN 62262, IK03.
  - **Material**: Polycarbonate.
  - **Degree of protection**: To BS EN 61140, Class II.
- **Isolator**: Switch-disconnector to BS EN 60947-3, category DC-PV2
- **Busbar rating**: Manufacturer's standard.
- **String fuses**:
  - **Type**: gR d.c to BS EN 60269-4 and Miniature circuit breakers to BS EN 60898-2.
- **Labelling**:
  - **Identification labels**: 'PV array junction box'.
  - **Safety labels**: 'Danger, contains live parts during daylight'.

410 Distribution boards type A

Used by: 70-70-45/110 Low voltage distribution system type A.

- **Type**: A
- **Manufacturer**: Refer to Schedule of Manufacturers
- **Standards**: To BS EN 61439-1 and BS EN 61439-3.
- **Third party certification**: ASTA Type test certification.
- **Rated operational voltage (Ue)**: Refer to project specific documentation.
- **Incoming device**: Refer to project specific documentation.
- **Outgoing devices**:
  - **Type**: Refer to project specific documentation.
  - **Quantity**: Refer to project specific documentation.
- **Busbars and connections**:
  - **Type**: Fully shrouded.
  - **Rated operational current (Ie)**: Refer to particular Distribution Board Schedule

  - **Rated short-time withstand current (Icw) for 1 s**: Refer to project specific documentation.
- **Neutral and earth bars**: Individual terminal for each outgoing circuit.
- **Neutral terminations**: Match current carrying capacity of phase conductor.
- **Spare ways**: Refer to project specific documentation.
- **Enclosure**:
  - **Ingress protection (minimum)**: Refer to project specific documentation.
  - **Material**: Refer to project specific documentation.
  - **Finish**: Refer to project specific documentation.
  - **Colour**: Refer to project specific documentation.
  - **Locking mechanism**: Cylinder locks with a standard key type.
- **Accessories**:
- **Execution**: 90-50-45/665 Installing switchgear generally type A.

410 Composite Distribution Board (CDB) General Three Phase type B

Used by: 70-70-45/110 Low voltage distribution system type A.

- **Manufacturer**: Refer to Schedule of Manufacturers
- **Standards**: To BS EN 61439-1 and BS EN 61439-3.
- **Third party certification**: ASTA Type test certification.
- **Rated operational voltage (Ue)**: Refer to project specific documentation.
- **Incoming device**: Refer to project specific documentation.
- **Outgoing devices**:
  - **Type**: Refer to project specific documentation.
  - **Quantity**: Refer to project specific documentation.
- **Busbars and connections**:
  - **Type**: Fully shrouded.
  - **Rated operational current (Ie)**: Refer to particular Distribution Board Schedule
  - **Rated short-time withstand current (Icw) for 1 s**: Refer to project specific documentation.
- **Neutral and earth bars**: Individual terminal for each outgoing circuit.
- **Neutral terminations**: Match current carrying capacity of phase conductor.
- **Spare ways**: Refer to project specific documentation.
- **Enclosure**:
  - **Ingress protection (minimum)**: Refer to project specific documentation.
  - **Material**: Refer to project specific documentation.
  - **Finish**: Refer to project specific documentation.
  - **Colour**: Refer to project specific documentation.
  - **Locking mechanism**: Cylinder locks with a standard key type.
- **Accessories**: Refer to project specific documentation.
- **Execution**: 90-50-45/665 Installing switchgear generally type A.

410 Power Distribution Unit GENERALLY type C

Used by: 70-70-45/110 Low voltage distribution system type A.

- **Manufacturer**: Refer to Schedule of Manufacturers
- **Standards**: To BS EN 61439-1 and BS EN 61439-3.
- **Third party certification**: ASTA Type test certification.
- **Rated operational voltage (Ue)**: Refer to project specific documentation.
- **Incoming device**: Refer to project specific documentation.
- **Outgoing devices**:
  - **Type**: Refer to project specific documentation.
  - **Quantity**: Refer to project specific documentation.
- **Busbars and connections**:
  - **Type**: Fully shrouded.
  - **Rated operational current (Ie)**: Refer to particular Distribution Board Schedule
  - **Rated short-time withstand current (Icw) for 1 s**: Refer to project specific documentation.
- **Neutral and earth bars**: Individual terminal for each outgoing circuit.
- **Neutral terminations**: Match current carrying capacity of phase conductor.
- **Spare ways**: Refer to project specific documentation.
- **Enclosure**:
  - **Ingress protection (minimum)**: Refer to project specific documentation.
  - **Material**: Refer to project specific documentation.
  - **Finish**: Refer to project specific documentation.
  - **Colour**: Refer to project specific documentation.
  - **Locking mechanism**: Cylinder locks with a standard key type.
- **Accessories**: Refer to project specific documentation.
- **Execution**: 90-50-45/665 Installing switchgear generally type A.

410 Distribution Boards and Consumer Units GENERALLY type D

Used by: 70-70-45/110 Low voltage distribution system type A.

- **Manufacturer**: Refer to Schedule of Manufacturers
- **Standards**: To BS EN 61439-1 and BS EN 61439-3.
- **Third party certification**: ASTA Type test certification.
- **Rated operational voltage (Ue)**: Refer to project specific documentation.
- **Incoming device**: Refer to project specific documentation.
- **Outgoing devices**:
  - **Type**: Refer to project specific documentation.
  - **Quantity**: Refer to project specific documentation.
- **Busbars and connections**:
  - **Type**: Fully shrouded.

  - **Rated operational current (Ie)**: Refer to particular Distribution Board Schedule
  - **Rated short-time withstand current (Icw) for 1 s**: Refer to project specific documentation.
- **Neutral and earth bars**: Individual terminal for each outgoing circuit.
- **Neutral terminations**: Match current carrying capacity of phase conductor.
- **Spare ways**: Refer to project specific documentation.
- **Enclosure**:
  - **Ingress protection (minimum)**: Refer to project specific documentation.
  - **Material**: Refer to project specific documentation.
  - **Finish**: Refer to project specific documentation.
  - **Colour**: Refer to project specific documentation.
  - **Locking mechanism**: Cylinder locks with a standard key type.
- **Accessories**: Refer to project specific documentation.
- **Execution**: 90-50-45/665 Installing switchgear generally type A.

420 Cubicle switchboards Generally

Used by: 70-70-45/110 Low voltage distribution system type A.

- **Manufacturer**: Refer to Schedule of Manufacturers
- **Standards**: To BS EN 61439-1 and BS EN 61439-2.
- **Third party certification**: ASTA Type test certification.
- **External design type**: Refer to project specific documentation.
- **Rated operational voltage (Ue)**: Refer to project specific documentation.
- **Incoming device**: Refer to project specific documentation.
- **Outgoing devices**:
  - **Type**: Refer to project specific documentation.
  - **Quantity**: Refer to project specific documentation.
- **Busbar and connections**:
  - **Rated operational current (Ie)**: Refer to project specific documentation.
  - **Rated short-time withstand current (Icw) for 1 s**: Refer to project specific documentation.
- **Terminals**: Suitable for the connection of copper conductors.
- **Full length internal copper earth bar**: Required.
- **Spare ways**: Refer to project specific documentation.
- **Enclosure**:
  - **Dimensions**: Refer to project specific documentation.
  - **Ingress protection (minimum)**: Refer to project specific documentation.
  - **Impact protection (minimum)**: To BS EN 62262, IK10.
  - **Material**: Steel.
  - **Finish**: Externally polyester powder coated.
    Internal partitions, zinc coated.

  - **Colour**: Manufacturer's standard.
  - **Locking mechanism**: Door-interlocked operating handles.
  - **Hardware**: Corrosion-resistant lever type handles with latching mechanism.
  - **Locks**: Cylinder type with a standardized key.
  - **Fixing of removable panels**: Captive, corrosion resistant knurled thumb screws and Captive, corrosion resistant bolts.
  - **Lifting bolts**: Integral within reinforced top frame.
- **Internal separation**: Refer to project specific documentation.
- **Cable entry**: Refer to project specific documentation.
- **Mounting arrangement for Electricity Distributor's metering equipment**: Refer to project specific documentation.
- **Accessories**: Refer to project specific documentation.
- **Execution**: 90-50-45/665 Installing switchgear generally type A.

450 Switch-disconnectors type A

Used by: 70-65-60/110 Grid connected photovoltaic system.

- **Type**: A
- **Standards**: To BS EN 60947-3.
- **Third party certification**: ASTA Type test certification.
- **Rated operational frequency**: 50 Hz.
- **Switch arrangement**:
- **Terminals**: Suitable for the connection of copper and aluminium conductors.
- **Mechanical interlocking**: Rotary handle capable of accepting up to three padlocks.
- **Enclosure**:
  - **Ingress protection (minimum)**: To BS EN 60529, IP44.
  - **Impact protection (minimum)**: To BS EN 62262, IK08.
  - **Material**: Polycarbonate.
  - **Finish**: Manufacturer's standard.
  - **Colour**: Manufacturer's standard.
  - **Gland plates**:
- **Execution**: and 90-50-45/665 Installing switchgear generally type A.

450 Switches, disconnectors, switch-disconnectors and fuse combination units GENERALLY type B

Used by: 70-70-45/110 Low voltage distribution system type A.

- **Manufacturer**: Refer to Schedule of Manufacturers
- **Standards**: To BS EN 60947-1 and BS EN 60947-3.
- **Third party certification**: ASTA Type test certification.
- **Rated operational voltage (Ue)**: Switches, disconnectors, switch-disconnectors and fuse combination units
  GENERALLY

- **Rated operational current (In)**: Switches, disconnectors, switch-disconnectors and fuse combination units
  GENERALLY
- **Rated operational frequency**: Switches, disconnectors, switch-disconnectors and fuse combination units
  GENERALLY
- **Switch arrangement**: Switches, disconnectors, switch-disconnectors and fuse combination units
  GENERALLY
- **Rated short-time withstand current (Icw) for 1 s**: Switches, disconnectors, switch-disconnectors and fuse combination units
  GENERALLY
- **Utilization category**: AC-23B.
- **Terminals**: Suitable for the connection of copper conductors.
- **Mechanical interlocking**: Switches, disconnectors, switch-disconnectors and fuse combination units
  GENERALLY
- **Enclosure**:
  - **Ingress protection (minimum)**: Refer to project specific documentation.
  - **Impact protection (minimum)**: Refer to project specific documentation.
  - **Material**: Sheet steel.
  - **Finish**: Powder coated.
  - **Colour**: Manufacturer's standard.
  - **Gland plates**: Fully removable to top and bottom faces and Pre-drilled cable knock-outs.
- **Execution**: 90-50-45/665 Installing switchgear generally type A.

460 Transfer switching equipment (TSE)

Used by: 70-65-35/110 Reciprocating internal combustion engine driven alternating current generator system.

- **Manufacturer**: Refer to project specific documentation.
- **Standards**: To BS EN 60947-1 and BS EN 60947-6-1.
- **Short-circuit capability**: Refer to project specific documentation.
- **Method of controlling transfer**: Refer to project specific documentation.
- **Operating sequence**: Refer to project specific documentation.
- **Operating mechanism**: Refer to project specific documentation.
- **Rated operational voltage (Ue)**: Refer to project specific documentation.
- **Rated impulse withstand voltage (Uimp)**: Refer to project specific documentation.
- **Rated insulation voltage (Ui)**: Refer to project specific documentation.
- **Rated operational current (In)**: Refer to project specific documentation.
- **Rated operational frequency**: Refer to project specific documentation.
- **Number of poles**: Refer to project specific documentation.

- **Rated short-time withstand current (Icw) for 1 s**: Refer to project specific documentation.
- **Rated short-circuit making capacity (Icm)**: Refer to project specific documentation.
- **Rated short-circuit breaking capacity (Icn)**: Refer to project specific documentation.
- **Utilization category**: Refer to project specific documentation.
- **Terminals**: Refer to project specific documentation.
- **Controls**:
  - **Type**: Refer to project specific documentation.
  - **Display type**:
  - **Illuminated display to indicate the following conditions**: Refer to project specific documentation.
  - **User adjustable functions**: Refer to project specific documentation.
  - **Features**: Refer to project specific documentation.
  - **Communication module**: Refer to project specific documentation.
- **Enclosure**:
  - **Ingress protection (minimum)**: Refer to project specific documentation.
  - **Impact protection (minimum)**: Refer to project specific documentation.
  - **Material**: Refer to project specific documentation.
  - **Finish**: Refer to project specific documentation.
  - **Colour**: Refer to project specific documentation.
  - **Gland plates**: Refer to project specific documentation.
- **Execution**: 90-50-45/665 Installing switchgear generally type E.

490 Switchgear mounting framework

Used by: 70-70-45/110 Low voltage distribution system type A.

- **Framing**: Metal channel to BS 6946 and Carbon steel plate, strip and sections to BS 1449-1-1.
- **Finish**: Hot dip galvanized.
- **Execution**: 90-50-45/670 Installing framework for mounting switchgear.

Execution

620 Installing busbar trunking

Used by: 90-50-45/320 Power busbar trunking.

- **Standard**: In accordance with BS 7671.
- **Supports and fixings**:
  - **Supports**: Purpose-made brackets.
  - **Finish**: Match trunking.
  - **Locations where moisture may occur**: Corrosion resistant, selected to prevent deterioration by electrolytic action.
- **Joints**:
  - **Type**: Manufacturer's jointing fittings.

  - **Rigidity**: Maintain across joint.
  - **Number of joints**: Minimize.
- **Trunking**:
  - **Lengths of trunking**: Maximize.
  - **Open ends**: Blank using manufacturer's removable end caps.
  - **Electrical continuity**: Maintain at each joint with a copper link fitted on the outside of the trunking.
  - **Cleaning**: Immediately before handover.
- **Trunking covers**:
  - **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 and extend these 50 mm from both sides of the opening.
- **Busbar terminals**: Label in accordance with BS EN 60445.

640 Installing tap off units

Used by: 90-50-45/330 Tap-off units.

- **Generally**: In accordance with BS 7671.
- **Position**: Refer to project specific documentation.
- **Tap-off point intervals**: Refer to project specific documentation.

645 Installing feed units

Used by: 90-50-45/340 Feed units.

- **Generally**: In accordance with BS 7671.
- **Position**: Refer to project specific documentation.

650 Installing fire barrier units

Used by: 90-50-45/350 Fire barrier units.

- **Generally**: In accordance with BS 7671.
- **Position**: At locations where the busbar trunking passes through a fire compartment wall or floor.

660 Testing and commissioning of site-assembled busbar trunking

Used by: 90-50-45/320 Power busbar trunking.

- **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.

665 Installing switchgear generally type A

Shared by: 90-50-45/410 Distribution boards type A; 90-50-45/410 Composite Distribution Board (CDB) General Three Phase type B; 90-50-45/410 Power Distribution Unit GENERALLY type C; 90-50-45/410 Distribution Boards and Consumer Units GENERALLY type D; 90-50-45/420 Cubicle switchboards Generally; 90-50-45/450 Switch-disconnectors type A; and 90-50-45/450 Switches, disconnectors, switch-disconnectors and fuse combination units GENERALLY type B.

- **General requirements**: 90-50-45/675 Labelling switchgear.
- **Switchgear cubicles**: Arrange in modular form to facilitate future extension.
- **Clearance (minimum)**:
  - **Front access switchgear**: 1000 mm in front of 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**: 90-55-15/345 Single core PVC insulated cables for switchgear and controlgear and Copper busbar links.
  - **Containment**: Manufacturer's enclosure and 90-55-10/410 Cable trunking and cable ducting for wall and ceiling mounting type A - Steel (no apparatus mounting).
- **Identification**:
  - **Neutral and earth bar terminals**: Label with the outgoing circuit reference.
  - **Cable terminations**: Label with circuit reference, with push-on plastics markers.

665 Installing switchgear generally type E

Used by: 90-50-45/460 Transfer switching equipment (TSE).

- **General requirements**: 90-50-45/675 Labelling switchgear.
- **Switchgear cubicles**: Arrange in modular form to facilitate future extension.

- **Clearance (minimum)**:
  - **Front access switchgear**:
  - **Rear access 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**: Refer to project specific documentation.
  - **Containment**: Refer to project specific documentation.
- **Identification**:
  - **Neutral and earth bar terminals**: Label with the outgoing circuit reference.
  - **Cable terminations**: Label with circuit reference, with push-on plastics markers.

670 Installing framework for mounting switchgear

Used by: 90-50-45/490 Switchgear mounting framework.

- **Arrangement**: Refer to project specific documentation.
- **Fixing**: Refer to project specific documentation.
- **Orientation**: Refer to project specific documentation.
- **Treatment to cut metalwork, fasteners and fixings**: Zinc-rich paint to BS 4652 to thickness of original layer.

675 Labelling switchgear

Shared by: 90-50-45/665 Installing switchgear generally; type A and type E.

- **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.

Ω End of section

90-50-75

Products

310 Electrical insulating matting type A

Used by: 70-70-35/110 High voltage distribution system.

- **Manufacturer**: Refer to project specific documentation.
- **Standard**: To BS EN 61111.
- **Class**: Refer to project specific documentation.
- **Width (minimum)**: 900 mm.
- **Length (minimum)**: Match low voltage switchgear assembly.
- **Execution**: 90-50-75/610 Installing electrical insulating matting.

310 Electrical insulating matting type B

Used by: 70-70-45/110 Low voltage distribution system type A.

- **Manufacturer**: Refer to project specific documentation.
- **Standard**: To BS EN 61111.
- **Class**: Refer to project specific documentation.
- **Width (minimum)**: 900 mm.
- **Length (minimum)**: Match low voltage switchgear assembly.
- **Execution**: 90-50-75/610 Installing electrical insulating matting.

Execution

610 Installing electrical insulating matting

Shared by: 90-50-75/310 Electrical insulating matting; type A and type B.

- **Front access equipment**: Install electrical insulating matting in front of the equipment.
- **Rear access equipment**: Install electrical insulating matting in front of and behind the equipment.
- **Installation**: Fix securely to the floor.
- **Position**: Refer to project specific documentation.

Ω End of section

90-50-80 Small wind turbines and photovoltaics

Products

310 Photovoltaic modules

Used by: 70-65-60/110 Grid connected photovoltaic system.

- **Cell type**: Monocrystalline to BS EN 61215;
  Polycrystalline to BS EN 61215;
  and Thin film amorphous silicon to BS EN 61646.
- **Format**: Screwed frame modules and Welded frame modules.
- **Framework**:
  - **Material**: Anodized aluminium and Unfinished stainless steel.
  - **Colour**: Manufacturer's standard.
- **Degree of protection**: To BS EN 61140, Class II.
- **Module interconnections**:
  - **Type**: Factory fitted plugs and sockets with pre-fitted insulated tails.
  - **Module connectors**: Polarized and suitably rated for the applicable d.c. voltage and current.
  - **Ingress protection (minimum)**: To BS EN 60529, IP65.
- **Nominal output of module**:
  - **Power output tolerance**: 0/3%.
- **Output warranty**: 90% power output after ten years and 80% power output after 25 years.

Ω End of section

90-55-10 Cable containment

Products

305 Channel cable supports

Shared by: 70-70-45/110 Low voltage distribution system type A; and 70-70-75/110 Hard wired low voltage small power system.

- **Manufacturer**: Refer to Schedule of Manufacturers.
- **Standard**: To BS 6946.
- **Format**: Plain and Slotted.
- **Material**: Carbon steel.
- **Finish**: Hot dip galvanized.
- **Accessories**:
  - **Manufacturer**: As channel cable support.
  - **Type**: 90° brackets;
    Base plates;
    Beam clamps;
    Channel type cantilever arms;
    End caps;
    Internal connectors;
    Threaded rod;
    Threaded rod connectors;
    Trapeze hangers;
    U bolt type beam clamps;
    and Window type beam clamps.
- **Execution**: 90-55-10/610 Installing channel cable supports;
  90-55-10/640 Installing cable supports on roofs type A;
  90-55-10/650 Multiple cable runs type A;
  and 90-55-10/660 Cable support zones type A.

310 Cable cleats type A

Shared by: 70-70-45/110 Low voltage distribution system type A; 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.

- **Standard**: To BS EN 61914.
- **Format**: Type 316 stainless steel with an integral LSZH polymeric liner and base pad.
- **Material**: Composite;
  Metallic;
  and Non-metallic.

- **Temperatures for permanent installation**:
  - **Maximum**: 85°C.
  - **Minimum**: -25°C.
- **Resistance to impact**: Heavy.
- **Type of retention or resistance to electromechanical forces**: With lateral retention;
  With axial retention;
  and Resistant to electromechanical forces, withstanding more than one short circuit.
- **Environmental influences**:
  - **Non-metallic and composite components**: Resistant to ultraviolet light.
  - **Metallic and composite components**: High resistance to corrosion.

310 Cable cleats type B

Used by: 70-70-35/110 High voltage distribution system.

- **Manufacturer**: Refer to Schedule of Manufacturers
- **Standard**: To BS EN 61914.
- **Format**: Match low voltage switchgear assembly.
- **Material**: Match low voltage switchgear assembly.
- **Temperatures for permanent installation**:
  - **Maximum**: Match low voltage switchgear assembly.
  - **Minimum**: Match low voltage switchgear assembly.
- **Resistance to impact**: Match low voltage switchgear assembly.
- **Type of retention or resistance to electromechanical forces**: Match low voltage switchgear assembly.
- **Environmental influences**:
  - **Non-metallic and composite components**: Resistant to ultraviolet light.
  - **Metallic and composite components**: Match low voltage switchgear assembly.

315 Cable ties

Shared by: 70-70-45/110 Low voltage distribution system type A; and 70-70-75/110 Hard wired low voltage small power system.

- **Standard**: To BS EN 62275.
- **Format**: Wrap around self locking non-releasable.
- **Material**: Generally -Nylon
  Grid connected photovoltaic system - Stainless steel
- **Loop tensile strength (minimum)**: 450 N.
- **Temperatures for permanent installation**:
  - **Maximum**: 105°C.
  - **Minimum**: -25°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.

320 Cable bands type A

Shared by: 70-70-45/110 Low voltage distribution system type A; 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.

- **Type**: A
- **Material**: Manufacturer's standard.
- **Protective covering**: LSZH.

325 Cable baskets type A

Shared by: 70-70-45/110 Low voltage distribution system type A; 70-70-75/110 Hard wired low voltage small power system; 70-80-25/110 Roadway lighting system; 70-80-25/120 Amenity lighting system; and 90-55-15/650 Extra low and low voltage cables in accessible roof spaces.

- **Manufacturer**: Refer to Schedule of Manufacturers
- **Standard**: To BS EN 61537.
- **Material**: 4 mm steel wire.
- **Coating material**: Pre galavanised to BS EN 10244.
- **Features**:
  - **Segregation**: Cable dividers.
  - **Protective cover**: Not required.
- **Execution**: 90-55-10/650 Multiple cable runs type A;
  90-55-10/660 Cable support zones type A;
  and 90-55-10/630 Installing cable basket.

330 Cable ladders

Shared by: 70-70-45/110 Low voltage distribution system type A; 70-70-75/110 Hard wired low voltage small power system; 70-80-25/110 Roadway lighting system; and 70-80-25/120 Amenity lighting system.

- **Manufacturer**: Refer to Schedule of Manufacturers.
- **Standard**: To BS EN 61537.
- **Material**: Refer to project specific documentation.
- **Resistance against flame propagation**: Non flame propagating.
- **Electrical properties**:
  - **Continuity characteristics**: With electrical continuity.
  - **Conductivity characteristics**: With electrical conductive system component.
- **Coating material**: Hot dip galvanized.
- **Temperature properties for transport, storage, installation and application**:
  - **Minimum**: -5°C.
  - **Maximum**: +60°C.

- **Mechanical properties**:
  - **Cable ladder free base area**: Class X.
  - **Resistance to impact**: Up to 20 J.
- **Width**: Refer to project specific documentation.
- **Features**:
  - **Segregation**: Cable dividers.
  - **Protective cover**: Refer to project specific documentation.
- **Execution**: 90-55-10/620 Installing cable tray and cable ladder type A; 90-55-10/640 Installing cable supports on roofs type A; 90-55-10/650 Multiple cable runs type A; and 90-55-10/660 Cable support zones type A.

335 Cable trays type A - External installations and/or further mechanical protection is required

Used by: 90-55-15/650 Extra low and low voltage cables in accessible roof spaces.

- **Standard**: To BS EN 61537.
- **Material**: Steel.
- **Resistance against flame propagation**: Non flame propagating.
- **Electrical properties**:
  - **Continuity characteristics**: With electrical continuity.
- **Coating material**: Pre galvanised to BS EN 10244
- **Temperature properties for transport, storage, installation and application**:
  - **Minimum**: -20°C.
  - **Maximum**: 105°C.
- **Mechanical properties**:
  - **Cable tray free base area**: Class X.
  - **Resistance to impact**: Up to 20 J.
- **Features**:
  - **Flange type**: Return.
  - **Segregation**: Not required.
  - **Protective cover**: Required.
- **Execution**: 90-55-10/620 Installing cable tray and cable ladder type A; 90-55-10/640 Installing cable supports on roofs type A; 90-55-10/650 Multiple cable runs type A; and 90-55-10/660 Cable support zones type A.

335 Cable trays type B - General

Shared by: 70-70-45/110 Low voltage distribution system type A; 70-70-75/110 Hard wired low voltage small power system; 70-80-25/110 Roadway lighting system; 70-80-25/120 Amenity lighting system; and 90-55-15/650 Extra low and low voltage cables in accessible roof spaces.

- **Standard**: To BS EN 61537.

- **Material**: Steel.
- **Resistance against flame propagation**: Non flame propagating.
- **Electrical properties**:
  - **Continuity characteristics**: With electrical continuity.
- **Coating material**: Powder coating and Hot dip galvanized.
- **Temperature properties for transport, storage, installation and application**:
  - **Minimum**: -20°C.
  - **Maximum**: 105°C.
- **Mechanical properties**:
  - **Cable tray free base area**: Class X.
  - **Resistance to impact**: Up to 20 J.
- **Features**:
  - **Flange type**: Return.
  - **Segregation**: Cable dividers.
  - **Protective cover**: Not required.
- **Execution**: 90-55-10/620 Installing cable tray and cable ladder type A;
  90-55-10/640 Installing cable supports on roofs type A;
  90-55-10/650 Multiple cable runs type A;
  and 90-55-10/660 Cable support zones type A.

335 Cable trays type C - Stainless Steel

Used by: 90-55-15/650 Extra low and low voltage cables in accessible roof spaces.

- **Standard**: To BS EN 61537.
- **Material**: Stainless steel.
- **Resistance against flame propagation**: Non flame propagating.
- **Electrical properties**:
  - **Continuity characteristics**: With electrical continuity.
- **Coating material**: None.
- **Temperature properties for transport, storage, installation and application**:
  - **Minimum**: -20°C.
  - **Maximum**: 105°C.
- **Mechanical properties**:
  - **Cable tray free base area**: Class X.
  - **Resistance to impact**: Up to 20 J.
- **Features**:
  - **Flange type**: Return.
  - **Segregation**: Cable dividers.
  - **Protective cover**: Not required.
- **Execution**: 90-55-10/620 Installing cable tray and cable ladder type A;
  90-55-10/640 Installing cable supports on roofs type A;

90-55-10/650 Multiple cable runs type A;
and 90-55-10/660 Cable support zones type A.

335 Cable trays type D - Composite

Used by: 90-55-15/650 Extra low and low voltage cables in accessible roof spaces.

- **Standard**: To BS EN 61537.
- **Material**: Composite.
- **Resistance against flame propagation**: Non flame propagating.
- **Electrical properties**:
  - **Continuity characteristics**: Without electrical continuity.
  - **Conductivity characteristics**: Without electrical conductive system component.
- **Coating material**: Manufacturer's standard.
- **Temperature properties for transport, storage, installation and application**:
  - **Minimum**: -20°C.
  - **Maximum**: 105°C.
- **Mechanical properties**:
  - **Cable tray free base area**: Class X.
  - **Resistance to impact**: Up to 20 J.
- **Features**:
  - **Flange type**: Return.
  - **Segregation**: Cable dividers.
  - **Protective cover**: Not required.
- **Execution**: 90-55-10/620 Installing cable tray and cable ladder type A;
  90-55-10/640 Installing cable supports on roofs type A;
  90-55-10/650 Multiple cable runs type A;
  and 90-55-10/660 Cable support zones type A.

360 Flexible conduit type A - Metallic

Used by: 90-55-10/735 Installing conduit connections to equipment.

- **Standards**: To BS EN 61386-23.
- **Mechanical properties**:
  - **Resistance to compression**: Medium.
  - **Resistance to impact**: Medium.
- **Transport, installation and application**:
  - **Lower temperature (minimum)**: -25°C.
  - **Upper temperature (maximum)**: 105°C.
- **Resistance to bending**: Flexible.
- **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.
- **Tensile strength**: Medium.
- **Resistance to flame propagation**: Required.
- **Suspended load capacity**: Medium.
- **Execution**: 90-55-10/735 Installing conduit connections to equipment; 90-55-10/765 Conduit, trunking and ducting zones; and 90-55-10/715 Installing pliable and flexible conduit.

360 Flexible conduit type B - PVC-U

Used by: 90-55-10/735 Installing conduit connections to equipment.

- **Standards**: To BS EN 61386-23.
- **Mechanical properties**:
  - **Resistance to compression**: Medium.
  - **Resistance to impact**: Medium.
- **Transport, installation and application**:
  - **Lower temperature (minimum)**: -25°C.
  - **Upper temperature (maximum)**: 105°C.
- **Resistance to bending**: Flexible.
- **Electrical characteristics**: With electrical insulating 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.
- **Tensile strength**: Medium.
- **Resistance to flame propagation**: Required.
- **Suspended load capacity**: Medium.
- **Execution**: 90-55-10/715 Installing pliable and flexible conduit; 90-55-10/735 Installing conduit connections to equipment; and 90-55-10/765 Conduit, trunking and ducting zones.

380 Rigid conduit type A - External and/or cast-in-situ installations

Shared by: 70-65-60/110 Grid connected photovoltaic system; 70-65-60/620 Installing photovoltaic systems generally; 70-70-25/660 Installing earthing conductor; 70-70-45/110 Low voltage distribution system type A; 70-70-75/110 Hard wired low voltage small power system; 70-80-25/110 Roadway lighting system; 70-80-25/120 Amenity lighting system; and 90-55-15/645 Low voltage cables concealed in walls and partitions.

- **Standards**: To BS EN 61386-21.
- **Mechanical properties**:
  - **Resistance to compression**: Heavy.
  - **Resistance to impact**: Heavy.
- **Transport, installation and application**:

  - **Lower temperature (minimum)**: -25°C.
  - **Upper temperature (maximum)**: 105°C.
- **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**: Required.
- **Suspended load capacity**: Heavy.
- **Colour**:
- **Execution**: 90-55-10/720 Installing rigid metallic conduit; 90-55-10/735 Installing conduit connections to equipment; and 90-55-10/765 Conduit, trunking and ducting zones.

380 Rigid conduit type B - Internal installations

Shared by: 70-70-25/660 Installing earthing conductor; 70-70-45/110 Low voltage distribution system type A; 70-70-75/110 Hard wired low voltage small power system; and 90-55-15/645 Low voltage cables concealed in walls and partitions.

- **Standards**: To BS EN 61386-21.
- **Mechanical properties**:
  - **Resistance to compression**: Heavy.
  - **Resistance to impact**: Heavy.
- **Transport, installation and application**:
  - **Lower temperature (minimum)**: -25°C.
  - **Upper temperature (maximum)**: 105°C.
- **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 3.
- **Tensile strength**: Heavy.
- **Resistance to flame propagation**: Required.
- **Suspended load capacity**: Heavy.
- **Colour**:
- **Execution**: 90-55-10/720 Installing rigid metallic conduit; 90-55-10/735 Installing conduit connections to equipment; and 90-55-10/765 Conduit, trunking and ducting zones.

380 Rigid conduit type C - Stainless steel

Shared by: 70-70-25/660 Installing earthing conductor; 70-70-45/110 Low voltage distribution system type A; 70-70-75/110 Hard wired low voltage small power system; and 90-55-15/645 Low voltage cables concealed in walls and partitions.

- **Manufacturer**: Refer to Schedule of Manufacturers
- **Standards**: To BS EN 61386-21.
- **Mechanical properties**:
  - **Resistance to compression**: Heavy.
  - **Resistance to impact**: Heavy.
- **Transport, installation and application**:
  - **Lower temperature (minimum)**: -25°C.
  - **Upper temperature (maximum)**: 105°C.
- **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, stainless steel.
- **Tensile strength**: Heavy.
- **Resistance to flame propagation**: Required.
- **Suspended load capacity**: Heavy.
- **Colour**:
- **Execution**: 90-55-10/720 Installing rigid metallic conduit; 90-55-10/735 Installing conduit connections to equipment; and 90-55-10/765 Conduit, trunking and ducting zones.

380 Rigid conduit type D - PVC-U (only acceptable if specifically allowed by project specific documentation)

Shared by: 70-70-25/660 Installing earthing conductor; 70-70-45/110 Low voltage distribution system type A; 70-70-75/110 Hard wired low voltage small power system; and 90-55-15/645 Low voltage cables concealed in walls and partitions.

- **Standards**: To BS EN 61386-21.
- **Mechanical properties**:
  - **Resistance to compression**: Heavy.
  - **Resistance to impact**: Heavy.
- **Transport, installation and application**:
  - **Lower temperature (minimum)**: -25°C.
  - **Upper temperature (maximum)**: 105°C.
- **Resistance to bending**: Rigid.
- **Electrical characteristics**: With electrical insulating 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.
- **Tensile strength**: Heavy.
- **Resistance to flame propagation**: Required.
- **Suspended load capacity**: Heavy.
- **Colour**:
- **Execution**: 90-55-10/735 Installing conduit connections to equipment;
  90-55-10/765 Conduit, trunking and ducting zones;
  and 90-55-10/725 Installing rigid non metallic conduit.

410 Cable trunking and cable ducting for wall and ceiling mounting type A - Steel (no apparatus mounting)

Shared by: 70-70-45/110 Low voltage distribution system type A; 70-70-75/110 Hard wired low voltage small power system; 70-80-25/110 Roadway lighting system; 70-80-25/120 Amenity lighting system; 90-50-45/665 Installing switchgear generally type A; 90-55-15/645 Low voltage cables concealed in walls and partitions; and 90-55-15/650 Extra low and low voltage cables in accessible roof spaces.

- **Standards**: To BS EN 50085-1 and BS EN 50085-2-1.
- **Installation position**:
- **Format**: 2.
- **Resistance to compression**: 750 N.
- **Resistance to impact**: 5 J.
- **Temperature properties**:
  - **Storage and transport temperature (minimum)**: Manufacturer's standard.
  - **Installation and application temperature (minimum)**: -25°C.
  - **Application temperature (maximum)**: +105°C.
- **Resistance to flame propagation**: Required.
- **Electrical properties**: With electrical continuity characteristics.
- **Protection by enclosure**:
  - **Protection against ingress of water (minimum)**: To BS EN 60529, IPX1.
  - **Protection against access to hazardous parts (minimum)**: To BS EN 60529, IPXXD.
  - **Protection against ingress of solid objects (minimum)**: To BS EN 60529, IP4X.
- **Access method**: Without tools.
- **Screening**: Not required.
- **Accessories and fittings**:
  - **Generally**: Factory made of the same material type and finish as trunking or ducting.
  - **Types**: 45° and 90° internal and external bends;
    tees;
    reducers;
    end caps;
    out flange;
    4-way intersection;

trunking cover speed lock;
vertical set;
offsets;
angle offsets; and
cable retainers.

- **Execution**: 90-55-10/765 Conduit, trunking and ducting zones and 90-55-10/740 Installing trunking generally.

410 Cable trunking and cable ducting for wall and ceiling mounting type B - Steel (with apparatus mounting)
Shared by: 70-70-45/110 Low voltage distribution system type A; 70-70-75/110 Hard wired low voltage small power system; 70-80-25/110 Roadway lighting system; 70-80-25/120 Amenity lighting system; 90-55-15/645 Low voltage cables concealed in walls and partitions; and 90-55-15/650 Extra low and low voltage cables in accessible roof spaces.

- **Manufacturer**: Refer to Schedule of Manufacturers
- **Standards**: To BS EN 50085-1 and BS EN 50085-2-1.
- **Installation position**:
- **Format**: 3.
- **Resistance to compression**: 750 N.
- **Resistance to impact**: 5 J.
- **Temperature properties**:
  - **Storage and transport temperature (minimum)**: Manufacturer's standard.
  - **Installation and application temperature (minimum)**: -25°C.
  - **Application temperature (maximum)**: +105°C.
- **Resistance to flame propagation**: Required.
- **Electrical properties**: With electrical continuity characteristics.
- **Protection by enclosure**:
  - **Protection against ingress of water (minimum)**: To BS EN 60529, IPX1.
  - **Protection against ingress of solid objects (minimum)**: To BS EN 60529, IP4X.
  - **Protection against access to hazardous parts (minimum)**: To BS EN 60529, IPXXD.
- **Access method**: Without tools.
- **Screening**: Not required.
- **Accessories and fittings**:
  - **Generally**: Factory made of the same material type and finish as trunking or ducting.
  - **Types**: 45° and 90° internal and external bends;
    tees;
    reducers;
    end caps;
    out flange;
    4-way intersection;
    trunking cover speed lock;

vertical set;
offsets;
angle offsets; and
cable retainers.

- **Execution**: 90-55-10/740 Installing trunking generally and 90-55-10/765 Conduit, trunking and ducting zones.

410 Cable trunking and cable ducting for wall and ceiling mounting type C - PVC-U (no apparatus mounting)
Shared by: 70-70-45/110 Low voltage distribution system type A; 70-70-75/110 Hard wired low voltage small power system; 70-80-25/110 Roadway lighting system; 70-80-25/120 Amenity lighting system; 90-55-15/645 Low voltage cables concealed in walls and partitions; and 90-55-15/650 Extra low and low voltage cables in accessible roof spaces.

- **Standards**: To BS EN 50085-1 and BS EN 50085-2-1.
- **Installation position**:
- **Format**: 2.
- **Resistance to compression**: 750 N.
- **Resistance to impact**: 5 J.
- **Temperature properties**:
  - **Storage and transport temperature (minimum)**: Manufacturer's standard.
  - **Installation and application temperature (minimum)**: -25°C.
  - **Application temperature (maximum)**: +105°C.
- **Resistance to flame propagation**: Required.
- **Electrical properties**: With electrical insulating characteristics.
- **Protection by enclosure**:
  - **Protection against ingress of solid objects (minimum)**: To BS EN 60529, IP4X.
  - **Protection against ingress of water (minimum)**: To BS EN 60529, IPX1.
  - **Protection against access to hazardous parts (minimum)**: To BS EN 60529, IPXXD.
- **Access method**: Without tools.
- **Screening**: Required.
- **Accessories and fittings**:
  - **Generally**: Factory made of the same material type and finish as trunking or ducting.
  - **Types**: 45° and 90° internal and external bends;
    tees;
    reducers;
    end caps;
    out flange;
    4-way intersection;
    trunking cover speed lock;
    vertical set;
    offsets;

angle offsets; and
cable retainers.

- **Execution**: 90-55-10/740 Installing trunking generally and 90-55-10/765 Conduit, trunking and ducting zones.

410 Cable trunking and cable ducting for wall and ceiling mounting type D - PVC-U (with apparatus mounting)

Shared by: 70-70-45/110 Low voltage distribution system type A; 70-70-75/110 Hard wired low voltage small power system; 70-80-25/110 Roadway lighting system; 70-80-25/120 Amenity lighting system; 90-55-15/645 Low voltage cables concealed in walls and partitions; and 90-55-15/650 Extra low and low voltage cables in accessible roof spaces.

- **Standards**: To BS EN 50085-1 and BS EN 50085-2-1.
- **Installation position**:
- **Format**: 3.
- **Resistance to compression**: 750 N.
- **Resistance to impact**: 5 J.
- **Temperature properties**:
  - **Storage and transport temperature (minimum)**: Manufacturer's standard.
  - **Installation and application temperature (minimum)**: -25°C.
  - **Application temperature (maximum)**: +105°C.
- **Resistance to flame propagation**: Required.
- **Electrical properties**: With electrical insulating characteristics.
- **Protection by enclosure**:
  - **Protection against ingress of solid objects (minimum)**: To BS EN 60529, IP4X.
  - **Protection against ingress of water (minimum)**: To BS EN 60529, IPX1.
  - **Protection against access to hazardous parts (minimum)**: To BS EN 60529, IPXXD.
- **Access method**: Without tools.
- **Screening**: Required.
- **Accessories and fittings**:
  - **Generally**: Factory made of the same material type and finish as trunking or ducting.
  - **Types**: 45° and 90° internal and external bends;
    tees;
    reducers;
    end caps;
    out flange;
    4-way intersection;
    trunking cover speed lock;
    vertical set;
    offsets;
    angle offsets; and

cable retainers.

- **Execution**: 90-55-10/740 Installing trunking generally and 90-55-10/765 Conduit, trunking and ducting zones.

410 Cable trunking and cable ducting for wall and ceiling mounting type E - Stainless Steel

Shared by: 70-70-45/110 Low voltage distribution system type A; 70-70-75/110 Hard wired low voltage small power system; 70-80-25/110 Roadway lighting system; 70-80-25/120 Amenity lighting system; 90-55-15/645 Low voltage cables concealed in walls and partitions; and 90-55-15/650 Extra low and low voltage cables in accessible roof spaces.

- **Standards**: To BS EN 50085-1 and BS EN 50085-2-1.
- **Installation position**:
- **Format**: 2.
- **Resistance to compression**: 750 N.
- **Resistance to impact**: 5 J.
- **Temperature properties**:
  - **Storage and transport temperature (minimum)**: Manufacturer's standard.
  - **Installation and application temperature (minimum)**: -25°C.
  - **Application temperature (maximum)**: +105°C.
- **Resistance to flame propagation**: Required.
- **Electrical properties**: With electrical continuity characteristics.
- **Protection by enclosure**:
  - **Protection against ingress of solid objects (minimum)**: To BS EN 60529, IP4X.
  - **Protection against ingress of water (minimum)**: To BS EN 60529, IPX1.
  - **Protection against access to hazardous parts (minimum)**: To BS EN 60529, IPXXD.
- **Access method**: Without tools.
- **Screening**: Not required.
- **Accessories and fittings**:
  - **Generally**: Factory made of the same material type and finish as trunking or ducting.
  - **Types**: 45° and 90° internal and external bends;
    tees;
    reducers;
    end caps;
    out flange;
    4-way intersection;
    trunking cover speed lock;
    vertical set;
    offsets;
    angle offsets; and
    cable retainers.

- **Execution**: 90-55-10/740 Installing trunking generally and 90-55-10/765 Conduit, trunking and ducting zones.

460 Conduit fittings type A

Shared by: 70-70-45/110 Low voltage distribution system type A; 70-70-75/110 Hard wired low voltage small power system; 70-80-25/110 Roadway lighting system; and 70-80-25/120 Amenity lighting 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**:
  - **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**: 90-55-10/700 Installing conduit, trunking and ducting.

460 Conduit fittings type B

Shared by: 70-80-25/110 Roadway lighting system; and 70-80-25/120 Amenity lighting 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**:
  - **Finish**: Match conduit.
- **Conduit boxes**: Fit covers of same material and finish as boxes. Include brass earthing terminals in PVC-U boxes.
- **Plugs**:
- **Locknuts.**:
- **Execution**: 90-55-10/700 Installing conduit, trunking and ducting.

470 Intumescent linear gap seals type A

Shared by: 70-70-45/110 Low voltage distribution system type A; 70-70-75/110 Hard wired low voltage small power system; 70-80-25/110 Roadway lighting system; and 70-80-25/120 Amenity lighting system.

- **Manufacturer**: Refer to Schedule of Manufacturers.
- **Standard**: To BS EN 1366-4.
- **Execution**: 90-55-10/700 Installing conduit, trunking and ducting.

470 Intumescent linear gap seals type B

Shared by: 70-80-25/110 Roadway lighting system; and 70-80-25/120 Amenity lighting system.

- **Manufacturer**: Refer to project specific documentation.
- **Standard**: To BS EN 1366-4.
- **Execution**: 90-55-10/700 Installing conduit, trunking and ducting.

Execution

610 Installing channel cable supports

Used by: 90-55-10/305 Channel cable supports.

- **Standards**: In accordance with BS 7671, IET Guidance Note 1 and BEAMA Best practice guide to cable ladder and cable tray systems: Channel support systems and other associated supports.
- **Preparation**:
  - **Burrs and sharp edges**: Make smooth.
  - **Cutting**: Minimize and make good edges. Cuts to slotted channel cable supports 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 channel cable supports to permit access for installing and maintaining cables.
- **Joints and expansion couplers**: Locate between the bracket support and the quarter point.
  - **Number of joints**: Minimize.
  - **Lengths of cable supports**: Maximize.
- **Fire barriers**: Provide where required to maintain fire performance of fabric.
- **Changes of size and direction**: Manufacturer's accessories of the same material type, pattern, finish and thickness as channel cable supports.
- **Support**:
  - **Fixing arrangement**: Refer to project specific documentation.
  - **Clearance from building fabric (minimum)**: 20 mm.
- **Components**: Avoid contact between dissimilar metals.
- **Routing of channel cable supports**: Submit drawings showing the proposed routes.

620 Installing cable tray and cable ladder type A

Shared by: 90-55-10/330 Cable ladders; and 90-55-10/335 Cable trays; type A - External installations and/or further mechanical protection is required; type B - General; type C - Stainless Steel and type D - Composite.

- **Standards**: In accordance with BS 7671 and 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.
  - **Clearance from building fabric (minimum)**: 20 mm.
- **Components**: Avoid contact between dissimilar metals.
- **Routing of cable ladder and tray**: Submit drawings showing the proposed routes of cable ladder and cable tray.

630 Installing cable basket

Used by: 90-55-10/325 Cable baskets type A.

- **Standards**: In accordance with BS 7671 and IET Guidance Note 1.
- **Joints**: Cut adjacent cross basket wires. Make smooth any burrs or edges.
- **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.
  - **Clearance from building fabric (minimum)**: 20 mm.
- **Components**: Avoid contact between dissimilar metals.
- **Routing of cable basket**: Submit drawings showing the proposed routes.

640 Installing cable supports on roofs type A

Shared by: 90-55-10/305 Channel cable supports; 90-55-10/330 Cable ladders; and 90-55-10/335 Cable trays; type A - External installations and/or further mechanical protection is required; type B - General; type C - Stainless Steel and type D - Composite.

- **Position**: Elevate above roof.
- **Mounting**: Load spreading supports.

650 Multiple cable runs type A

Shared by: 90-55-10/305 Channel cable supports; 90-55-10/325 Cable baskets type A; 90-55-10/330 Cable ladders; and 90-55-10/335 Cable trays; type A - External installations and/or further mechanical protection is required; type B - General; type C - Stainless Steel and type D - Composite.

- **Requirement**: Required when three or more cables run in parallel.

660 Cable support zones type A

Shared by: 90-55-10/305 Channel cable supports; 90-55-10/325 Cable baskets type A; 90-55-10/330 Cable ladders; and 90-55-10/335 Cable trays; type A - External installations and/or further mechanical protection is required; type B - General; type C - Stainless Steel and type D - Composite.

- **Ceiling voids**: Provide clear distance of 150 mm (minimum) between underside of any cable supports and brackets and the topside of ceiling.

700 Installing conduit, trunking and ducting

Shared by: 90-55-10/460 Conduit fittings; type A and type B; 90-55-10/470 Intumescent linear gap seals; type A and type B; 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.
- **Draw wires**:
- **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**:
- **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.

710 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.

715 Installing pliable and flexible conduit

Shared by: 90-55-10/360 Flexible conduit; type A - Metallic and type B - PVC-U.

- **General requirements**: 90-55-10/710 Installing conduit generally and 90-55-10/700 Installing conduit, trunking and ducting.
- **Fixings**: Distance saddle;
  Saddle;
  Spacer bar saddle;

and Steel p-clip with PVC insert.

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

720 Installing rigid metallic conduit

Shared by: 90-55-10/380 Rigid conduit; type A - External and/or cast-in-situ installations; type B - Internal installations and type C - Stainless steel.

- **General requirements**: 90-55-10/710 Installing conduit generally and 90-55-10/700 Installing conduit, trunking and ducting.
- **Fixings**: Spacer bar saddle.
- **Joints**: Screwed.
- **Threaded conduits**: Tightly screw to ensure electrical continuity, with no thread showing.
- **Conduit connections to boxes and items of equipment, other than those with threaded entries**: Earthing coupling with male brass bush and protective conductor.

725 Installing rigid non metallic conduit

Used by: 90-55-10/380 Rigid conduit type D - PVC-U (only acceptable if specifically allowed by project specific documentation).

- **General requirements**: 90-55-10/710 Installing conduit generally and 90-55-10/700 Installing conduit, trunking and ducting.
- **Fixings**: Spacer bar saddle.
- **Joints**: Solvent and Threaded.
- **Conduit connections to boxes and items of equipment**: Threaded bushed entries.

735 Installing conduit connections to equipment

Shared by: 90-55-10/360 Flexible conduit; type A - Metallic and type B - PVC-U; and 90-55-10/380 Rigid conduit; type A - External and/or cast-in-situ installations; type B - Internal installations; type C - Stainless steel and type D - PVC-U (only acceptable if specifically allowed by project specific documentation).

- **General requirements**: 90-55-10/710 Installing conduit generally and 90-55-10/700 Installing conduit, trunking and ducting.
- **Surface mounted equipment**:
  - **Concealed conduit**: Conceal the final connection.
  - **Exposed conduit**: General - contain the final connection from the conduit box within flexible metal conduit.
    Grid connected photovoltaic systems - contain the final connection from the conduit box within rigid 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**: General - 90-55-10/360 Flexible conduit type A - Metallic and 90-55-10/360 Flexible conduit type B - PVC-U.
  Grid connected photovoltaic system - Cable gland.

740 Installing trunking generally

Shared by: 90-55-10/410 Cable trunking and cable ducting for wall and ceiling mounting; type A - Steel (no apparatus mounting); type B - Steel (with apparatus mounting); type C - PVC-U (no apparatus mounting); type D - PVC-U (with apparatus mounting) and type E - Stainless Steel.

- **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.

765 Conduit, trunking and ducting zones

Shared by: 90-55-10/360 Flexible conduit; type A - Metallic and type B - PVC-U; 90-55-10/380 Rigid conduit; type A - External and/or cast-in-situ installations; type B - Internal installations; type C - Stainless steel and type D - PVC-U (only acceptable if specifically allowed by project specific documentation); and 90-55-10/410 Cable trunking and cable ducting for wall and ceiling mounting; type A - Steel (no apparatus mounting); type B - Steel (with apparatus mounting); type C - PVC-U (no apparatus mounting); type D - PVC-U (with apparatus mounting) and type E - Stainless Steel.

- **General requirements**: 90-55-10/700 Installing conduit, trunking and ducting.
- **Ceiling voids**:

Ω End of section

90-55-15 Cables

Products

305 Anti-vandal capping

Used by: 75-85-45/110 Lightning protection system.

- **Material**: HDPE;
  Black PVC coated steel;
  and Galvanized steel.
- **Execution**: 90-55-15/745 Installing anti-vandal capping.

305 Anti-vandal capping

Used by: 70-70-25/110 Earthing and bonding system.

- **Material**: HDPE;
  Black PVC coated steel;
  and Galvanized steel.
- **Execution**: 90-55-15/745 Installing anti-vandal capping.

309 Plastic warning devices for underground cables and pipelines

Shared by: 70-80-25/110 Roadway lighting system; and 70-80-25/120 Amenity lighting system.

- **Manufacturer**: Refer to project specific documentation.
- **Format**:
  - **Text colour**: Black.

311 Underground concrete cable protection covers type A

Shared by: 70-80-25/110 Roadway lighting system; and 70-80-25/120 Amenity lighting system.

- **Type**: A
- **Manufacturer**: Refer to project specific documentation.
- **Standard**: To BS 2484.
- **Size**:
  - **Length**: 914 mm.

311 Underground concrete cable protection covers type B

Used by: 70-70-35/110 High voltage distribution system.

- **Manufacturer**: Refer to project specific documentation.
- **Standard**: To BS 2484.
- **Arrangement**: Peaked.
- **Size**:

  - **Length**: Refer to project specific documentation.
  - **Width**: Refer to project specific documentation.
  - **Thickness at outer edge**: Refer to project specific documentation.

311 Underground concrete cable protection covers type C

Used by: 70-70-45/110 Low voltage distribution system type A.

- **Manufacturer**: Refer to project specific documentation.
- **Standard**: To BS 2484.
- **Arrangement**: Peaked.
- **Size**:
  - **Length**: Refer to project specific documentation.
  - **Width**: Refer to project specific documentation.
  - **Thickness at outer edge**: Refer to project specific documentation.

313 Underground plastics cable protection covers

Used by: 90-55-15/725 Cables in trenches.

- **Material**: Polyethylene.
- **Size**:
  - **Width**: 150 mm.
  - **Thickness**: 6 mm.
- **Jointing method**: Peg.
- **Format**:
  - **Background colour**: Yellow.
  - **Text colour**: Black.
- **Labelling**: Laminate underground cable marker tape to top face.

313 Underground plastics cable protection covers type A

Shared by: 70-80-25/110 Roadway lighting system; and 70-80-25/120 Amenity lighting system.

- **Manufacturer**: Refer to project specific documentation.
- **Standard**: To ENA 12-23.
- **Material**: Polyethylene.
- **Size**:
  - **Length**: 1000 mm.
- **Jointing method**: Peg.
- **Format**:
  - **Background colour**: Yellow.
  - **Text colour**: Black.
- **Labelling**: “CAUTION – ELECTRIC CABLE BELOW” continuous along the tile length.

313 Underground plastics cable protection covers type B

Used by: 70-70-35/110 High voltage distribution system.

- **Manufacturer**: Refer to project specific documentation.
- **Standard**: To ENA 12-23.
- **Material**: Polyethylene.
- **Size**:
  - **Width**: 150 mm.
  - **Thickness**: 6 mm.
- **Jointing method**: Peg.
- **Format**:
  - **Background colour**: Yellow.
  - **Text colour**: Black.
- **Labelling**: Laminate underground cable marker tape to top face.

324 Thermosetting insulated and thermoplastic sheathed (LSHF) armoured cables

Shared by: 70-70-45/110 Low voltage distribution system type A; and 70-70-75/110 Hard wired low voltage small power system.

- **Manufacturer**: Refer to Schedule of Manufacturers.
- **Standard**: To BS 6724.
- **Third party certification**: British Approvals Service for Cables (BASEC) certified.
- **Size**: Refer to project specific documentation.
- **Insulation**: Cross-linked Polyethelyne
- **Sheath colour**: Black.
- **Execution**: 90-55-15/680 Installing low voltage armoured cables;
  90-55-15/715 Excavations;
  90-55-15/720 Cables in ducts;
  90-55-15/725 Cables in trenches;
  90-55-15/735 Cable installation on channel cable supports, cable tray, cable ladder and cable basket;
  and 90-55-15/740 Cables in vertical trunking and ducts.

324 Thermosetting insulated and thermoplastic sheathed (LSHF) armoured cables

Used by: 70-65-60/110 Grid connected photovoltaic system.

- **Standard**: To BS 6724.
- **Third party certification**: British Approvals Service for Cables (BASEC) certified.
- **Insulation**: Cross-linked polyethylene GP 8.
- **Sheath colour**: Black.
- **Execution**: ;
  ;

;
90-55-15/660 Installing low voltage cables in conduit and trunking;
90-55-15/735 Cable installation on channel cable supports, cable tray, cable ladder and cable basket;
90-55-15/680 Installing low voltage armoured cables;
90-55-15/685 Jointing and terminating low voltage armoured cables;
90-55-15/715 Excavations;
90-55-15/720 Cables in ducts;
90-55-15/725 Cables in trenches;
;
and 90-55-15/740 Cables in vertical trunking and ducts.

330 Fire resistant screened (LSHF) cables

Shared by: 70-70-45/110 Low voltage distribution system type A; and 70-70-75/110 Hard wired low voltage small power system.

- **Manufacturer**: Refer to Schedule of Manufacturers.
- **Standard**: To BS 7629-1.
- **Third party certification**: British Approvals Service for Cables (BASEC) certified and LPCB.
- **Size**: Refer to project specific documentation.
- **Fire resistance category**: Refer to project specific documentation.
- **Screen**: Manufacturer's standard.
- **Execution**: 90-55-15/635 Installing low voltage cables type A;
  90-55-15/660 Installing low voltage cables in conduit and trunking;
  and 90-55-15/735 Cable installation on channel cable supports, cable tray, cable ladder and cable basket.

332 Thermosetting insulated armoured fire resistant (LSHF) cables

Shared by: 70-70-45/110 Low voltage distribution system type A; and 70-70-75/110 Hard wired low voltage small power system.

- **Manufacturer**: Refer to Schedule of Manufacturers.
- **Standard**: To BS 7846.
- **Third party certification**: British Approvals Service for Cables (BASEC) certified and LPCB.
- **Size**: Refer to project specific documentation.
- **Fire resistance category**: Refer to project specific documentation.
- **Oversheath colour**: Black.
- **Execution**: 90-55-15/680 Installing low voltage armoured cables;
  90-55-15/715 Excavations;
  90-55-15/720 Cables in ducts;
  90-55-15/725 Cables in trenches;

90-55-15/735 Cable installation on channel cable supports, cable tray, cable ladder and cable basket;
and 90-55-15/740 Cables in vertical trunking and ducts.

334 Single core non-sheathed cables with LSHF insulation

Shared by: 70-70-45/110 Low voltage distribution system type A; and 70-70-75/110 Hard wired low voltage small power system.

- **Manufacturer**: Refer to Schedule of Manufacturers.
- **Standards**: To BS EN 50525-1 and BS EN 50525-3-41.
- **Third party certification**: British Approvals Service for Cables (BASEC) certified.
- **Cable type**: Manufacturer's standard.
- **Size**: Refer to project specific documentation.
- **Execution**: 90-55-15/635 Installing low voltage cables type A and 90-55-15/660 Installing low voltage cables in conduit and trunking.

338 Light duty mineral insulated cables

Shared by: 70-70-45/110 Low voltage distribution system type A; and 70-70-75/110 Hard wired low voltage small power system.

- **Manufacturer**: Refer to Schedule of Manufacturers.
- **Standard**: To BS EN 60702-1.
- **Third party certification**: British Approvals Service for Cables (BASEC) certified and LPCB.
- **Size**: Refer to project specific documentation.
- **Metallic sheath**: Copper.
- **Outer covering**:
  - **Material**: LSHF.
  - **Colour**: Refer to project specific documentation.
- **Execution**: 90-55-15/660 Installing low voltage cables in conduit and trunking and 90-55-15/735 Cable installation on channel cable supports, cable tray, cable ladder and cable basket.

339 Heavy duty mineral insulated cables

Shared by: 70-70-45/110 Low voltage distribution system type A; and 70-70-75/110 Hard wired low voltage small power system.

- **Manufacturer**: Refer to Schedule of Manufacturers.
- **Standard**: To BS EN 60702-1.
- **Third party certification**: British Approvals Service for Cables (BASEC) certified and LPCB.
- **Size**: Refer to project specific documentation.
- **Metallic sheath**: Copper.
- **Outer covering**:
  - **Material**: LSHF.
  - **Colour**: Refer to project specific documentation.

- **Execution**: 90-55-15/660 Installing low voltage cables in conduit and trunking and 90-55-15/735 Cable installation on channel cable supports, cable tray, cable ladder and cable basket.

340 Multicore screened thermosetting insulated (LSHF) sheathed cables type A

Shared by: 70-70-45/110 Low voltage distribution system type A; and 70-70-75/110 Hard wired low voltage small power system.

- **Manufacturer**: Refer to Schedule of Manufacturers.
- **Standard**: To BS 8436.
- **Third party certification**: British Approvals Service for Cables (BASEC) certified.
- **Size**: Refer to project specific documentation.
- **Sheath colour**: Refer to project specific documentation.
- **Execution**: 90-55-15/635 Installing low voltage cables type A; 90-55-15/660 Installing low voltage cables in conduit and trunking; and 90-55-15/735 Cable installation on channel cable supports, cable tray, cable ladder and cable basket.

340 Flexible cords type D

Used by: 70-70-75/110 Hard wired low voltage small power system.

340 Multicore screened thermosetting insulated (LSHF) sheathed cables type E

Used by: 70-70-45/110 Low voltage distribution system type A.

- **Manufacturer**:
- **Standard**: To BS 8436.
- **Third party certification**:
- **Size**:
- **Sheath colour**:
- **Execution**:

340 Multicore screened thermosetting insulated (LSHF) sheathed cables type F

Used by: 70-70-45/110 Low voltage distribution system type A.

- **Manufacturer**:
- **Standard**: To BS 8436.
- **Third party certification**:
- **Size**:
- **Sheath colour**:
- **Execution**:

340 Multicore screened thermosetting insulated (LSHF) sheathed cables type G

Used by: 70-70-45/110 Low voltage distribution system type B.

- **Manufacturer**:

- **Standard**: To BS 8436.
- **Third party certification**:
- **Size**:
- **Sheath colour**:
- **Execution**:

345 Single core PVC insulated cables for switchgear and controlgear

Used by: 90-50-45/665 Installing switchgear generally type A.

- **Standard**: To BS 6231.
- **Third party certification**: British Approvals Service for Cables (BASEC) certified.
- **Cable type**:
- **Execution**: 90-55-15/635 Installing low voltage cables type A and 90-55-15/660 Installing low voltage cables in conduit and trunking.

350 Thermosetting insulated and thermoplastic sheathed (LSHF) cables

Shared by: 70-70-45/110 Low voltage distribution system type A; and 70-70-75/110 Hard wired low voltage small power system.

- **Manufacturer**: Refer to Schedule of Manufacturers.
- **Standard**: To BS 7211.
- **Third party certification**: British Approvals Service for Cables (BASEC) certified.
- **Cable type**: 6181B;
  6182B;
  6183B;
  6184B;
  6185B;
  6241B;
  6242B;
  and 6243B.
- **Size**: Refer to project specific documentation.
- **Execution**: 90-55-15/635 Installing low voltage cables type A;
  90-55-15/660 Installing low voltage cables in conduit and trunking;
  and 90-55-15/735 Cable installation on channel cable supports, cable tray, cable ladder and cable basket.

350 Thermosetting insulated and thermoplastic sheathed (LSHF) cables type A

Shared by: 70-65-60/110 Grid connected photovoltaic system; and 70-70-25/110 Earthing and bonding system.

- **Standard**: To BS 7211.
- **Third party certification**: British Approvals Service for Cables (BASEC) certified.
- **Cable type**:

- **Execution**: 90-55-15/635 Installing low voltage cables type A;
  ;
  ;
  ;
  ;
  90-55-15/660 Installing low voltage cables in conduit and trunking;
  and 90-55-15/735 Cable installation on channel cable supports, cable tray, cable ladder and cable basket.

352 Thermosetting insulated non-armoured PVC sheathed cables type A

Shared by: 70-70-25/110 Earthing and bonding system; and 70-70-75/110 Hard wired low voltage small power system.

- **Manufacturer**: Refer to Schedule of Manufacturers
- **Standard**: To BS 7889.
- **Third party certification**: British Approvals Service for Cables (BASEC) certified.
- **Sheath colour**: Black.
- **Execution**: 90-55-15/635 Installing low voltage cables type A;
  ;
  ;
  ;
  ;
  and 90-55-15/660 Installing low voltage cables in conduit and trunking.

352 Thermosetting insulated non-armoured PVC sheathed cables type B

Shared by: 70-70-45/110 Low voltage distribution system type A; and 70-70-75/110 Hard wired low voltage small power system.

- **Manufacturer**: Refer to Schedule of Manufacturers
- **Standard**: To BS 7889.
- **Third party certification**: British Approvals Service for Cables (BASEC) certified.
- **Size**: Refer to project specific documentation.
- **Sheath colour**: Black.
- **Execution**: 90-55-15/635 Installing low voltage cables type A and 90-55-15/660 Installing low voltage cables in conduit and trunking.

405 Balanced twisted-pair cables type A

Used by: 75-45-20/110 Data distribution system.

- **Manufacturer**: Refer to project specific documentation.
- **Standard**: To BS EN 50173-1 and To TIA 568-C.2.
- **Category**: Refer to project specific documentation.
- **Cable type**: Refer to project specific documentation.

- **Number of pairs**: Refer to project specific documentation.
- **Size**: Refer to project specific documentation.
- **Sheath**:
  - **Type**: LSHF.
  - **Colour**: Refer to project specific documentation.
- **Execution**: 90-55-15/635 Installing low voltage cables type B.

405 Balanced twisted-pair cables type B

Used by: 75-60-05/110 Electronic access control system.

- **Manufacturer**: Refer to project specific documentation.
- **Standard**: Refer to project specific documentation.
- **Category**: Refer to project specific documentation.
- **Cable type**: Refer to project specific documentation.
- **Number of pairs**: Refer to project specific documentation.
- **Size**: Refer to project specific documentation.
- **Sheath**:
  - **Type**: Refer to project specific documentation.
  - **Colour**: Refer to project specific documentation.
- **Execution**: 90-55-15/635 Installing low voltage cables type B.

405 Balanced twisted-pair cables type C

Used by: 75-60-05/120 Intercom system.

- **Manufacturer**: Refer to project specific documentation.
- **Standard**: Refer to project specific documentation.
- **Category**: Refer to project specific documentation.
- **Cable type**: Refer to project specific documentation.
- **Number of pairs**: Refer to project specific documentation.
- **Size**: Refer to project specific documentation.
- **Sheath**:
  - **Type**: Refer to project specific documentation.
  - **Colour**: Refer to project specific documentation.
- **Execution**: 90-55-15/635 Installing low voltage cables type B.

405 Balanced twisted-pair cables type D

Used by: 75-60-10/110 CCTV system.

- **Manufacturer**: Refer to project specific documentation.
- **Standard**: Refer to project specific documentation.
- **Category**: Refer to project specific documentation.
- **Cable type**: Refer to project specific documentation.
- **Number of pairs**: Refer to project specific documentation.

- **Size**: Refer to project specific documentation.
- **Sheath**:
  - **Type**: Refer to project specific documentation.
  - **Colour**: Refer to project specific documentation.
- **Execution**: 90-55-15/635 Installing low voltage cables type B.

450 T connectors

Used by: 70-80-35/120 General lighting systems with prefabricated wiring.

- **Manufacturer**: Refer to project specific documentation.
- **Third party certification**: British Approvals Service for Cables (BASEC) certified.
- **Arrangement**: Refer to project specific documentation.
- **Cable**:
  - **Type**: Refer to project specific documentation.
  - **Number of cores**: Refer to project specific documentation.
  - **Size**: Refer to project specific documentation.
  - **Length**: Refer to project specific documentation.
- **Mechanical protection**: Refer to project specific documentation.
- **Connectors**:
  - **Standard**: To BS EN 61535.
  - **'T' arrangement**: One fully shrouded male connector and one fully shrouded female connector.
  - **Rating (minimum)**: 16 A.
  - **Poles**: Refer to project specific documentation.
- **Execution**: 90-55-15/670 Installing prefabricated wiring.

465 Home run cables type A

Used by: 70-80-35/120 General lighting systems with prefabricated wiring.

- **Manufacturer**: Refer to project specific documentation.
- **Third party certification**: British Approvals Service for Cables (BASEC) certified.
- **Cable**:
  - **Type**: Refer to project specific documentation.
  - **Number of cores**: Refer to project specific documentation.
  - **Size**: Refer to project specific documentation.
  - **Length**: Refer to project specific documentation.
- **Mechanical protection**: 20 mm flexible galvanized steel conduit to BS EN 61386-1 and BS EN 61386-23.
  25 mm flexible galvanized steel conduit to BS EN 61386-1 and BS EN 61386-23.

- **Connectors**:
  - **Standard**: To BS EN 61535.

  - **Arrangement**: Refer to project specific documentation.
- **Execution**: 90-55-15/670 Installing prefabricated wiring.

465 Home run cables type B

Used by: 70-70-75/120 Low voltage small power systems with prefabricated wiring.

- **Manufacturer**: Refer to project specific documentation.
- **Third party certification**: British Approvals Service for Cables (BASEC) certified.
- **Cable**:
  - **Type**: Refer to project specific documentation.
  - **Number of cores**: Refer to project specific documentation.
  - **Size**: Refer to project specific documentation.
  - **Length**: Refer to project specific documentation.
- **Mechanical protection**: 20 mm flexible galvanized steel conduit to BS EN 61386-1 and BS EN 61386-23.
  25 mm flexible galvanized steel conduit to BS EN 61386-1 and BS EN 61386-23.

- **Connectors**:
  - **Standard**: To BS EN 61535.
  - **Arrangement**: Refer to project specific documentation.
- **Execution**: 90-55-15/670 Installing prefabricated wiring.

470 Lighting extender leads

Used by: 70-80-35/120 General lighting systems with prefabricated wiring.

- **Manufacturer**: Refer to project specific documentation.
- **Third party certification**: British Approvals Service for Cables (BASEC) certified.
- **Cable**:
  - **Type**: Refer to project specific documentation.
  - **Number of cores**: Refer to project specific documentation.
  - **Size**: Refer to project specific documentation.
  - **Length**: Refer to project specific documentation.
- **Connectors**:
  - **Standard**: To BS EN 61535.
  - **Arrangement**: One fully shrouded male connector and one fully shrouded female connector.
  - **Rating (minimum)**: 16 A.
  - **Poles**: Refer to project specific documentation.
- **Execution**: 90-55-15/670 Installing prefabricated wiring.

475 Luminaire connection cables

Used by: 70-80-35/120 General lighting systems with prefabricated wiring.

- **Manufacturer**: Refer to project specific documentation.
- **Third party certification**: British Approvals Service for Cables (BASEC) certified.
- **Cable**:
  - **Type**: Refer to project specific documentation.
  - **Number of cores**: Refer to project specific documentation.
  - **Size**: Refer to project specific documentation.
  - **Length**: Refer to project specific documentation.
- **Connectors**:
  - **Standard**: To BS EN 61535.
  - **Arrangement**: One fully shrouded male connector and one free cable end.
  - **Rating (minimum)**: 16 A.
  - **Poles**: Refer to project specific documentation.
- **Execution**: 90-55-15/670 Installing prefabricated wiring.

490 Starter leads type A

Used by: 70-80-35/120 General lighting systems with prefabricated wiring.

- **Manufacturer**: Refer to project specific documentation.
- **Third party certification**: British Approvals Service for Cables (BASEC) certified.
- **Cable**:
  - **Type**: Refer to project specific documentation.
  - **Number of cores**: Refer to project specific documentation.
  - **Size**: Refer to project specific documentation.
- **Length**: Refer to project specific documentation.
- **Mechanical protection**: Refer to project specific documentation.
- **Connectors**:
  - **Standard**: Refer to project specific documentation.
  - **Arrangement**: Refer to project specific documentation.
  - **Rating (minimum)**: 16 A.
  - **Poles**: Refer to project specific documentation.
- **Execution**: 90-55-15/670 Installing prefabricated wiring.

490 Starter leads type B

Used by: 70-70-75/120 Low voltage small power systems with prefabricated wiring.

- **Manufacturer**: Refer to project specific documentation.
- **Third party certification**: British Approvals Service for Cables (BASEC) certified.
- **Cable**:
  - **Type**: Refer to project specific documentation.
  - **Number of cores**: Refer to project specific documentation.
  - **Size**: Refer to project specific documentation.
- **Length**: Refer to project specific documentation.

- **Mechanical protection**: Refer to project specific documentation.
- **Connectors**:
  - **Standard**: Refer to project specific documentation.
  - **Arrangement**: Refer to project specific documentation.
  - **Rating (minimum)**: 16 A.
  - **Poles**: Refer to project specific documentation.
- **Execution**: 90-55-15/670 Installing prefabricated wiring.

495 Switch connection leads

Used by: 70-80-35/120 General lighting systems with prefabricated wiring.

- **Manufacturer**: Refer to project specific documentation.
- **Third party certification**: British Approvals Service for Cables (BASEC) certified.
- **Cable**:
  - **Type**: Refer to project specific documentation.
  - **Number of cores**: Refer to project specific documentation.
  - **Size**: Refer to project specific documentation.
  - **Length**: Refer to project specific documentation.
- **Connectors**:
  - **Standard**: To BS EN 61535.
  - **Arrangement**: Refer to project specific documentation.
  - **Rating (minimum)**: 16 A.
  - **Poles**: Refer to project specific documentation.
- **Execution**: 90-55-15/670 Installing prefabricated wiring.

Execution

635 Installing low voltage cables type A

Shared by: 90-55-15/330 Fire resistant screened (LSHF) cables; 90-55-15/334 Single core non-sheathed cables with LSHF insulation; 90-55-15/340 Multicore screened thermosetting insulated (LSHF) sheathed cables type A; 90-55-15/345 Single core PVC insulated cables for switchgear and controlgear; 90-55-15/350 Thermosetting insulated and thermoplastic sheathed (LSHF) cables type A; 90-55-15/352 Thermosetting insulated non-armoured PVC sheathed cables; type A and type B; 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**: Sleeve with conduit or pipeduct. Bush at both ends.
- **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.

635 Installing low voltage cables type B

Shared by: 90-55-15/405 Balanced twisted-pair cables; type A; type B; type C and type D.

- **Standard**: To BS 7671.
- **Timing**: Do not start internal cabling until building enclosure provides permanently dry conditions.
- **Preparation**: Store cables above 5°C for 24 hours before installation.
  Clear cable path of debris.
- **Installation temperature (minimum)**: 5°C.
- **Cables**: Install in one length.
- **Cable pulling**: Do not overstress. Prevent kinks and twisting of the cable.
- **Cables passing through walls**: Sleeve with conduit or pipeduct. Bush at both ends.
- **Cables surrounded or covered by insulation**: Derate.
- **Jointing and termination**:
  - **Final circuit cables**: At electrical accessories only.
  - **Core connections**: Using compression lugs to equipment without integral clamping terminals.
- **Mechanical protection**: Provide anti vandal capping to surface run cables to 2 m above finished ground level.

640 Extra low and low voltage cable routes

- **Cables generally**:
  - **Concealed cable runs to wall accessories**: Run vertically from the accessory.
  - **Exposed cable runs**: On containment.
- **Distance from other services running parallel (minimum)**: 150 mm. Position cables below heating pipes.

645 Low voltage cables concealed in walls and partitions

- **Protection**: 90-55-10/380 Rigid conduit type C - Stainless steel;

90-55-10/380 Rigid conduit type B - Internal installations;
90-55-10/380 Rigid conduit type A - External and/or cast-in-situ installations;
90-55-10/380 Rigid conduit type D - PVC-U (only acceptable if specifically allowed by project specific documentation);
90-55-10/410 Cable trunking and cable ducting for wall and ceiling mounting type E - Stainless Steel;
90-55-10/410 Cable trunking and cable ducting for wall and ceiling mounting type A - Steel (no apparatus mounting);
90-55-10/410 Cable trunking and cable ducting for wall and ceiling mounting type C - PVC-U (no apparatus mounting);
90-55-10/410 Cable trunking and cable ducting for wall and ceiling mounting type B - Steel (with apparatus mounting);
and 90-55-10/410 Cable trunking and cable ducting for wall and ceiling mounting type D - PVC-U (with apparatus mounting).

650 Extra low and low voltage cables in accessible roof spaces

- **Cables running across ceiling joists**: 90-55-10/325 Cable baskets type A;
  90-55-10/335 Cable trays type B - General;
  90-55-10/335 Cable trays type C - Stainless Steel;
  90-55-10/335 Cable trays type D - Composite;
  90-55-10/410 Cable trunking and cable ducting for wall and ceiling mounting type E - Stainless Steel;
  90-55-10/410 Cable trunking and cable ducting for wall and ceiling mounting type A - Steel (no apparatus mounting);
  90-55-10/410 Cable trunking and cable ducting for wall and ceiling mounting type C - PVC-U (no apparatus mounting);
  90-55-10/410 Cable trunking and cable ducting for wall and ceiling mounting type B - Steel (with apparatus mounting);
  90-55-10/410 Cable trunking and cable ducting for wall and ceiling mounting type D - PVC-U (with apparatus mounting);
  and 90-55-10/335 Cable trays type A - External installations and/or further mechanical protection is required.

655 Extra low and low voltage surface mounted cables

- **Fastening**: Minimum 25 mm between cable face and structure.
- **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.

660 Installing low voltage cables in conduit and trunking

Shared by: 90-55-15/324 Thermosetting insulated and thermoplastic sheathed (LSHF) armoured cables; 90-55-15/330 Fire resistant screened (LSHF) cables; 90-55-15/334 Single core non-sheathed cables with

LSHF insulation; 90-55-15/338 Light duty mineral insulated cables; 90-55-15/339 Heavy duty mineral insulated cables; 90-55-15/340 Multicore screened thermosetting insulated (LSHF) sheathed cables type A; 90-55-15/345 Single core PVC insulated cables for switchgear and controlgear; 90-55-15/350 Thermosetting insulated and thermoplastic sheathed (LSHF) cables; and 90-55-15/352 Thermosetting insulated non-armoured PVC sheathed cables; type A and type B.

- **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 10 m intervals.
- **Extra low voltage cables**: Install within a separate partition from low voltage cables where installed in multi compartment trunking.

670 Installing prefabricated wiring

Shared by: 90-55-15/450 T connectors; 90-55-15/465 Home run cables; type A and type B; 90-55-15/470 Lighting extender leads; 90-55-15/475 Luminaire connection cables; 90-55-15/490 Starter leads; type A and type B; and 90-55-15/495 Switch connection leads.

- **General requirements**: 90-55-15/635 Installing low voltage cables type A.
- **Connection arrangement**: Form circuits using a male connector working away from any master distribution boxes.
- **Fixing distribution boxes**: Refer to project specific documentation.
- **Fixing cabling**:
  - **Maximum distance between clips**: Refer to project specific documentation.
  - **Adjacent to connectors**: Clip within 100 mm.
  - **Bends**: Not permitted within 150 mm of connectors.

680 Installing low voltage armoured cables

Shared by: 90-55-15/324 Thermosetting insulated and thermoplastic sheathed (LSHF) armoured cables; and 90-55-15/332 Thermosetting insulated armoured fire resistant (LSHF) cables.

- **General requirements**: 90-55-15/635 Installing low voltage cables type A.
- **Earthing**: Bond armour to equipment and main earthing system.
- **Connections to apparatus**: Moisture proof, sealed glands and shrouds.

685 Jointing and terminating low voltage armoured cables

Used by: 90-55-15/324 Thermosetting insulated and thermoplastic sheathed (LSHF) 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.

715 Excavations

Shared by: 90-55-15/324 Thermosetting insulated and thermoplastic sheathed (LSHF) armoured cables; and 90-55-15/332 Thermosetting insulated armoured fire resistant (LSHF) cables.

- **Excavations next to existing underground services**: In accordance with HSG 47.
- **Existing underground services**: Expose and identify.

720 Cables in ducts

Shared by: 90-55-15/324 Thermosetting insulated and thermoplastic sheathed (LSHF) armoured cables; and 90-55-15/332 Thermosetting insulated armoured fire resistant (LSHF) 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.

725 Cables in trenches

Shared by: 90-55-15/324 Thermosetting insulated and thermoplastic sheathed (LSHF) armoured cables; and 90-55-15/332 Thermosetting insulated armoured fire resistant (LSHF) 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.

735 Cable installation on channel cable supports, cable tray, cable ladder and cable basket

Shared by: 90-55-15/324 Thermosetting insulated and thermoplastic sheathed (LSHF) armoured cables; 90-55-15/330 Fire resistant screened (LSHF) cables; 90-55-15/332 Thermosetting insulated armoured fire resistant (LSHF) cables; 90-55-15/338 Light duty mineral insulated cables; 90-55-15/339 Heavy duty mineral insulated cables; 90-55-15/340 Multicore screened thermosetting insulated (LSHF) sheathed cables type A; and 90-55-15/350 Thermosetting insulated and thermoplastic sheathed (LSHF) cables type A.

- **Cabling**: Install when cable supports are complete.
- **Position**: Place single and multicore 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**: 90-55-10/320 Cable bands type A.
  - **Submain cables >95 mm²**: 90-55-10/310 Cable cleats type A.
  - **Final circuit cabling**:
  - **Extra low voltage, communications and fibre optic cabling**:

740 Cables in vertical trunking and ducts

Shared by: 90-55-15/324 Thermosetting insulated and thermoplastic sheathed (LSHF) armoured cables; and 90-55-15/332 Thermosetting insulated armoured fire resistant (LSHF) cables.

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

745 Installing anti-vandal capping

Used by: 90-55-15/305 Anti-vandal capping.

- **Position**: Provide between finished ground level and 3 m high.

Ω End of section

90-55-20 High voltage cables and accessories

Products

310 High voltage cables generally

Shared by: 90-55-20/320 High voltage power cables with low smoke thermosetting insulation; and 90-55-20/325 High voltage power cables with thermosetting insulation.

- **Materials**:
  - **Underground cable networks for housing developments**: In accordance with ENA G81/2.
  - **6.6 kV and 11 kV, underground industrial and commercial connections**: In accordance with ENA G81/5.
- **Bonds for electrical power cable terminations**: To BS 7197.

320 High voltage power cables with low smoke thermosetting insulation

Used by: 70-70-35/110 High voltage distribution system.

- **General requirements**: 90-55-20/310 High voltage cables generally .
- **Manufacturer**: Refer to project specific documentation.
- **Voltage designation**: Refer to project specific documentation.
- **Standard**: To BS 7835.
- **Number of cores**: Refer to project specific documentation.
- **Size**: Refer to project specific documentation.
- **Conductors**: Refer to project specific documentation.
- **Conductor screen**: Semi conducting compound.
- **Insulation**: Refer to project specific documentation.
- **Semi conductive insulation screen**: Refer to project specific documentation.
- **Metallic screen**: Refer to project specific documentation.
- **Armour material**: Refer to project specific documentation.
- **Oversheath**: Refer to project specific documentation.
  - **Material**: Thermoplastic.
  - **Colour**: Red.
- **Semi-conducting layer on oversheath**: Refer to project specific documentation.
- **Execution**: 90-55-20/615 Installing high voltage power cables with low smoke thermosetting insulation.

325 High voltage power cables with thermosetting insulation

Used by: 70-70-35/110 High voltage distribution system.

- **General requirements**: 90-55-20/310 High voltage cables generally.
- **Manufacturer**: Refer to project specific documentation.

- **Voltage designation**: Refer to project specific documentation.
- **Standard**: To BS 6622.
- **Number of cores**: Refer to project specific documentation.
- **Size**: Refer to project specific documentation.
- **Conductors**: Refer to project specific documentation.
- **Conductor screen**: Semi conducting compound.
- **Insulation**: Refer to project specific documentation.
- **Semi conductive insulation screen**: Refer to project specific documentation.
- **Metallic screen**: Refer to project specific documentation.
- **Armour material**: Refer to project specific documentation.
- **Oversheath**:
  - **Material**: Refer to project specific documentation.
  - **Colour**: Red.
- **Semi-conducting layer on oversheath**: Refer to project specific documentation.
- **Execution**: 90-55-20/620 Installing high voltage power cables with thermosetting insulation.

340 High voltage cable terminations for extruded insulation cables

Used by: 70-70-35/110 High voltage distribution system.

- **Manufacturer**: Refer to project specific documentation.
- **Standard**: To BS 7888-4-1.
- **Rated voltage**: Refer to project specific documentation.
- **Application**: Refer to project specific documentation.
- **Number of cores**: Refer to project specific documentation.
- **Conductor size**: Refer to project specific documentation.
- **Tail length**: Refer to project specific documentation.

Execution

605 Installing high voltage cables generally

Shared by: 90-55-20/615 Installing high voltage power cables with low smoke thermosetting insulation; and 90-55-20/620 Installing high voltage power cables with thermosetting insulation.

- **Underground cable networks for housing developments**: In accordance with ENA G81/3.
- **6.6 kV and 11 kV underground industrial and commercial connections**: In accordance with ENA G81/6.
- **Installation**:
  - **Generally**: Controlled by authorized persons and undertaken by competent persons.
  - **Evidence of authorization**: Submit within 1 week of confirmation of successful tender.
  - **Evidence of competence**: Submit within 1 week of confirmation of successful tender.
  - **Permit to work procedure and method statements**: Submit 4 weeks prior to commencement of work on site.

- **Cables**: Install in one length.
- **Cable pulling**: Do not overstress. Prevent kinks and twisting of the cable.

615 Installing high voltage power cables with low smoke thermosetting insulation

Used by: 90-55-20/320 High voltage power cables with low smoke thermosetting insulation.

- **General requirements**: 90-55-20/605 Installing high voltage cables generally.
- **Installation**: In accordance with BS 7835, annex C.
- **Continuity and polarity**: Verify.
- **Electrical tests after installation**:
  - **Oversheath test**: In accordance with BS 7835, annex C.7.2.
  - **Insulation tests**: Test for 5 min with the phase-to-phase voltage of the system applied between the conductor and the metallic screen/sheath;
    Test for 24 h with the normal operating voltage of the system;
    and Apply d.c. test voltage equal to four times U 0 for 15 min.
  - **Results**: Submit.

620 Installing high voltage power cables with thermosetting insulation

Used by: 90-55-20/325 High voltage power cables with thermosetting insulation.

- **General requirements**: 90-55-20/605 Installing high voltage cables generally.
- **Installation**: In accordance with BS 6622, annex C.
- **Continuity and polarity**: Verify.
- **Electrical tests after installation**:
  - **Oversheath test**: In accordance with BS 6622, annex C.7.2.
  - **Insulation tests**: Test for 5 min with the phase-to-phase voltage of the system applied between the conductor and the metallic screen/sheath;
    Test for 24 h with the normal operating voltage of the system;
    and Apply d.c. test voltage equal to four times U 0 for 15 min.
  - **Results**: Submit.

Ω End of section

90-60-25 Electrical accessories

Products

325 Light switches type A

Used by: 70-80-35/110 Hard wired general lighting system.

- **Manufacturer**: Refer to Schedule of Manufacturers
- **Standard**: To BS EN 60669-1.
- **Ingress protection (minimum)**: Refer to project specific documentation.
- **Rating**: Refer to project specific documentation.
- **Actuating method**: Refer to project specific documentation.
- **Poles**: Refer to project specific documentation.
- **Mounting**: Refer to project specific documentation.
- **Cable termination**: Screw.
- **Plate**:
  - **Material**: Refer to project specific documentation.
  - **Finish**: Refer to project specific documentation.
- **Insert colour**: Refer to project specific documentation.
- **Execution**: 90-60-25/640 Installing light switches.

325 Light switches type B

Used by: 70-80-35/120 General lighting systems with prefabricated wiring.

- **Manufacturer**: Refer to Schedule of Manufacturers
- **Standard**: To BS EN 60669-1.
- **Ingress protection (minimum)**: Refer to project specific documentation.
- **Rating**: Refer to project specific documentation.
- **Actuating method**: Refer to project specific documentation.
- **Poles**: Refer to project specific documentation.
- **Mounting**: Refer to project specific documentation.
- **Cable termination**: Screw.
- **Plate**:
  - **Material**: Refer to project specific documentation.
  - **Finish**: Refer to project specific documentation.
- **Insert colour**: Refer to project specific documentation.
- **Execution**: 90-60-25/640 Installing light switches.

325 Light switches type C

Used by: 70-80-35/130 Central battery supplied emergency lighting system.

- **Manufacturer**: Refer to Schedule of Manufacturers

- **Standard**: To BS EN 60669-1.
- **Ingress protection (minimum)**: Refer to project specific documentation.
- **Rating**: Refer to project specific documentation.
- **Actuating method**: Refer to project specific documentation.
- **Poles**: Refer to project specific documentation.
- **Mounting**: Refer to project specific documentation.
- **Cable termination**: Screw.
- **Plate**:
  - **Material**: Refer to project specific documentation.
  - **Finish**: Refer to project specific documentation.
- **Insert colour**: Refer to project specific documentation.
- **Execution**: Refer to project specific documentation.

325 Light switches type D

Used by: 70-80-90/110 Underwater lighting system.

- **Manufacturer**: Refer to Schedule of Manufacturers
- **Standard**: To BS EN 60669-1.
- **Ingress protection (minimum)**: Refer to project specific documentation.
- **Rating**: Refer to project specific documentation.
- **Actuating method**: Refer to project specific documentation.
- **Poles**: Refer to project specific documentation.
- **Mounting**: Refer to project specific documentation.
- **Cable termination**: Screw.
- **Plate**:
  - **Material**: Refer to project specific documentation.
  - **Finish**: Refer to project specific documentation.
- **Insert colour**: Refer to project specific documentation.
- **Execution**: 90-60-25/640 Installing light switches.

330 Dimmer switches and controls type A

Used by: 70-80-35/110 Hard wired general lighting system.

- **Manufacturer**: Refer to Schedule of Manufacturers
- **Standards**: To BS EN 60669-2-1 and BS EN 55015.
- **Ingress protection (minimum)**: To BS EN 60529, IP 2X.
- **Rating**: Refer to project specific documentation.
- **Control**: Refer to project specific documentation.
- **Format**: Refer to project specific documentation.
- **Suitable for the following loads**: Refer to project specific documentation.
- **Mounting**: Refer to project specific documentation.
- **Cable termination**: Screw.

- **Plate**:
  - **Material**: Refer to project specific documentation.
  - **Finish**: Refer to project specific documentation.
- **Insert colour**: Refer to project specific documentation.
- **Execution**: Refer to project specific documentation.

330 Dimmer switches and controls type B

Used by: 70-80-35/120 General lighting systems with prefabricated wiring.

- **Manufacturer**: Refer to Schedule of Manufacturers
- **Standards**: To BS EN 60669-2-1 and BS EN 55015.
- **Ingress protection (minimum)**: To BS EN 60529, IP 2X.
- **Rating**: Refer to project specific documentation.
- **Control**: Refer to project specific documentation.
- **Format**: Refer to project specific documentation.
- **Suitable for the following loads**: Refer to project specific documentation.
- **Mounting**: Refer to project specific documentation.
- **Cable termination**: Screw.
- **Plate**:
  - **Material**: Refer to project specific documentation.
  - **Finish**: Refer to project specific documentation.
- **Insert colour**: Refer to project specific documentation.
- **Execution**: Refer to project specific documentation.

415 Switch modules for prefabricated wiring

Used by: 70-80-35/120 General lighting systems with prefabricated wiring.

- **Manufacturer**: Refer to Schedule of Manufacturers
- **Standard**: To BS EN 60669-1.
- **Arrangement**: Refer to project specific documentation.
- **Rating**: 16 A.
- **Cable**:
  - **Type**: Refer to project specific documentation.
  - **Number of cores**: Refer to project specific documentation.
  - **Size**: Refer to project specific documentation.
  - **Length**: Refer to project specific documentation.
- **Connectors**:
  - **Standard**: To BS EN 61535.
  - **Arrangement**: One fully shrouded male connector and one fully shrouded female connector.
- **Poles**: Refer to project specific documentation.
- **Execution**: 90-60-25/610 Installing electrical accessories.

420 Ceiling light switches

Used by: 70-80-35/110 Hard wired general lighting system.

- **Manufacturer**: Refer to project specific documentation.
- **Standard**: To BS EN 60669-1.
- **Ingress protection (minimum)**: To BS EN 60529, IP 4X.
- **Rating**: Refer to project specific documentation.
- **Configuration**: Refer to project specific documentation.
- **Cord colour**: Refer to project specific documentation.
- **Mounting**: Refer to project specific documentation.
- **Cable termination**: Screw.
- **Material**: Plastics.
- **Colour**: White.
- **Execution**: 90-60-25/610 Installing electrical accessories and 90-60-25/640 Installing light switches.

425 Ceiling roses

Used by: 70-80-35/110 Hard wired general lighting system.

- **Manufacturer**: Refer to project specific documentation.
- **Standard**: To BS 67.
- **Rating**: 6 A.
- **Material**: Plastics.
- **Colour**: White.
- **Mounting**: Refer to project specific documentation.
- **Execution**: 90-60-25/610 Installing electrical accessories.

430 Luminaire supporting couplers type A

Used by: 70-80-35/110 Hard wired general lighting system.

- **Manufacturer**: Refer to Schedule of Manufacturers
- **Standard**: To BS 7001.
- **Plug type**: Rewireable, independent.
- **Pin configuration**: Refer to project specific documentation.
- **Colour**: Refer to project specific documentation.
- **Cable type**: Refer to project specific documentation.
- **Cable size**: Refer to project specific documentation.
- **Flex length (maximum)**: Refer to project specific documentation.
- **Execution**: 90-60-25/610 Installing electrical accessories and 90-60-25/650 Installing suspended lampholders.

430 Luminaire supporting couplers type B

Used by: 70-80-35/130 Central battery supplied emergency lighting system.

- **Manufacturer**: Refer to Schedule of Manufacturers
- **Standard**: To BS 7001.
- **Plug type**: Rewireable, independent.
- **Pin configuration**: Refer to project specific documentation.
- **Colour**: Refer to project specific documentation.
- **Cable type**: Refer to project specific documentation.
- **Cable size**: Refer to project specific documentation.
- **Flex length (maximum)**: Refer to project specific documentation.
- **Execution**: 90-60-25/610 Installing electrical accessories and 90-60-25/650 Installing suspended lampholders.

435 Safety pendant lampholders

Used by: 70-80-35/110 Hard wired general lighting system.

- **Manufacturer**: Refer to project specific documentation.
- **Standard**: To BS EN 61184 and BS 7895.
- **Colour**: Refer to project specific documentation.
- **Execution**: 90-60-25/610 Installing electrical accessories and 90-60-25/650 Installing suspended lampholders.

440 Safety pendant sets

Used by: 70-80-35/110 Hard wired general lighting system.

- **Manufacturer**: Refer to project specific documentation.
- **Standards**: Ceiling roses to BS 67.
  Cable to BS EN 50525-1 and BS EN 50525-2-11.
  Lampholders to BS EN 61184 and BS 7895.
- **Cable**:
  - **Colour**: White.
  - **Size**: Refer to project specific documentation.
  - **Length**: Refer to project specific documentation.
- **Execution**: 90-60-25/610 Installing electrical accessories and 90-60-25/650 Installing suspended lampholders.

445 Television outlets

Used by: 75-45-90/110 Television and radio distribution system.

- **Manufacturer**: Refer to project specific documentation.
- **Standard**: To BS 5733.
- **Format**: Refer to project specific documentation.
- **Frequency range**: Refer to project specific documentation.
- **Signal loss**: Refer to project specific documentation.
- **Mounting**: Refer to project specific documentation.

- **Plate**:
  - **Material**: Refer to project specific documentation.
  - **Finish**: Refer to project specific documentation.
- **Insert colour**: Refer to project specific documentation.
- **Execution**: 90-60-25/610 Installing electrical accessories.

450 Telecommunication outlets

Used by: 75-45-85/110 Telecommunications system.

- **Manufacturer**: Refer to project specific documentation.
- **Standards**: To BS 6312-2-1 and BS 6312-2-2.
- **Types**: Refer to project specific documentation.
- **Mounting**: Refer to project specific documentation.
- **Cable termination**: BT insulation displacement connection type.
- **Plate**:
  - **Material**: Refer to project specific documentation.
  - **Finish**: Refer to project specific documentation.
- **Insert colour**: Refer to project specific documentation.
- **Execution**: 90-60-25/610 Installing electrical accessories.

490 PV array junction boxes

Used by: 70-65-60/110 Grid connected photovoltaic system.

- **Standard**: To BS EN 61439-2.
- **Enclosure**:
  - **Material**: Polycarbonate.
  - **Degree of protection**: To BS EN 61140, Class II.
  - **Ingress protection (minimum)**: To BS EN 60529, IP 65.
  - **Mechanical protection (minimum)**: To BS EN 62262, IK03.
- **Bus bar rating**: Manufacturer's standard.
- **String fuses**:
  - **Fuse type**: gR d.c. to BS EN 60269-4 and Miniature circuit breakers to BS EN 60898-2.
- **Labelling**:
  - **Identification labels**: 'PV array junction box'.
  - **Safety labels**: 'Danger, contains live parts during daylight'.

Execution

610 Installing electrical accessories

Shared by: 90-60-25/415 Switch modules for prefabricated wiring; 90-60-25/420 Ceiling light switches; 90-60-25/425 Ceiling roses; 90-60-25/430 Luminaire supporting couplers; type A and type B; 90-60-

25/435 Safety pendant lampholders; 90-60-25/440 Safety pendant sets; 90-60-25/445 Television outlets; and 90-60-25/450 Telecommunication outlets.

- **Standard**: In accordance with BS 7671.
- **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**:
  - **Generally**: Measure from finished floor level to centre line of accessory.
  - **Light switches**: Refer to project specific documentation.
  - **Single voltage shaver outlets**: Refer to project specific documentation.
  - **Shaver supply units**: Refer to project specific documentation.
  - **Socket outlets**: Refer to project specific documentation.
  - **Fan isolators**: Refer to project specific documentation.
  - **Cooker control units**: Refer to project specific documentation.
  - **Cooker connection units**: Refer to project specific documentation.
  - **Telecommunications and data outlets**: Refer to project specific documentation.
- **Separation distance between adjacent accessories (minimum)**: Refer to project specific documentation.

640 Installing light switches

Shared by: 90-60-25/325 Light switches; type A; type B and type D; and 90-60-25/420 Ceiling 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.

650 Installing suspended lampholders

Shared by: 90-60-25/430 Luminaire supporting couplers; type A and type B; 90-60-25/435 Safety pendant lampholders; and 90-60-25/440 Safety pendant sets.

- **Flex length**: Refer to project specific documentation.

Ω End of section

90-60-30 Electrical protective devices

Products

310 Air circuit breakers

Used by: 70-70-45/110 Low voltage distribution system type A.

- **Manufacturer**: Refer to project specific documentation.
- **Standard**: To BS EN 60947-2.
- **Third party certification**: ASTA Type test certification.
- **Protection relays**: Adjustable time delay on overload and I^2t characteristics.
- **Trip function**: Earth leakage.
  N-phase protection.
  Phase rotation protection.
- **Charge mechanism**: Manual.
  Electric motor.
- **Mechanical interlocking**: Refer to project specific documentation.
- **Rated operational current (In)**: Refer to project specific documentation.
- **Rated operational voltage (Ue)**: Refer to project specific documentation.
- **Number of poles**: Refer to project specific documentation.
- **Rated ultimate short-circuit breaking capacity (Icu)**: Refer to project specific documentation.
- **Utilization category**: Refer to project specific documentation.
- **Provision for maintenance**: Maintainable.
- **Method of installation**: Withdrawable.
- **Ingress protection (minimum)**: To BS EN 60529, IP30.
- **Accessories**: Refer to project specific documentation.

320 Moulded case circuit breakers

Used by: 70-70-45/110 Low voltage distribution system type A.

- **Manufacturer**: Refer to project specific documentation.
- **Standard**: To BS EN 60947-2.
- **Third party certification**: ASTA Type test certification.
- **Circuit breaker operation**: Refer to project specific documentation.
- **Operating handle**: Manufacturer's standard.
- **Mechanical interlocking**: Refer to project specific documentation.
- **Rated operational current (In)**: Refer to project specific documentation.
- **Rated operational voltage (Ue)**: Refer to project specific documentation.
- **Number of poles**: Refer to project specific documentation.
- **Rated ultimate short-circuit breaking capacity (Icu)**: Refer to project specific documentation.
- **Utilization category**: Refer to project specific documentation.

- **Method of installation**: Refer to project specific documentation.
- **Ingress protection (minimum)**: To BS EN 60529, IP30.
- **Integral RCD**: Refer to project specific documentation.

380 Fuse links

Used by: 70-70-75/110 Hard wired low voltage small power system.

- **Manufacturer**: Refer to Schedule of Manufacturers.
- **Rated operational current (In)**: Refer to project specific documentation.

410 Surge protective devices for low voltage power supplies type A

Used by: 70-65-60/110 Grid connected photovoltaic system.

- **Standard**: To BS EN 61643-11, Type 1 and To BS EN 61643-11, Type 2.
- **Operating voltage and frequency (nominal)**: 230 V at 50 Hz and 400 V at 50 Hz.
- **Number of poles**: Single and Three.
- **Maximum continuous operating voltage (Uc)**: 500 V.
- **Mode of protection**: Lines to earth, lines to neutral, neutral to earth.
- **Lightning impulse current (Iimp)**:
- **Nominal discharge current (In)**:
- **Maximum discharge current 8/20µs (Imax)**:
- **Minimum short-circuit current rating (Isccr)**:
- **Voltage protection level (Up)**:
- **Open circuit voltage (Uoc)**:
- **Thermal overload protection**: Required
- **Protection status indicators**: Full protection status;
  Reduced protection – replacement required;
  and No protection – failure of device.
- **Remote monitoring**: Required.
- **Ingress protection (minimum)**: To BS EN 60529, IP20.
- **Mounting arrangement**: 35 mm DIN rail.
- **Execution**: 90-60-30/620 Installing surge protective devices for telecommunications and signalling networks.

410 Surge protective devices for low voltage power supplies type B

Used by: 70-70-45/110 Low voltage distribution system type A.

- **Manufacturer**: Refer to project specific documentation.
- **Standard**: Refer to project specific documentation.
- **Operating voltage and frequency (nominal)**: Refer to project specific documentation.
- **Number of poles**: Refer to project specific documentation.
- **Maximum continuous operating voltage (Uc)**: Refer to project specific documentation.
- **Mode of protection**: Lines to earth, lines to neutral, neutral to earth.

- **Lightning impulse current (Iimp)**: Refer to project specific documentation.
- **Nominal discharge current (In)**: Refer to project specific documentation.
- **Maximum discharge current 8/20µs (Imax)**: Refer to project specific documentation.
- **Minimum short-circuit current rating (Isccr)**: Refer to project specific documentation.
- **Voltage protection level (Up)**: Refer to project specific documentation.
- **Open circuit voltage (Uoc)**: Refer to project specific documentation.
- **Thermal overload protection**: Refer to project specific documentation.
- **Protection status indicators**: Refer to project specific documentation.
- **Remote monitoring**: Refer to project specific documentation.
- **Ingress protection (minimum)**: To BS EN 60529, IP20.
- **Mounting arrangement**: 35 mm DIN rail.
- **Execution**: 90-60-30/610 Installing surge protective devices for low voltage power supplies.

410 Surge protective devices for low voltage power supplies type C

Used by: 75-85-45/110 Lightning protection system.

- **Manufacturer**: Refer to project specific documentation.
- **Standard**: Refer to project specific documentation.
- **Operating voltage and frequency (nominal)**: Refer to project specific documentation.
- **Number of poles**: Refer to project specific documentation.
- **Maximum continuous operating voltage (Uc)**: Refer to project specific documentation.
- **Mode of protection**: Lines to earth, lines to neutral, neutral to earth.
- **Lightning impulse current (Iimp)**: Refer to project specific documentation.
- **Nominal discharge current (In)**: Refer to project specific documentation.
- **Maximum discharge current 8/20µs (Imax)**: Refer to project specific documentation.
- **Minimum short-circuit current rating (Isccr)**: Refer to project specific documentation.
- **Voltage protection level (Up)**: Refer to project specific documentation.
- **Open circuit voltage (Uoc)**: Refer to project specific documentation.
- **Thermal overload protection**: Refer to project specific documentation.
- **Protection status indicators**: Refer to project specific documentation.
- **Remote monitoring**: Refer to project specific documentation.
- **Ingress protection (minimum)**: To BS EN 60529, IP20.
- **Mounting arrangement**: 35 mm DIN rail.
- **Execution**: 90-60-30/610 Installing surge protective devices for low voltage power supplies.

410 Surge protective devices for low voltage power supplies type D

Used by: 70-70-75/110 Hard wired low voltage small power system.

- **Manufacturer**: Refer to project specific documentation.
- **Standard**: Refer to project specific documentation.
- **Operating voltage and frequency (nominal)**: Refer to project specific documentation.
- **Number of poles**: Refer to project specific documentation.

- **Maximum continuous operating voltage (Uc)**: Refer to project specific documentation.
- **Mode of protection**: Lines to earth, lines to neutral, neutral to earth.
- **Lightning impulse current (Iimp)**: Refer to project specific documentation.
- **Nominal discharge current (In)**: Refer to project specific documentation.
- **Maximum discharge current 8/20µs (Imax)**: Refer to project specific documentation.
- **Minimum short-circuit current rating (Isccr)**: Refer to project specific documentation.
- **Voltage protection level (Up)**: Refer to project specific documentation.
- **Open circuit voltage (Uoc)**: Refer to project specific documentation.
- **Thermal overload protection**: Refer to project specific documentation.
- **Protection status indicators**: Refer to project specific documentation.
- **Remote monitoring**: Refer to project specific documentation.
- **Ingress protection (minimum)**: To BS EN 60529, IP20.
- **Mounting arrangement**: 35 mm DIN rail.
- **Execution**: 90-60-30/610 Installing surge protective devices for low voltage power supplies.

430 Surge protective devices for telecommunications and signalling networks type A

Used by: 75-45-85/110 Telecommunications system.

- **Manufacturer**: Refer to project specific documentation.
- **Standard**: To BS EN 61643-21.
- **Category**: Refer to project specific documentation.
- **Maximum continuous operating voltage (Uc)**: Refer to project specific documentation.
- **Mode of protection**: Lines to earth, lines to lines.
- **Rated current**: Refer to project specific documentation.
- **Voltage protection level (Up)**: Refer to project specific documentation.
- **Bandwidth**: Refer to project specific documentation.
- **Mounting arrangement**: Refer to project specific documentation.
- **Execution**: 90-60-30/620 Installing surge protective devices for telecommunications and signalling networks.

430 Surge protective devices for telecommunications and signalling networks type B

Used by: 75-45-20/110 Data distribution system.

- **Manufacturer**: Refer to project specific documentation.
- **Standard**: To BS EN 61643-21.
- **Category**: Refer to project specific documentation.
- **Maximum continuous operating voltage (Uc)**: Refer to project specific documentation.
- **Mode of protection**: Lines to earth, lines to lines.
- **Rated current**: Refer to project specific documentation.
- **Voltage protection level (Up)**: Refer to project specific documentation.
- **Bandwidth**: Refer to project specific documentation.
- **Mounting arrangement**: Refer to project specific documentation.

- **Execution**: 90-60-30/620 Installing surge protective devices for telecommunications and signalling networks.

Execution

610 Installing surge protective devices for low voltage power supplies

Shared by: 90-60-30/410 Surge protective devices for low voltage power supplies; type B; type C and type D; and 90-60-30/620 Installing surge protective devices for telecommunications and signalling networks.

- **Standards**: In accordance with BS 7671 and DD CLC/TS 61643-12.
- **Point of installation**:
- **Interconnecting cable**:
  - **Cable type**: Device manufacturer's standard.
  - **Cable size**: Device manufacturer's standard.
  - **Cable length (maximum)**: 500 mm.
  - **Cable installation**: Tightly bind connecting leads together.

620 Installing surge protective devices for telecommunications and signalling networks

Shared by: 90-60-30/410 Surge protective devices for low voltage power supplies type A; and 90-60-30/430 Surge protective devices for telecommunications and signalling networks; type A and type B.

- **Standards**: In accordance with BS 7671 and PD CLC/TS 61643-22.

Ω End of section

90-60-40 Inverters and power devices

Products

320 Inverters

Used by: 70-65-60/110 Grid connected photovoltaic system.

- **Standard**: In accordance with ENA G59/2-1 and In accordance with ENA G83/1-1.
- **Enclosure**:
  - **Material**:
  - **Ingress protection (minimum)**: To BS EN 60529, IP 65.
- **Input**:
  - **Voltage range**: 200–500 V d.c.
  - **Current (maximum)**: 32 A.
- **Output**:
  - **Nominal voltage**: 230 V and 400 V
  - **Nominal frequency**: 50 Hz.
  - **Voltage harmonic distortion**: < 4% with linear load.
  - **Overall efficiency (minimum)**: 93% at rated capacity.
  - **Maximum power point tracker (MPPT)**:
- **Topology**: Via integral transformer.

360 Automatic power factor correction equipment

Used by: 70-70-45/110 Low voltage distribution system type A.

- **Manufacturer**: Refer to project specific documentation.
- **Standards**: To BS EN 61439-1, BS EN 61439-2 and BS EN 61921.
- **Rated voltage**: Refer to project specific documentation.
- **Rated frequency**: Refer to project specific documentation.
- **Rated reactive power**: Refer to project specific documentation.
- **Rated short-time withstand current (Icw) for 1 s**: Refer to project specific documentation.
- **Capacitor banks**: Refer to project specific documentation.
- **Capacitor modules**:
  - **Standards**: To BS EN 60831-1, BS EN 60831-2.
  - **Elements**: Integral, dry, metallized dielectric, self-healing.
  - **Encapsulation**: Individual elements vacuum treated, encapsulated with thermosetting resin and sealed in within plastic case. Element array encased within sheet steel enclosure, filled with inorganic, inert and fire proof granules.
- **Enclosure**:
  - **Mounting arrangement**: Refer to project specific documentation.
  - **Ingress protection (minimum)**: Refer to project specific documentation.

  - **Impact protection (minimum)**: Refer to project specific documentation.
  - **Material**: Steel.
  - **Finish**: Externally polyester powder coated.
    Internal partitions, zinc coated.
  - **Colour**: Refer to project specific documentation.
  - **Incoming cabling access**: Refer to project specific documentation.
  - **Outgoing cable access**: Refer to project specific documentation.
  - **Cable entry**: Refer to project specific documentation.
  - **Lifting bolts**: Refer to project specific documentation.
- **Incoming device**:
  - **Type**: Refer to project specific documentation.
  - **Rated ultimate short-circuit breaking capacity (Icu)**: Refer to project specific documentation.
  - **Locking mechanism**: Door-interlocked operating handles.
  - **Mounting**: Front of panel.
- **Controls**:
  - **Functions**: Refer to project specific documentation.
  - **Display type**: Menu driven Liquid crystal display (LCD).
  - **Display the following information**: Required and actual power factors.
    Number of capacitor banks in use.
    Bank reconnection delay time.
    Real and reactive currents.
    Voltage THD.
    System alarms.
  - **Accuracy**: Within 1% of measured value.
  - **Operating modes**: On, off and automatic compensation.
  - **Undervoltage sensing**: Disconnects capacitor banks at pre-set adjustable undervoltage and upon supply failure.
  - **Alarms**: Refer to project specific documentation.
  - **Mounting**: Front of panel.
- **Remote monitoring**: Refer to project specific documentation.
- **Execution**: 90-60-40/610 Factory inspections of power factor correction equipment;
  90-60-40/620 Installing power factor correction equipment;
  and 90-60-40/630 Framework for mounting power factor correction equipment.

410 Uninterruptible power supply (UPS) unit type A

Used by: 70-70-45/110 Low voltage distribution system type A.

- **Manufacturer**: Refer to project specific documentation.
- **Standards**: To BS EN 62040-1 and BS EN 62040-3.
- **Test requirements**: Factory tests and Submit type test certificates.

- **Mode of operation**: Refer to project specific documentation.
- **Configuration**: Refer to project specific documentation.
- **Load compatibility**: Refer to project specific documentation.
- **Input**:
  - **Nominal voltage**: Refer to project specific documentation.
  - **Voltage tolerance**: ±10% at full load.
  - **Frequency**: Refer to project specific documentation.
  - **Power factor**: >0.98 at full load.
  - **Input current distortion (THDi)**: <3% at full load.
  - **Inrush current**: Limited by soft start to maximum In.
- **Maintenance bypass**: Refer to project specific documentation.
- **Integral bypass operation**:
  - **Automatic transfer of the load to the bypass source under the following conditions**:
    Inverter overload capacity exceeded;
    Inverter over temperature;
    and Fault condition.
  - **Re-transfer of the load from the bypass source**: Refer to project specific documentation.
- **Galvanic separation between input and output**: Required.
- **Inverter output**:
  - **Rated output apparent power**: Refer to project specific documentation.
  - **Nominal voltage**: Refer to project specific documentation.
  - **Voltage tolerance**: Refer to project specific documentation.
  - **Voltage waveform**: Sinusoidal in both normal and stored energy mode of operation.
  - **Voltage distortion**: Refer to project specific documentation.
  - **Nominal frequency**: Refer to project specific documentation.
  - **Frequency tolerance**: ±0.1% with internal reference (free running).
  - **Overload capability**: Refer to project specific documentation.
  - **Operation on overload**: Refer to project specific documentation.
  - **Output power factor (minimum)**: Refer to project specific documentation.
  - **Crest factor**: Refer to project specific documentation.
- **Batteries**:
  - **Location**: Refer to project specific documentation.
  - **Type**: Refer to project specific documentation.
  - **Voltage**: Refer to project specific documentation.
  - **Number of cells (minimum)**: Refer to project specific documentation.
  - **Battery autonomy (stored energy time at rated power)**: Refer to project specific documentation.
  - **Battery service life (minimum)**: Refer to project specific documentation.
  - **Battery design (minimum)**: Refer to project specific documentation.

- **Fused parallel battery strings**:
  - **Quantity (minimum)**: Refer to project specific documentation.
  - **Automatic disconnection of a faulty string**: Required.
- **Impact resistant plastic shields to intercell terminal and output terminals**: Required.
- **Battery supply d.c. circuit breaker with overload and short circuit protection**: Required.
- **Battery charger**: Manufacturer's standard.
- **Battery recharge time**:
  - **To 80% capacity**: Refer to project specific documentation.
  - **To 100% capacity**: Refer to project specific documentation.
- **Battery monitors**:
  - **Type**: Refer to project specific documentation.
  - **Features**: Refer to project specific documentation.

- **Controls, indicators and alarms**:
  - **Status indicators**:
    - **During normal operation (on-line) indicate the following with green LED**: Refer to project specific documentation.
    - **During mains failure indicate the following with green LED**: Refer to project specific documentation.
    - **During mains failure indicate the following with red LED**: Refer to project specific documentation.
  - **LCD display**:
    - **Display the following information**: Refer to project specific documentation.
  - **Event log**: Refer to project specific documentation.
- **Audible alarms**:
  - **Type**: Refer to project specific documentation.
  - **Activation and reset**: Activated by any fault condition. Continuous output until fault cleared or alarm silenced. Silencing of the alarm must not clear LED status indication.
- **Communications and signalling**: Refer to project specific documentation.
- **Enclosure**:
  - **Ingress protection (minimum)**: Refer to project specific documentation.
  - **Material and construction**:
    - **Type**: Refer to project specific documentation.
    - **Finish**: Refer to project specific documentation.
    - **Colour**: Refer to project specific documentation.
  - **Lockable access doors**: Refer to project specific documentation.
  - **Cable entry with removable gland plates**: Refer to project specific documentation.
  - **Ventilation arrangement**:
    - **Type**: Refer to project specific documentation.
    - **Fan failure alarms**: Refer to project specific documentation.
  - **Noise emission**:

Sound pressure level in normal mode (maximum): Refer to project specific documentation.
Sound pressure level in battery mode (maximum): Refer to project specific documentation.

- **Efficiency**:
  - **Overall (minimum)**: Refer to project specific documentation.
  - **Eco mode (minimum)**: 98% at 100% load through bypass.
- **Execution**: 90-60-40/670 Factory inspections of UPS equipment;
  90-60-40/680 Installation of UPS;
  90-60-40/690 Installing UPS batteries;
  and 90-60-40/700 Installing external maintenance bypass.

410 Uninterruptible power supply (UPS) unit type B

Used by: 70-70-75/110 Hard wired low voltage small power system.

- **Manufacturer**: Refer to project specific documentation.
- **Standards**: To BS EN 62040-1 and BS EN 62040-3.
- **Test requirements**: Factory tests and Submit type test certificates.
- **Mode of operation**: Refer to project specific documentation.
- **Configuration**: Refer to project specific documentation.
- **Load compatibility**: Refer to project specific documentation.
- **Input**:
  - **Nominal voltage**: Refer to project specific documentation.
  - **Voltage tolerance**: ±10% at full load.
  - **Frequency**: Refer to project specific documentation.
  - **Power factor**: >0.98 at full load.
  - **Input current distortion (THDi)**: <3% at full load.
  - **Inrush current**: Limited by soft start to maximum In.
- **Maintenance bypass**: Refer to project specific documentation.
- **Integral bypass operation**:
  - **Automatic transfer of the load to the bypass source under the following conditions**:
    Inverter overload capacity exceeded;
    Inverter over temperature;
    and Fault condition.
  - **Re-transfer of the load from the bypass source**: Refer to project specific documentation.
- **Galvanic separation between input and output**: Required.
- **Inverter output**:
  - **Rated output apparent power**: Refer to project specific documentation.
  - **Nominal voltage**: Refer to project specific documentation.
  - **Voltage tolerance**: Refer to project specific documentation.

- **Voltage waveform**: Sinusoidal in both normal and stored energy mode of operation.
- **Voltage distortion**: Refer to project specific documentation.
- **Nominal frequency**: Refer to project specific documentation.
- **Frequency tolerance**: ±0.1% with internal reference (free running).
- **Overload capability**: Refer to project specific documentation.
- **Operation on overload**: Refer to project specific documentation.
- **Output power factor (minimum)**: Refer to project specific documentation.
- **Crest factor**: Refer to project specific documentation.

- **Batteries**:
  - **Location**: Refer to project specific documentation.
  - **Type**: Refer to project specific documentation.
  - **Voltage**: Refer to project specific documentation.
  - **Number of cells (minimum)**: Refer to project specific documentation.
  - **Battery autonomy (stored energy time at rated power)**: Refer to project specific documentation.
  - **Battery service life (minimum)**: Refer to project specific documentation.
  - **Battery design (minimum)**: Refer to project specific documentation.
  - **Fused parallel battery strings**:

    Quantity (minimum): Refer to project specific documentation.

    Automatic disconnection of a faulty string: Required.
  - **Impact resistant plastic shields to intercell terminal and output terminals**: Required.
  - **Battery supply d.c. circuit breaker with overload and short circuit protection**: Required.
  - **Battery charger**: Manufacturer's standard.
  - **Battery recharge time**:

    To 80% capacity: Refer to project specific documentation.

    To 100% capacity: Refer to project specific documentation.
  - **Battery monitors**:

    Type: Refer to project specific documentation.

    Features: Refer to project specific documentation.

- **Controls, indicators and alarms**:
  - **Status indicators**:

    During normal operation (on-line) indicate the following with green LED: Refer to project specific documentation.

    During mains failure indicate the following with green LED: Refer to project specific documentation.

    During mains failure indicate the following with red LED: Refer to project specific documentation.
  - **LCD display**:

    Display the following information: Refer to project specific documentation.
  - **Event log**: Refer to project specific documentation.

- **Audible alarms**:
  - **Type**: Refer to project specific documentation.
  - **Activation and reset**: Activated by any fault condition. Continuous output until fault cleared or alarm silenced. Silencing of the alarm must not clear LED status indication.
- **Communications and signalling**: Refer to project specific documentation.
- **Enclosure**:
  - **Ingress protection (minimum)**: Refer to project specific documentation.
  - **Material and construction**:
    Type: Refer to project specific documentation.
    Finish: Refer to project specific documentation.
    Colour: Refer to project specific documentation.
  - **Lockable access doors**: Refer to project specific documentation.
  - **Cable entry with removable gland plates**: Refer to project specific documentation.
  - **Ventilation arrangement**:
    Type: Refer to project specific documentation.
    Fan failure alarms: Refer to project specific documentation.
  - **Noise emission**:
    Sound pressure level in normal mode (maximum): Refer to project specific documentation.
    Sound pressure level in battery mode (maximum): Refer to project specific documentation.
- **Efficiency**:
  - **Overall (minimum)**: Refer to project specific documentation.
  - **Eco mode (minimum)**: 98% at 100% load through bypass.
- **Execution**: 90-60-40/670 Factory inspections of UPS equipment;
  90-60-40/680 Installation of UPS;
  and 90-60-40/690 Installing UPS batteries.

420 Uninterruptible power supply (UPS) remote alarm and indicator panels type A

Used by: 70-70-45/110 Low voltage distribution system type A.

- **Manufacturer**: Refer to project specific documentation.
- **Status indicators**:
  - **During normal operation (on-line) indicate the following with green LED**: UPS on line.
  - **During mains failure indicate the following with green LED**: Refer to project specific documentation.
  - **During mains failure indicate the following with red LED**: Refer to project specific documentation.
  - **Display the following information**: Refer to project specific documentation.
- **Audible alarms**:
  - **Type**: Integral alarm providing minimum 65 dBA at 1 m.

  - **Activation and reset**: Activated by any fault condition. Continuous output until fault cleared or alarm silenced. Silencing of the alarm must not clear LED status indication.
- **Power supply**: Refer to project specific documentation.
- **Mounting**: Refer to project specific documentation.
- **Execution**: 90-60-40/710 Installing UPS remote alarm and indicator panels type A.

420 Uninterruptible power supply (UPS) remote alarm and indicator panels type B

Used by: 70-70-75/110 Hard wired low voltage small power system.

- **Manufacturer**: Refer to project specific documentation.
- **Status indicators**:
  - **During normal operation (on-line) indicate the following with green LED**: UPS on line.
  - **During mains failure indicate the following with green LED**: Refer to project specific documentation.
  - **During mains failure indicate the following with red LED**: Refer to project specific documentation.
  - **Display the following information**: Refer to project specific documentation.
- **Audible alarms**:
  - **Type**: Integral alarm providing minimum 65 dBA at 1 m.
  - **Activation and reset**: Activated by any fault condition. Continuous output until fault cleared or alarm silenced. Silencing of the alarm must not clear LED status indication.
- **Power supply**: Refer to project specific documentation.
- **Mounting**: Refer to project specific documentation.
- **Execution**: 90-60-40/710 Installing UPS remote alarm and indicator panels type B.

440 Static inverter power supply units type A

Used by: 70-80-35/110 Hard wired general lighting system.

- **Manufacturer**: Refer to project specific documentation.
- **Standard**: To BS EN 50171.
- **Third party certification**: ICEL 1009.
- **Mode of operation**: Refer to project specific documentation.
- **Integral maintenance bypass**: Refer to project specific documentation.
- **Input**:
  - **Nominal voltage**: Refer to project specific documentation.
  - **Nominal frequency**: Refer to project specific documentation.
- **Battery charger**:
  - **Type**: Refer to project specific documentation.
  - **Battery recharge time**: To 80% capacity within 12 hours and 100% capacity within 24 hours.
- **Change over contactor**: To BS 764.
- **Inverter output**:

- **Load compatibility**: Suitable for use with loads operating at any power factor, leading or lagging up to 0.9.
- **Rated output apparent power**: Refer to project specific documentation.
- **Nominal voltage**: Refer to project specific documentation.
- **Voltage waveform**: Sinusoidal.
- **Voltage harmonic distortion**: Refer to project specific documentation.
- **Nominal frequency**: Refer to project specific documentation.

- **Controls, indicators and alarms**:
  - **Status indicators**:

    Indicate the following with green LED: a.c. mains input to battery charger and a.c. mains output to maintained lighting circuit.

    Indicate the following with amber LED: Boost charge;
    Float charge;
    Inverter running;
    Low battery voltage;
    and High battery voltage.

    Indicate the following with red LED: Battery charger failure;
    Deep discharge protection activated;
    Earth leakage from battery;
    Inverter overload;
    and Mains failure.
  - **LCD display**:

    Display the following information: Battery voltage and Charge/ Discharge current.
  - **Event log**: Record up to 64 fault occurrences including time and date for each occurrence. Provide user access to event log through LCD display.
- **Audible alarms**:
  - **Type**: Integral alarm within central battery enclosure providing minimum 65 dBA at 1 m.
  - **Activation and reset**: Activated by any fault condition. Continuous output until fault cleared or alarm silenced. Silencing of the alarm must not clear LED status indication.
- **Common fault relay contact**: Refer to project specific documentation.
- **Enclosure**:
  - **Mounting arrangement**: Refer to project specific documentation.
  - **Ingress protection (minimum)**: Refer to project specific documentation.
  - **Material and construction**:

    Type: Manufacturer's standard.
    Finish: Epoxy powder coated.
    Colour: Manufacturer's standard.
  - **Lockable access doors**: Required.
  - **Cable entry**: Removable gland plates, for top entry cables and Removable gland plates for bottom entry cables.

  - **Ventilation arrangement**: Forced ventilation fans during emergency mode and Naturally ventilated during stand-by mode.
  - **Fan failure alarms**: Required.
  - **Noise emission**:

    Sound pressure level in normal mode (maximum): 55 dBA at 1 m.

    Sound pressure level in battery mode (maximum): 60 dBA at 1 m.
- **System efficiency (minimum)**: 85%.
- **Battery**:
  - **Type**: Refer to project specific documentation.
  - **Labelling**: Refer to project specific documentation.
- **Accessories**: Refer to project specific documentation.

440 Static inverter power supply units type B

Used by: 70-80-35/120 General lighting systems with prefabricated wiring.

- **Manufacturer**: Refer to project specific documentation.
- **Standard**: To BS EN 50171.
- **Third party certification**: ICEL 1009.
- **Mode of operation**: Refer to project specific documentation.
- **Integral maintenance bypass**: Refer to project specific documentation.
- **Input**:
  - **Nominal voltage**: Refer to project specific documentation.
  - **Nominal frequency**: Refer to project specific documentation.
- **Battery charger**:
  - **Type**: Refer to project specific documentation.
  - **Battery recharge time**: To 80% capacity within 12 hours and 100% capacity within 24 hours.
- **Change over contactor**: To BS 764.
- **Inverter output**:
  - **Load compatibility**: Suitable for use with loads operating at any power factor, leading or lagging up to 0.9.
  - **Rated output apparent power**: Refer to project specific documentation.
  - **Nominal voltage**: Refer to project specific documentation.
  - **Voltage waveform**: Sinusoidal.
  - **Voltage harmonic distortion**: Refer to project specific documentation.
  - **Nominal frequency**: Refer to project specific documentation.
- **Controls, indicators and alarms**:
  - **Status indicators**:

    Indicate the following with green LED: a.c. mains input to battery charger and a.c. mains output to maintained lighting circuit.

    Indicate the following with amber LED: Boost charge;

Float charge;
Inverter running;
Low battery voltage;
and High battery voltage.
Indicate the following with red LED: Battery charger failure;
Deep discharge protection activated;
Earth leakage from battery;
Inverter overload;
and Mains failure.

- **LCD display**:
  Display the following information: Battery voltage and Charge/ Discharge current.
- **Event log**: Record up to 64 fault occurrences including time and date for each occurrence. Provide user access to event log through LCD display.

- **Audible alarms**:
  - **Type**: Integral alarm within central battery enclosure providing minimum 65 dBA at 1 m.
  - **Activation and reset**: Activated by any fault condition. Continuous output until fault cleared or alarm silenced. Silencing of the alarm must not clear LED status indication.
- **Common fault relay contact**: Refer to project specific documentation.
- **Enclosure**:
  - **Mounting arrangement**: Refer to project specific documentation.
  - **Ingress protection (minimum)**: Refer to project specific documentation.
  - **Material and construction**:
    Type: Manufacturer's standard.
    Finish: Epoxy powder coated.
    Colour: Manufacturer's standard.
  - **Lockable access doors**: Required.
  - **Cable entry**: Removable gland plates, for top entry cables and Removable gland plates for bottom entry cables.
  - **Ventilation arrangement**: Forced ventilation fans during emergency mode and Naturally ventilated during stand-by mode.
  - **Fan failure alarms**: Required.
  - **Noise emission**:
    Sound pressure level in normal mode (maximum): 55 dBA at 1 m.
    Sound pressure level in battery mode (maximum): 60 dBA at 1 m.
- **System efficiency (minimum)**: 85%.
- **Battery**:
  - **Type**: Refer to project specific documentation.
  - **Labelling**: Refer to project specific documentation.
- **Accessories**: Refer to project specific documentation.

Execution

610 Factory inspections of power factor correction equipment

Used by: 90-60-40/360 Automatic power factor correction equipment.

- **Notice before inspection and testing**: Seven days.
- **Witnessing**: Arrange for factory testing to be witnessed by the contract administrator and one colleague.
- **Scope**: Factory test power factor correction equipment before delivery to site.
- **Tests**: Routine capacitor production tests, including short-time overvoltage, capacitance, leak, and dissipation-factor tests.
- **Operations, controls, indicators, sensors, and protective devices**: Functional test.
- **Test equipment calibration certificates**: Submit.
- **Test report**: Submit.

620 Installing power factor correction equipment

Used by: 90-60-40/360 Automatic power factor correction equipment.

- **Standard**: In accordance with BS 7671.
- **Transportation, off-load and installation**: Submit method statement.
- **Weight limit**: Refer to project specific documentation.
- **Assembly**: Replace fittings removed for transport.
- **Separate enclosures**: Arrange in modular form to facilitate future extension.
- **Clearance (minimum)**: Refer to project specific documentation.
- **Fixing equipment**: Fix independently of wiring installation with zinc electroplated fasteners.
- **Indoor equipment**: Fix with internal lugs.
- **Outdoor equipment**: Fix with external lugs.
- **Extension boxes**: Provide where necessary.
- **Gland plates**: Non-ferrous for single core cables.
- **Interconnection with close coupled switchgear**:
  - **Cable type**: Refer to project specific documentation.
  - **Cable size**: Refer to project specific documentation.
  - **Containment**: Refer to project specific documentation.
- **Remote monitoring**: Connect to central controls and BMS.

630 Framework for mounting power factor correction equipment

Used by: 90-60-40/360 Automatic power factor correction equipment.

- **Material**: Match main switchgear;
  Metal channel to BS 6946;
  and Carbon steel plate, strip and sections to BS 1449-1-1.
- **Finish**: Hot dip galvanized.
- **Arrangement and fixings**: Submit proposals.

670 Factory inspections of UPS equipment

Shared by: 90-60-40/410 Uninterruptible power supply (UPS) unit; type A and type B.

- **Notice before inspection and testing**: Seven days.
- **Witnessing**: Arrange for factory testing to be witnessed by the contract administrator and one colleague.
- **Scope**: Factory test UPS equipment before delivery to site.
- **Tests**:
  - **Standard**: To BS EN 62040-3.
  - **Routine tests**: Undertake.
  - **Special tests**: Balanced load test;
    Efficiency test;
    Harmonic components test;
    Input voltage and frequency test;
    and Inrush current test.
- **Test equipment calibration certificates**: Submit.
- **Test report**: Submit.

680 Installation of UPS

Shared by: 90-60-40/410 Uninterruptible power supply (UPS) unit; type A and type B.

- **Standard**: In accordance with BS 7671.
- **Transportation, off-load and installation**: Submit method statement.
- **Weight limit**: Refer to project specific documentation.
- **Assembly**: Replace fittings removed for transport.
- **UPS units**: Interconnect.
- **UPS controls and batteries**: Interconnect.
- **Identification labels**: Refer to project specific documentation.

690 Installing UPS batteries

Shared by: 90-60-40/410 Uninterruptible power supply (UPS) unit; type A and type B.

- **Position**: Refer to project specific documentation.
- **Batteries**: Interconnect individual cells.
- **Battery circuit breaker**: Interconnect with UPS units and batteries.

700 Installing external maintenance bypass

Used by: 90-60-40/410 Uninterruptible power supply (UPS) unit type A.

- **Position**: Refer to project specific documentation.
- **Interconnection**: Interconnect with UPS, mains supply and load.
- **Arrangement**: Refer to project specific documentation.

710 Installing UPS remote alarm and indicator panels type A

Used by: 90-60-40/420 Uninterruptible power supply (UPS) remote alarm and indicator panels type A.

- **Position**: Refer to project specific documentation.
- **Equipment interconnection**: Connect to UPS unit.
- **Interface**: With central controls and building management system.

710 Installing UPS remote alarm and indicator panels type B

Used by: 90-60-40/420 Uninterruptible power supply (UPS) remote alarm and indicator panels type B.

- **Position**:
- **Equipment interconnection**:
- **Interface**:

Ω End of section

90-60-50 Luminaires and lamps

Products

365 Bayonet lampholders

Used by: 70-80-35/110 Hard wired general lighting system.

- **Manufacturer**: Refer to project specific documentation.
- **Standard**: To BS EN 61184.
- **Arrangement**: 2-pin.
- **Material**: Refer to project specific documentation.
- **Protective skirt**: Required.
- **Mounting**: Refer to project specific documentation.

370 Edison screw lampholders

Used by: 70-80-35/110 Hard wired general lighting system.

- **Manufacturer**: Refer to project specific documentation.
- **Standard**: To BS EN 60238.
- **Material**: Refer to project specific documentation.
- **Protective skirt**: Required.
- **Mounting**: Refer to project specific documentation.

405 General purpose luminaires type A

Used by: 70-80-25/110 Roadway lighting system.

- **General requirements**: 90-60-50/440 Control gear generally.
- **Manufacturer**: Refer to Schedule of Manufacturers
- **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 60598-2-18;
  To BS EN 60598-2-23;
  and To BS EN 60598-2-25.
- **Electric shock classification**: Refer to project specific documentation.
- **Photometric performance**: To BS EN 13032-1.
- **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.
- **Luminaire type**: Refer to Luminaire Schedule
- **Features**: Refer to Luminaire Schedule
- **Ingress protection (minimum)**: Refer to Luminaire Schedule
- **Ballasts CELMA energy efficiency index (minimum)**: A1, A2 For interior lighting solution and B1 for external lighting solutions.
- **Control gear position**: Refer to project specific documentation.
- **Lamps**:
  - **Number**: Refer to Luminaire Schedule
  - **Type**: Refer to Luminaire Schedule
  - **Colour temperature**: Refer to Luminaire Schedule
  - **Colour rendering index**: Refer to project specific documentation.
  - **Rating**: Refer to Luminaire Schedule
- **Execution**: 90-60-50/610 Luminaire samples;
  90-60-50/620 Installing luminaires and lamps generally;
  90-60-50/630 Luminaire cable connections;
  90-60-50/640 Luminaires mounted as part of a suspended ceiling;
  90-60-50/660 Installing extra low voltage luminaires;
  90-60-50/670 Installing controlgear;
  and 90-60-50/690 Installing luminaire supports.

405 General purpose luminaires type B

Used by: 70-80-25/120 Amenity lighting system.

- **General requirements**: 90-60-50/440 Control gear generally.
- **Manufacturer**: Refer to Schedule of Manufacturers
- **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 60598-2-18;
  To BS EN 60598-2-23;
  and To BS EN 60598-2-25.
- **Electric shock classification**: Refer to project specific documentation.
- **Photometric performance**: To BS EN 13032-1.
- **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.
- **Luminaire type**: Refer to Luminaire Schedule
- **Features**: Refer to Luminaire Schedule
- **Ingress protection (minimum)**: Refer to Luminaire Schedule
- **Ballasts CELMA energy efficiency index (minimum)**: A1, A2 For interior lighting solution and B1 for external lighting solutions.
- **Control gear position**: Refer to project specific documentation.
- **Lamps**:
  - **Number**: Refer to Luminaire Schedule
  - **Type**: Refer to Luminaire Schedule
  - **Colour temperature**: Refer to Luminaire Schedule
  - **Colour rendering index**: Refer to project specific documentation.
  - **Rating**: Refer to Luminaire Schedule
- **Execution**: 90-60-50/610 Luminaire samples;
  90-60-50/620 Installing luminaires and lamps generally;
  90-60-50/630 Luminaire cable connections;
  90-60-50/640 Luminaires mounted as part of a suspended ceiling;
  90-60-50/660 Installing extra low voltage luminaires;
  90-60-50/670 Installing controlgear;
  and 90-60-50/690 Installing luminaire supports.

405 General purpose luminaires type C

Used by: 70-80-35/110 Hard wired general lighting system.

- **General requirements**: 90-60-50/440 Control gear generally.
- **Manufacturer**: Refer to Schedule of Manufacturers
- **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 60598-2-18;
  To BS EN 60598-2-23;
  and To BS EN 60598-2-25.
- **Electric shock classification**: Refer to project specific documentation.
- **Photometric performance**: To BS EN 13032-1.
- **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.
- **Luminaire type**: Refer to Luminaire Schedule
- **Features**: Refer to Luminaire Schedule
- **Ingress protection (minimum)**: Refer to Luminaire Schedule
- **Ballasts CELMA energy efficiency index (minimum)**: A1, A2 For interior lighting solution and B1 for external lighting solutions.
- **Control gear position**: Refer to project specific documentation.
- **Lamps**:
  - **Number**: Refer to Luminaire Schedule
  - **Type**: Refer to Luminaire Schedule
  - **Colour temperature**: Refer to Luminaire Schedule
  - **Colour rendering index**: Refer to project specific documentation.
  - **Rating**: Refer to Luminaire Schedule
- **Execution**: 90-60-50/610 Luminaire samples;
  90-60-50/620 Installing luminaires and lamps generally;
  90-60-50/630 Luminaire cable connections;
  90-60-50/640 Luminaires mounted as part of a suspended ceiling;
  90-60-50/660 Installing extra low voltage luminaires;
  90-60-50/670 Installing controlgear;
  and 90-60-50/690 Installing luminaire supports.

405 General purpose luminaires type D

Used by: 70-80-35/120 General lighting systems with prefabricated wiring.

- **General requirements**: 90-60-50/440 Control gear generally.
- **Manufacturer**: Refer to Schedule of Manufacturers
- **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 60598-2-18;
  To BS EN 60598-2-23;
  and To BS EN 60598-2-25.
- **Electric shock classification**: Refer to project specific documentation.
- **Photometric performance**: To BS EN 13032-1.
- **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.
- **Luminaire type**: Refer to Luminaire Schedule
- **Features**: Refer to Luminaire Schedule
- **Ingress protection (minimum)**: Refer to Luminaire Schedule
- **Ballasts CELMA energy efficiency index (minimum)**: A1, A2 For interior lighting solution and B1 for external lighting solutions.
- **Control gear position**: Refer to project specific documentation.
- **Lamps**:
  - **Number**: Refer to Luminaire Schedule
  - **Type**: Refer to Luminaire Schedule
  - **Colour temperature**: Refer to Luminaire Schedule
  - **Colour rendering index**: Refer to project specific documentation.
  - **Rating**: Refer to Luminaire Schedule
- **Execution**: 90-60-50/610 Luminaire samples;
  90-60-50/620 Installing luminaires and lamps generally;
  90-60-50/630 Luminaire cable connections;
  90-60-50/640 Luminaires mounted as part of a suspended ceiling;
  90-60-50/660 Installing extra low voltage luminaires;
  90-60-50/670 Installing controlgear;
  and 90-60-50/690 Installing luminaire supports.

405 General purpose luminaires type E

Used by: 70-80-90/110 Underwater lighting system.

- **General requirements**: 90-60-50/440 Control gear generally.
- **Manufacturer**: Refer to Schedule of Manufacturers
- **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 60598-2-18;
  To BS EN 60598-2-23;
  and To BS EN 60598-2-25.
- **Electric shock classification**: Refer to project specific documentation.
- **Photometric performance**: To BS EN 13032-1.
- **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.
- **Luminaire type**: Refer to Luminaire Schedule
- **Features**: Refer to Luminaire Schedule
- **Ingress protection (minimum)**: Refer to Luminaire Schedule
- **Ballasts CELMA energy efficiency index (minimum)**: A1, A2 For interior lighting solution and B1 for external lighting solutions.
- **Control gear position**: Refer to project specific documentation.
- **Lamps**:
  - **Number**: Refer to Luminaire Schedule
  - **Type**: Refer to Luminaire Schedule
  - **Colour temperature**: Refer to Luminaire Schedule
  - **Colour rendering index**: Refer to project specific documentation.
  - **Rating**: Refer to Luminaire Schedule
- **Execution**: 90-60-50/610 Luminaire samples;
  90-60-50/620 Installing luminaires and lamps generally;
  90-60-50/630 Luminaire cable connections;
  90-60-50/640 Luminaires mounted as part of a suspended ceiling;
  90-60-50/660 Installing extra low voltage luminaires;
  90-60-50/670 Installing controlgear;
  and 90-60-50/690 Installing luminaire supports.

410 Combined emergency luminaires type A

Used by: 70-80-35/110 Hard wired general lighting system.

- **General requirements**: 90-60-50/440 Control gear generally.
- **Manufacturer**: Refer to Schedule of Manufacturers
- **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 60598-2-13;
  and To BS EN 60598-2-25.
- **Third party certification**: ICEL 1001.
- **Electric shock classification**: Refer to project specific documentation.
- **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 from normal supply**: 230 V a.c.
- **Input voltage from emergency supply**: Refer to project specific documentation.
- **Luminaire power factor**: Correct to minimum 0.9 lagging.

- **Luminaire type**: Refer to Luminaire Schedule
- **Features**: Refer to project specific documentation.
- **Ingress protection (minimum)**: Refer to Luminaire Schedule
- **Ballasts CELMA energy efficiency index (minimum)**: A1 or A2 for interior lighting and B1 for exterior lighting.
- **Control gear position**: Refer to project specific documentation.
- **Indicators**:
  - **Charging**: Green light emitting diodes.
  - **Fault**: Flashing red light emitting diodes.
  - **Position within luminaire**: Readily visible. Fix to luminaire body.
- **Primary lamps**:
  - **Number**: Refer to project specific documentation.
  - **Type**: Refer to project specific documentation.
  - **Colour temperature**: Refer to project specific documentation.
  - **Colour rendering index**: Refer to project specific documentation.
  - **Rating**: Refer to project specific documentation.
- **Secondary lamps**:
  - **Number**: Refer to project specific documentation.
  - **Type**: Refer to project specific documentation.
  - **Colour temperature**: Refer to project specific documentation.
  - **Colour rendering index**: Refer to project specific documentation.
  - **Rating**: Refer to project specific documentation.
- **Accessories**: Refer to project specific documentation.
- **Execution**: 90-60-50/610 Luminaire samples;
  90-60-50/620 Installing luminaires and lamps generally;
  90-60-50/630 Luminaire cable connections;
  90-60-50/640 Luminaires mounted as part of a suspended ceiling;
  90-60-50/660 Installing extra low voltage luminaires;
  90-60-50/670 Installing controlgear;
  and 90-60-50/690 Installing luminaire supports.

410 Combined emergency luminaires type B

Used by: 70-80-35/120 General lighting systems with prefabricated wiring.

- **General requirements**: 90-60-50/440 Control gear generally.
- **Manufacturer**: Refer to Schedule of Manufacturers
- **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 60598-2-13;

and To BS EN 60598-2-25.

- **Third party certification**: ICEL 1001.
- **Electric shock classification**: Refer to project specific documentation.
- **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 from normal supply**: 230 V a.c.
- **Input voltage from emergency supply**: Refer to project specific documentation.
- **Luminaire power factor**: Correct to minimum 0.9 lagging.
- **Luminaire type**: Refer to Luminaire Schedule
- **Features**: Refer to project specific documentation.
- **Ingress protection (minimum)**: Refer to Luminaire Schedule
- **Ballasts CELMA energy efficiency index (minimum)**: A1 or A2 for interior lighting and B1 for exterior lighting.
- **Control gear position**: Manufacturer's standard.
- **Indicators**:
  - **Charging**: Green light emitting diodes.
  - **Fault**: Flashing red light emitting diodes.
  - **Position within luminaire**: Readily visible. Fix to luminaire body.
- **Primary lamps**:
  - **Number**: Refer to project specific documentation.
  - **Type**: Refer to project specific documentation.
  - **Colour temperature**: Refer to project specific documentation.
  - **Colour rendering index**: Refer to project specific documentation.
  - **Rating**: Refer to project specific documentation.
- **Secondary lamps**:
  - **Number**: Refer to project specific documentation.
  - **Type**: Refer to project specific documentation.
  - **Colour temperature**: Refer to project specific documentation.
  - **Colour rendering index**: Refer to project specific documentation.
  - **Rating**: Refer to project specific documentation.
- **Accessories**: Refer to project specific documentation.
- **Execution**: 90-60-50/610 Luminaire samples;
  90-60-50/620 Installing luminaires and lamps generally;
  90-60-50/630 Luminaire cable connections;
  90-60-50/640 Luminaires mounted as part of a suspended ceiling;
  90-60-50/660 Installing extra low voltage luminaires;
  90-60-50/670 Installing controlgear;
  and 90-60-50/690 Installing luminaire supports.

410 Combined emergency luminaires type C

Used by: 70-80-35/130 Central battery supplied emergency lighting system.

- **General requirements**: 90-60-50/440 Control gear generally.
- **Manufacturer**: Refer to Schedule of Manufacturers
- **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 60598-2-13;
  and To BS EN 60598-2-25.
- **Third party certification**: ICEL 1001.
- **Electric shock classification**: Refer to project specific documentation.
- **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 from normal supply**: 230 V a.c.
- **Input voltage from emergency supply**: Refer to project specific documentation.
- **Luminaire power factor**: Correct to minimum 0.9 lagging.
- **Luminaire type**: Refer to Luminaire Schedule
- **Features**: Refer to project specific documentation.
- **Ingress protection (minimum)**: Refer to Luminaire Schedule
- **Ballasts CELMA energy efficiency index (minimum)**: A1 or A2 for interior lighting and B1 for exterior lighting.
- **Control gear position**: Refer to project specific documentation.
- **Indicators**:
  - **Charging**: Green light emitting diodes.
  - **Fault**: Flashing red light emitting diodes.
  - **Position within luminaire**: Readily visible. Fix to luminaire body.
- **Primary lamps**:
  - **Number**: Refer to project specific documentation.
  - **Type**: Refer to project specific documentation.
  - **Colour temperature**: Refer to project specific documentation.
  - **Colour rendering index**: Refer to project specific documentation.
  - **Rating**: Refer to project specific documentation.
- **Secondary lamps**:
  - **Number**: Refer to project specific documentation.
  - **Type**: Refer to project specific documentation.
  - **Colour temperature**: Refer to project specific documentation.
  - **Colour rendering index**: Refer to project specific documentation.
  - **Rating**: Refer to project specific documentation.

- **Accessories**: Refer to project specific documentation.
- **Execution**: 90-60-50/610 Luminaire samples;
  90-60-50/620 Installing luminaires and lamps generally;
  90-60-50/630 Luminaire cable connections;
  90-60-50/640 Luminaires mounted as part of a suspended ceiling;
  90-60-50/660 Installing extra low voltage luminaires;
  90-60-50/670 Installing controlgear;
  and 90-60-50/690 Installing luminaire supports.

430 Lighting tracks type A

Used by: 70-80-35/110 Hard wired general lighting system.

- **Manufacturer**: Refer to project specific documentation.
- **Standard**: To BS EN 60570.
- **Number of ways**: Refer to project specific documentation.
- **Class**: Refer to project specific documentation.
- **Conductor rating**: Refer to project specific documentation.
- **Housing material**: Refer to project specific documentation.
- **Mounting**: Refer to project specific documentation.
- **Execution**: 90-60-50/650 Installing lighting track.

430 Lighting tracks type B

Used by: 70-80-35/120 General lighting systems with prefabricated wiring.

- **Manufacturer**: Refer to project specific documentation.
- **Standard**: To BS EN 60570.
- **Number of ways**: Refer to project specific documentation.
- **Class**: Refer to project specific documentation.
- **Conductor rating**: Refer to project specific documentation.
- **Housing material**: Refer to project specific documentation.
- **Mounting**: Refer to project specific documentation.
- **Execution**:

430 Lighting tracks type C

Used by: 70-80-35/130 Central battery supplied emergency lighting system.

- **Manufacturer**: Refer to project specific documentation.
- **Standard**: To BS EN 60570.
- **Number of ways**: Refer to project specific documentation.
- **Class**: Refer to project specific documentation.
- **Conductor rating**: Refer to project specific documentation.
- **Housing material**: Refer to project specific documentation.
- **Mounting**: Refer to project specific documentation.

- **Execution**: 90-60-50/650 Installing lighting track.

440 Control gear generally

Shared by: 90-60-50/405 General purpose luminaires; type A; type B; type C; type D and type E; and 90-60-50/410 Combined emergency luminaires; type A; type B and type C.

- **Third party certification**: ENEC.
- **Ballasts**:
  - **For fluorescent lamps**: To BS EN 60921, BS EN 61347-1 and BS EN 61347-2-8.
  - **For discharge lamps**: To BS EN 60923, BS EN 61347-1 and BS EN 61347-2-9.
- **Lamp starters generally**: To BS EN 60927, BS EN 61347-1 and BS EN 61347-2-1.
- **Electronic control gear**:
  - **For fluorescent lamps**: To BS EN 60929, BS EN 61347-1 and BS EN 61347-2-3.
  - **For battery supplied self-contained emergency lighting**: To BS EN 61347-1 and BS EN 61347-2-7.
  - **For discharge lamps**: To BS EN 61347-1 and BS EN 61347-2-12.
  - **For LED modules**: To BS EN 61347-1 and BS EN 61347-2-13 and BS EN 62384.
- **Digital addressable control gear**:
  - **For digital addressable fluorescent lamps**: To BS EN 62386-102 and BS EN 62386-201.
  - **For digital addressable self-contained emergency lighting**: To BS EN 62386-102 and BS EN 62386-202.
  - **For digital addressable high intensity discharge lamps**: To BS EN 62386-102 and BS EN 62386-203.
  - **For digital addressable low voltage halogen lamps**: To BS EN 62386-102 and BS EN 62386-204.
  - **For digital addressable incandescent lamps**: To BS EN 62386-102 and BS EN 62386-205.
  - **For digital addressable LED modules**: To BS EN 62386-102 and BS EN 62386-207.

455 Luminaire smoke hoods type A

Used by: 70-80-35/110 Hard wired general lighting system.

- **Manufacturer**: Refer to project specific documentation.
- **Standard**: To BS 476-21.
- **Smoke hoods and blankets**: Match fire performance of building fabric.
- **Execution**: 90-60-50/695 Installing smoke hoods.

455 Luminaire smoke hoods type B

Used by: 70-80-35/120 General lighting systems with prefabricated wiring.

- **Manufacturer**: Refer to project specific documentation.
- **Standard**: To BS 476-21.
- **Smoke hoods and blankets**: Match fire performance of building fabric.
- **Execution**: 90-60-50/695 Installing smoke hoods.

455 Luminaire smoke hoods type C

Used by: 70-80-35/130 Central battery supplied emergency lighting system.

- **Manufacturer**: Refer to project specific documentation.
- **Standard**: To BS 476-21.
- **Smoke hoods and blankets**: Match fire performance of building fabric.
- **Execution**: Refer to project specific documentation.

470 Separated extra-low voltage lighting transformers type A

Used by: 70-80-25/120 Amenity lighting system.

- **Manufacturer**: Refer to project specific documentation.
- **Standards**: BS EN 61558.
- **Format**: Refer to project specific documentation.
- **Power rating**: Refer to project specific documentation.
- **Output**:
  - **Voltage**: 12 V a.c.
  - **Connections**: Manufacturer's standard.
  - **Constant secondary voltage**: Maintain irrespective of load.
- **Luminaire connections**: Refer to project specific documentation.
- **Degree of ingress protection (minimum)**: Refer to project specific documentation.

470 Separated extra-low voltage lighting transformers type B

Used by: 70-80-35/110 Hard wired general lighting system.

- **Manufacturer**: Refer to project specific documentation.
- **Standards**: BS EN 61558.
- **Format**: Refer to project specific documentation.
- **Power rating**: Refer to project specific documentation.
- **Output**:
  - **Voltage**: 12 V a.c.
  - **Connections**: Manufacturer's standard.
  - **Constant secondary voltage**: Maintain irrespective of load.
- **Luminaire connections**: Refer to project specific documentation.
- **Degree of ingress protection (minimum)**: Refer to project specific documentation.

470 Separated extra-low voltage lighting transformers type C

Used by: 70-80-35/120 General lighting systems with prefabricated wiring.

- **Manufacturer**: Refer to project specific documentation.
- **Standards**: BS EN 61558.
- **Format**: Refer to project specific documentation.
- **Power rating**: Refer to project specific documentation.

- **Output**:
  - **Voltage**: 12 V a.c.
  - **Connections**: Manufacturer's standard.
  - **Constant secondary voltage**: Maintain irrespective of load.
- **Luminaire connections**: Refer to project specific documentation.
- **Degree of ingress protection (minimum)**: Refer to project specific documentation.

Execution

610 Luminaire samples

Shared by: 90-60-50/405 General purpose luminaires; type A; type B; type C; type D and type E; and 90-60-50/410 Combined emergency luminaires; type A; type B and type C.

- **Sample luminaires**: Refer to project specific documentation.
- **Submittals**: Include manufacturer's technical information with each sample.
- **Identification**: Label samples with the luminaire references.

620 Installing luminaires and lamps generally

Shared by: 90-60-50/405 General purpose luminaires; type A; type B; type C; type D and type E; and 90-60-50/410 Combined emergency luminaires; type A; type B and type C.

- **Orientation**: Linear luminaires to be installed parallel with ceiling.
- **Lamps and accessories**: Provide.
- **Supports**: Adequate for weight of luminaire.

630 Luminaire cable connections

Shared by: 90-60-50/405 General purpose luminaires; type A; type B; type C; type D and type E; and 90-60-50/410 Combined emergency luminaires; type A; type B and type C.

- **Cable connection size (minimum)**: Refer to project specific documentation.
- **Connection of luminaire supporting couplers**:
  - **General luminaires**: White plug with white cover.
  - **Flex length (maximum)**: Refer to project specific documentation.
- **Conduit mounted**:
  - **Final connection**: Refer to project specific documentation.
  - **Cable type**: Refer to project specific documentation.
- **Trunking mounted**:
  - **Final connection**: Refer to project specific documentation.
  - **Cable type**: Refer to project specific documentation.
- **Suspended trunking**:
  - **Final connection**: Refer to project specific documentation.
  - **Mounting arrangement**: From cable connection on side of trunking.
  - **Cable type**: Refer to project specific documentation.

- **Rod or chain suspended**:
  - **Final connection**: Refer to project specific documentation.
  - **Cable type**: Refer to project specific documentation.
  - **Connection arrangement**: Clipped to chain or rod. Do not pass cord through chain links.
- **Cable entry**: Grommeted.
- **Class 1 earth connections**: Connect to luminaire circuit protective conductor.
- **Wiring within luminaires**: Minimize. Clip at 300 mm intervals.

640 Luminaires mounted as part of a suspended ceiling

Shared by: 90-60-50/405 General purpose luminaires; type A; type B; type C; type D and type E; and 90-60-50/410 Combined emergency luminaires; type A; type B and type C.

- **Luminaire supports**: Refer to project specific documentation.
- **Luminaire final connection**: Refer to project specific documentation.
- **Mounting arrangement**: From cable connection on side of trunking.
- **Length (maximum)**: Refer to project specific documentation.

650 Installing lighting track

Shared by: 90-60-50/430 Lighting tracks; type A and type C.

- **Orientation**: Level with ceiling.
- **Track suspensions**:
  - **Type**: Refer to project specific documentation.
  - **Position**: Within 500 mm of each joint and end of track.
    Provide dedicated suspension point for supply feed.

660 Installing extra low voltage luminaires

Shared by: 90-60-50/405 General purpose luminaires; type A; type B; type C; type D and type E; and 90-60-50/410 Combined emergency luminaires; type A; type B and type C.

- **Transformer location**: Accessible.
- **Conductor size for cables connecting transformers and luminaires (minimum)**: Refer to project specific documentation.
- **Multi-point transformers**:
  - **Cabling to luminaire**: Equal size and length.
  - **Lamps**: Same power rating.
  - **Fixing**: Secure to non-flammable materials.

670 Installing controlgear

Shared by: 90-60-50/405 General purpose luminaires; type A; type B; type C; type D and type E; and 90-60-50/410 Combined emergency luminaires; type A; type B and type C.

- **Position**: Within 1 m of luminaire.
- **Fixing**: Secure to building fabric.

690 Installing luminaire supports

Shared by: 90-60-50/405 General purpose luminaires; type A; type B; type C; type D and type E; and 90-60-50/410 Combined emergency luminaires; type A; type B and type C.

- **Support and fixing arrangement**: Refer to project specific documentation.
- **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.

695 Installing smoke hoods

Shared by: 90-60-50/455 Luminaire smoke hoods; type A and type B.

- **Support and fixing arrangement**: Refer to project specific documentation.

Ω End of section

90-65-05 Automatic lighting controls

Products

400 Automatic emergency lighting test panels type A

Used by: 70-80-35/110 Hard wired general lighting system.

- **Manufacturer**: Refer to project specific documentation.
- **Standard**: To BS EN 62034.
- **Panel type**: Refer to project specific documentation.
- **Main display**:
  - **Features**: Refer to project specific documentation.
  - **Functions**: Refer to project specific documentation.
- **Individual green LED indication of the following conditions**: Refer to project specific documentation.
- **Individual red LED indication of the following conditions**: Refer to project specific documentation.
- **Enclosure**:
  - **Type**: Special purpose hinged glazed cover.
  - **Ingress protection (minimum)**: To BS EN 60529, IP 30.
  - **Material**: Refer to project specific documentation.
- **Execution**: 90-65-05/610 Installing automatic emergency lighting test panels.

400 Automatic emergency lighting test panels type B

Used by: 70-80-35/120 General lighting systems with prefabricated wiring.

- **Manufacturer**: Refer to project specific documentation.
- **Standard**: To BS EN 62034.
- **Panel type**: Refer to project specific documentation.
- **Main display**:
  - **Features**: Refer to project specific documentation.
  - **Functions**: Refer to project specific documentation.
- **Individual green LED indication of the following conditions**: Refer to project specific documentation.
- **Individual red LED indication of the following conditions**: Refer to project specific documentation.
- **Enclosure**:
  - **Type**: Special purpose hinged glazed cover.
  - **Ingress protection (minimum)**: To BS EN 60529, IP 30.
  - **Material**: Refer to project specific documentation.
- **Execution**:

400 Automatic emergency lighting test panels type C

Used by: 70-80-35/130 Central battery supplied emergency lighting system.

- **Manufacturer**: Refer to project specific documentation.
- **Standard**: To BS EN 62034.
- **Panel type**: Refer to project specific documentation.
- **Main display**:
  - **Features**: Refer to project specific documentation.
  - **Functions**: Refer to project specific documentation.
- **Individual green LED indication of the following conditions**: Refer to project specific documentation.
- **Individual red LED indication of the following conditions**: Refer to project specific documentation.
- **Enclosure**:
  - **Type**: Special purpose hinged glazed cover.
  - **Ingress protection (minimum)**: To BS EN 60529, IP 30.
  - **Material**: Refer to project specific documentation.
- **Execution**: 90-65-05/610 Installing automatic emergency lighting test panels.

405 Lighting control modules type A

Used by: 70-80-35/110 Hard wired general lighting system.

- **Manufacturer**: Refer to Schedule of Manufacturers
- **Standard**: Refer to project specific documentation.
- **Controller type**: Refer to project specific documentation.
- **Equipment interconnectivity**: Refer to project specific documentation.
- **Rated voltage**: 230 V a.c.
- **Rated current**: 10 A resistive, 3 A inductive.
- **Control protocol**: Refer to project specific documentation.
- **Communication ports**: RJ 45.
- **Addressable input ports**: Refer to project specific documentation.
- **Addressable output ports**: Refer to project specific documentation.
- **Enclosure**:
  - **Ingress protection (minimum)**: Refer to project specific documentation.
  - **Material**: Refer to project specific documentation.
  - **Finish**: Refer to project specific documentation.
  - **Mounting**: Refer to project specific documentation.
- **Execution**: 90-65-05/620 Installing lighting control modules.

405 Lighting control modules type B

Used by: 70-80-35/120 General lighting systems with prefabricated wiring.

- **Manufacturer**: Refer to Schedule of Manufacturers
- **Standard**: Refer to project specific documentation.
- **Controller type**: Refer to project specific documentation.
- **Equipment interconnectivity**: Refer to project specific documentation.
- **Rated voltage**: 230 V a.c.
- **Rated current**: 10 A resistive, 3 A inductive.
- **Control protocol**: Refer to project specific documentation.
- **Communication ports**: RJ 45.
- **Addressable input ports**: Refer to project specific documentation.
- **Addressable output ports**: Refer to project specific documentation.
- **Enclosure**:
  - **Ingress protection (minimum)**: Refer to project specific documentation.
  - **Material**: Refer to project specific documentation.
  - **Finish**: Refer to project specific documentation.
  - **Mounting**: Refer to project specific documentation.
- **Execution**: 90-65-05/620 Installing lighting control modules.

410 Combined daylight and occupancy detectors type A

Used by: 70-80-35/110 Hard wired general lighting system.

- **Manufacturer**: Refer to Schedule of Manufacturers
- **Daylight sensitivity**: Adjustable.
- **Equipment interconnectivity**: Refer to project specific documentation.
- **Occupancy sensitivity**: Adjustable.
- **Range**: Adjustable.
- **Field of view**: Adjustable.
- **Remote setup/ override**: By infrared controller.
- **Mounting**: Refer to project specific documentation.
- **Ingress protection (minimum)**: To BS EN 60529, IP44.
- **Adjustable sensor settings**: Required.
- **Execution**: 90-65-05/630 Installing combined daylight and occupancy sensors.

410 Combined daylight and occupancy detectors type B

Used by: 70-80-35/120 General lighting systems with prefabricated wiring.

- **Manufacturer**: Refer to Schedule of Manufacturers
- **Daylight sensitivity**: Adjustable.
- **Equipment interconnectivity**: Refer to project specific documentation.
- **Occupancy sensitivity**: Adjustable.
- **Range**: Adjustable.
- **Field of view**: Adjustable.
- **Remote setup/ override**: By infrared controller.

- **Mounting**: Refer to project specific documentation.
- **Ingress protection (minimum)**: To BS EN 60529, IP44.
- **Adjustable sensor settings**: Required.
- **Execution**: 90-65-05/630 Installing combined daylight and occupancy sensors.

415 Daylight sensors type A

Used by: 70-80-35/110 Hard wired general lighting system.

- **Manufacturer**: Refer to project specific documentation.
- **Equipment interconnectivity**: Refer to project specific documentation.
- **Daylight sensitivity**: Adjustable.
- **Remote setup/ override**: By infrared controller.
- **Mounting**: Refer to project specific documentation.
- **Ingress protection (minimum)**: To BS EN 60529, IP44.
- **Adjustable sensor settings**: Required.
- **Execution**: 90-65-05/640 Installing daylight sensors.

415 Daylight sensors type B

Used by: 70-80-35/120 General lighting systems with prefabricated wiring.

- **Manufacturer**: Refer to project specific documentation.
- **Equipment interconnectivity**: Refer to project specific documentation.
- **Daylight sensitivity**: Adjustable.
- **Remote setup/ override**: By infrared controller.
- **Mounting**: Refer to project specific documentation.
- **Ingress protection (minimum)**: To BS EN 60529, IP44.
- **Adjustable sensor settings**: Required.
- **Execution**: 90-65-05/640 Installing daylight sensors.

420 Extra-low voltage occupancy detectors type A

Used by: 70-80-35/110 Hard wired general lighting system.

- **Manufacturer**: Refer to Schedule of Manufacturers
- **Equipment interconnectivity**: Refer to project specific documentation.
- **Format**: Refer to project specific documentation.
- **Occupancy sensitivity**: Adjustable.
- **Range**: Adjustable.
- **Field of view**: Adjustable.
- **Remote setup/ override**: By infrared controller.
- **Mounting**: Refer to project specific documentation.
- **Ingress protection (minimum)**: To BS EN 60529, IP44.
- **Adjustable sensor settings**: Required.
- **Execution**: 90-65-05/650 Installing extra-low voltage occupancy detectors.

420 Extra-low voltage occupancy detectors type B

Used by: 70-80-35/120 General lighting systems with prefabricated wiring.

- **Manufacturer**: Refer to Schedule of Manufacturers
- **Equipment interconnectivity**: Refer to project specific documentation.
- **Format**: Refer to project specific documentation.
- **Occupancy sensitivity**: Adjustable.
- **Range**: Adjustable.
- **Field of view**: Adjustable.
- **Remote setup/ override**: By infrared controller.
- **Mounting**: Refer to project specific documentation.
- **Ingress protection (minimum)**: To BS EN 60529, IP44.
- **Adjustable sensor settings**: Required.
- **Execution**: 90-65-05/650 Installing extra-low voltage occupancy detectors.

425 Mains voltage occupancy detectors type A

Used by: 70-80-35/110 Hard wired general lighting system.

- **Manufacturer**: Refer to project specific documentation.
- **Format**: Refer to project specific documentation.
- **Inductive switching capacity**: Refer to project specific documentation.
- **Occupancy sensitivity**: Adjustable.
- **Range**: Adjustable.
- **Field of view**: Adjustable.
- **Switching delay**: Adjustable.
- **Remote setup/ override**: By infrared controller.
- **Mounting**: Refer to project specific documentation.
- **Ingress protection (minimum)**: To BS EN 60529, IP44.
- **Adjustable sensor settings**: Required.
- **Execution**: 90-65-05/660 Installing mains voltage occupancy detectors.

425 Mains voltage occupancy detectors type B

Used by: 70-80-35/120 General lighting systems with prefabricated wiring.

- **Manufacturer**: Refer to project specific documentation.
- **Format**: Refer to project specific documentation.
- **Inductive switching capacity**: Refer to project specific documentation.
- **Occupancy sensitivity**: Adjustable.
- **Range**: Adjustable.
- **Field of view**: Adjustable.
- **Switching delay**: Adjustable.
- **Remote setup/ override**: By infrared controller.

- **Mounting**: Refer to project specific documentation.
- **Ingress protection (minimum)**: To BS EN 60529, IP44.
- **Adjustable sensor settings**: Required.
- **Execution**: 90-65-05/660 Installing mains voltage occupancy detectors.

430 Photoelectric control units type A

Used by: 70-80-25/110 Roadway lighting system.

- **Manufacturer**: Refer to project specific documentation.
- **Standard**: To BS 5972.
- **Equipment interconnectivity**: Refer to project specific documentation.
- **Inductive switching capacity**: Refer to project specific documentation.
- **Switching settings**:
  - **Adjustable switching time delay**: Required.
  - **On lighting level**: Adjustable.
  - **Off lighting level**: Adjustable.
  - **Timed on**: Programmable 7 day 24 h clock.
  - **Timed off**: Programmable 7 day 24 h clock.
- **Remote setup/ override**: By infrared controller.
- **Mounting**: Refer to project specific documentation.
- **Ingress protection (minimum)**: To BS EN 60529, IP67.
- **Execution**: 90-65-05/670 Installing photoelectric control units.

430 Photoelectric control units type B

Used by: 70-80-25/120 Amenity lighting system.

- **Manufacturer**: Refer to project specific documentation.
- **Standard**: To BS 5972.
- **Equipment interconnectivity**: Refer to project specific documentation.
- **Inductive switching capacity**: Refer to project specific documentation.
- **Switching settings**:
  - **Adjustable switching time delay**: Required.
  - **On lighting level**: Adjustable.
  - **Off lighting level**: Adjustable.
  - **Timed on**: Programmable 7 day 24 h clock.
  - **Timed off**: Programmable 7 day 24 h clock.
- **Remote setup/ override**: By infrared controller.
- **Mounting**: Refer to project specific documentation.
- **Ingress protection (minimum)**: To BS EN 60529, IP67.
- **Execution**: 90-65-05/670 Installing photoelectric control units.

430 Photoelectric control units type C

Used by: 70-80-35/110 Hard wired general lighting system.

- **Manufacturer**: Refer to project specific documentation.
- **Standard**: To BS 5972.
- **Equipment interconnectivity**: Refer to project specific documentation.
- **Inductive switching capacity**: Refer to project specific documentation.
- **Switching settings**:
  - **Adjustable switching time delay**: Required.
  - **On lighting level**: Adjustable.
  - **Off lighting level**: Adjustable.
  - **Timed on**: Programmable 7 day 24 h clock.
  - **Timed off**: Programmable 7 day 24 h clock.
- **Remote setup/ override**: By infrared controller.
- **Mounting**: Refer to project specific documentation.
- **Ingress protection (minimum)**: To BS EN 60529, IP67.
- **Execution**: 90-65-05/670 Installing photoelectric control units.

430 Photoelectric control units type D

Used by: 70-80-35/120 General lighting systems with prefabricated wiring.

- **Manufacturer**: Refer to project specific documentation.
- **Standard**: To BS 5972.
- **Equipment interconnectivity**: Refer to project specific documentation.
- **Inductive switching capacity**: Refer to project specific documentation.
- **Switching settings**:
  - **Adjustable switching time delay**: Required.
  - **On lighting level**: Adjustable.
  - **Off lighting level**: Adjustable.
  - **Timed on**: Programmable 7 day 24 h clock.
  - **Timed off**: Programmable 7 day 24 h clock.
- **Remote setup/ override**: By infrared controller.
- **Mounting**: Refer to project specific documentation.
- **Ingress protection (minimum)**: To BS EN 60529, IP67.
- **Execution**: 90-65-05/670 Installing photoelectric control units.

Execution

605 Installing automatic lighting controls generally

Shared by: 90-65-05/610 Installing automatic emergency lighting test panels; 90-65-05/620 Installing lighting control modules; 90-65-05/630 Installing combined daylight and occupancy sensors; 90-65-05/640 Installing daylight sensors; 90-65-05/650 Installing extra-low voltage occupancy detectors; 90-

65-05/660 Installing mains voltage occupancy detectors; and 90-65-05/670 Installing photoelectric control units.

- **Standard**: In accordance with BS 7671.
- **Equipment and sensor identification labels**: Refer to project specific documentation.

610 Installing automatic emergency lighting test panels

Shared by: 90-65-05/400 Automatic emergency lighting test panels; type A and type C.

- **General requirements**: 90-65-05/605 Installing automatic lighting controls generally.
- **Position**: Refer to project specific documentation.
- **Interconnections with emergency luminaires**:
  - **Connection topology**: Refer to project specific documentation.
  - **Cable type**: Refer to project specific documentation.
- **Luminaire address**: Assign individual, unique software address to each emergency luminaire.

620 Installing lighting control modules

Shared by: 90-65-05/405 Lighting control modules; type A and type B.

- **General requirements**: 90-65-05/605 Installing automatic lighting controls generally.
- **Position**: Refer to project specific documentation.
- **Clearance (minimum)**: Refer to project specific documentation.
- **Connection to building monitoring and management system**: Refer to project specific documentation.
- **Interconnections with detectors, sensors and luminaires**:
  - **Connection topology**: Refer to project specific documentation.
  - **Cable type**: Refer to project specific documentation.
- **Software addressing**: Assign individual, unique software address to detectors, sensors and luminaires.
- **Output circuits**: Label describing purpose.

630 Installing combined daylight and occupancy sensors

Shared by: 90-65-05/410 Combined daylight and occupancy detectors; type A and type B.

- **General requirements**: 90-65-05/605 Installing automatic lighting controls generally.
- **Position**: Refer to project specific documentation.
- **Interconnection**: Refer to project specific documentation.
- **Cable type**: Refer to project specific documentation.

640 Installing daylight sensors

Shared by: 90-65-05/415 Daylight sensors; type A and type B.

- **General requirements**: 90-65-05/605 Installing automatic lighting controls generally.
- **Position**: Refer to project specific documentation.

- **Interconnection**: Refer to project specific documentation.
- **Cable type**: Refer to project specific documentation.

650 Installing extra-low voltage occupancy detectors

Shared by: 90-65-05/420 Extra-low voltage occupancy detectors; type A and type B.

- **General requirements**: 90-65-05/605 Installing automatic lighting controls generally.
- **Position**: Refer to project specific documentation.
- **Interconnection**: Refer to project specific documentation.
- **Cable type**: Refer to project specific documentation.

660 Installing mains voltage occupancy detectors

Shared by: 90-65-05/425 Mains voltage occupancy detectors; type A and type B.

- **General requirements**: 90-65-05/605 Installing automatic lighting controls generally.
- **Position**: Refer to project specific documentation.
- **Interconnection**: Refer to project specific documentation.
- **Cable type**: Refer to project specific documentation.

670 Installing photoelectric control units

Shared by: 90-65-05/430 Photoelectric control units; type A; type B; type C and type D.

- **General requirements**: 90-65-05/605 Installing automatic lighting controls generally.
- **Position**: Refer to project specific documentation.
- **Interconnection**: Refer to project specific documentation.
- **Cable type**: Refer to project specific documentation.

Ω End of section

90-65-25 Electrical controls and starters

Products

310 a.c. semiconductor motor controllers and starters

Used by: 70-70-75/110 Hard wired low voltage small power system.

- **Manufacturer**: Refer to Schedule of Manufacturers.
- **Standard**: To BS EN 60947-4-2.
- **Equipment type**: Refer to project specific documentation.
- **Form**: Refer to project specific documentation.
- **Rated operational voltage (Ue)**: Refer to project specific documentation.
- **Rated power (kW)**: Refer to project specific documentation.
- **Rated operational frequency**: Refer to project specific documentation.
- **Number of poles**: Refer to project specific documentation.
- **Method of operation**: Refer to project specific documentation.
- **Control method**: Refer to project specific documentation.
- **Motor connection**: Refer to project specific documentation.
- **Utilization category**: Refer to project specific documentation.
- **Enclosure**:
  - **Mounting arrangement**: Refer to project specific documentation.
  - **Material**: Refer to project specific documentation.
    - **Finish**: Manufacturer's standard.
    - **Colour**: Manufacturer's standard.
  - **Ingress protection (minimum)**: Refer to project specific documentation.
- **Control features**:
  - **User adjustable functions**: Refer to project specific documentation.
  - **Protection**: Refer to project specific documentation.
  - **Display type**: Refer to project specific documentation.
    - **Display the following conditions**: Refer to project specific documentation.

320 Direct-on-line starters

Used by: 70-70-75/110 Hard wired low voltage small power system.

- **Manufacturer**: Refer to Schedule of Manufacturers.
- **Standard**: To BS EN 60947-4-1.
- **Rated operational voltage (Ue)**: Refer to project specific documentation.
- **Rated power (kW)**: Refer to project specific documentation.
- **Rated operational frequency**: Refer to project specific documentation.
- **Utilization category**: Refer to project specific documentation.
- **Number of poles**: Refer to project specific documentation.

- **Interrupting medium**: Air.
- **Reverse mode**: Refer to project specific documentation.
- **Control coil**: Refer to project specific documentation.
- **Overload relay**:
  - **Type**: Refer to project specific documentation.
  - **Rating**: Refer to project specific documentation.
  - **Features**: Refer to project specific documentation.
- **Enclosure**:
  - **Mounting arrangement**: Refer to project specific documentation.
  - **Material**: Manufacturer's standard.
    - **Finish**: Manufacturer's standard.
    - **Colour**: Refer to project specific documentation.
  - **Ingress protection (minimum)**: Refer to project specific documentation.
  - **Integral control buttons**: Refer to project specific documentation.
  - **Motor control switch**: To BS EN 60947-3.
- **Accessories**: Refer to project specific documentation.

330 Star delta starters

Used by: 70-70-75/110 Hard wired low voltage small power system.

- **Manufacturer**: Refer to Schedule of Manufacturers.
- **Standard**: To BS EN 60947-4-1.
- **Rated operational voltage (Ue)**: Refer to project specific documentation.
- **Rated power (kW)**: Refer to project specific documentation.
- **Rated operational frequency**: Refer to project specific documentation.
- **Utilization category**: AC-3.
- **Number of poles**: Refer to project specific documentation.
- **Interrupting medium**: Air.
- **Reverse mode**: Refer to project specific documentation.
- **Control coil**: Refer to project specific documentation.
- **Overload relay**:
  - **Type**: Refer to project specific documentation.
  - **Rating**: Refer to project specific documentation.
  - **Features**: Refer to project specific documentation.
- **Changeover timer**:
- **Enclosure**:
  - **Mounting arrangement**: Refer to project specific documentation.
  - **Material**: Refer to project specific documentation.
    - **Finish**: Manufacturer's standard.
    - **Colour**: Manufacturer's standard.
  - **Ingress protection (minimum)**: Refer to project specific documentation.

  - **Integral control buttons**: Refer to project specific documentation.
  - **Motor control switch**: To BS EN 60947-3.
- **Accessories**: Refer to project specific documentation.

340 Electromechanical contactors

Used by: 70-70-75/110 Hard wired low voltage small power system.

- **Manufacturer**: Refer to Schedule of Manufacturers.
- **Standard**: To BS EN 60947-4-1.
- **Equipment type**: Refer to project specific documentation.
- **Rated operational voltage (Ue)**: Refer to project specific documentation.
- **Rated operational current (In)**: Refer to project specific documentation.
- **Rated operational frequency**: Refer to project specific documentation.
- **Utilization category**: Refer to project specific documentation.
- **Number of poles**: Refer to project specific documentation.
- **Interrupting medium**: Air.
- **Control coil**: Refer to project specific documentation.
- **Enclosure**:
  - **Material**: Refer to project specific documentation.
    Finish: Manufacturer's standard.
    Colour: Manufacturer's standard.
  - **Ingress protection (minimum)**: Refer to project specific documentation.
  - **Integral switch disconnector**: To BS EN 60947-3.
- **Overload relay**:
  - **Type**: Refer to project specific documentation.
  - **Rating**: Refer to project specific documentation.
- **Accessories**: Refer to project specific documentation.

350 a.c. drives

Used by: 70-70-75/110 Hard wired low voltage small power system.

- **Manufacturer**: Refer to Schedule of Manufacturers.
- **Standard**: To BS EN 61800-3.
- **Rated operational voltage (Ue)**: Refer to project specific documentation.
- **Rated power (kW)**: Refer to project specific documentation.
- **Rated operational frequency**: Refer to project specific documentation.
- **Output**:
  - **Frequency range**: Refer to project specific documentation.
  - **Efficiency**: Refer to project specific documentation.
  - **Overload capacity (minimum)**: Refer to project specific documentation.
- **Power factor correction**: Refer to project specific documentation.
- **Controls**:

  - **Display type**: Full text, multiple line liquid crystal display (LCD).
  - **User interface**: Refer to project specific documentation.
  - **Display the following conditions**: Refer to project specific documentation.
  - **User adjustable functions**: Refer to project specific documentation.
  - **Drive protection**: Refer to project specific documentation.
  - **Motor protection**: Refer to project specific documentation.
  - **Relay type**: Refer to project specific documentation.
  - **Communications protocol**: Refer to project specific documentation.
- **Accessories**: Refer to project specific documentation.
- **Enclosure**:
  - **Mounting arrangement**: Refer to project specific documentation.
  - **Material**: Refer to project specific documentation.
  - **Finish**: Manufacturer's standard.
  - **Colour**: Manufacturer's standard.
  - **Ingress protection (minimum)**: Refer to project specific documentation.

360 Electromechanical control circuit devices

Used by: 70-70-75/110 Hard wired low voltage small power system.

- **Manufacturer**: Refer to Schedule of Manufacturers.
- **Standard**: To BS EN 60947-5-1.
- **Format**: Refer to project specific documentation.
- **Number of poles**: Refer to project specific documentation.
- **Interrupting medium**: Refer to project specific documentation.
- **Operating method**: Refer to project specific documentation.
- **Control method**: Refer to project specific documentation.
- **Utilization category**: Refer to project specific documentation.
- **Form**: Refer to project specific documentation.
- **Features**: Refer to project specific documentation.
- **Enclosure**:
  - **Material**: Refer to project specific documentation.
  - **Ingress protection (minimum)**: Refer to project specific documentation.

370 Emergency stop buttons

Used by: 70-70-75/110 Hard wired low voltage small power system.

- **Manufacturer**: Refer to Schedule of Manufacturers.
- **Standard**: To BS EN 60947-5-5.
- **Format**: Refer to project specific documentation.
- **Shroud**: Refer to project specific documentation.
- **Enclosure**:
  - **Material**: Refer to project specific documentation.

  - **Ingress protection (minimum)**: Refer to project specific documentation.
- **Execution**: 90-65-25/610 Installing emergency stop buttons.

380 Time switches type A

Used by: 70-80-25/120 Amenity lighting system.

- **Manufacturer**: Refer to project specific documentation.
- **Standards**: To BS EN 60730-1 and BS EN 60730-2-7.
- **Third party certification**: British Electrotechnical Approvals Board Control Mark (BEAB).
- **Equipment interconnectivity**: Refer to project specific documentation.
- **Format**: Refer to project specific documentation.
- **Display**: Refer to project specific documentation.
- **Programme capability**: Refer to project specific documentation.
- **Number of switching channels**: Refer to project specific documentation.
- **Inductive switching capacity**: Refer to project specific documentation.
- **Cable termination capacity**: Refer to project specific documentation.
- **Override facility**: Refer to project specific documentation.
- **GMT/BST daylight saving**: Automatic.
- **Enclosure**:
  - **Ingress protection (minimum)**: Refer to project specific documentation.
  - **Material and construction**: Refer to project specific documentation.
- **Battery backup**: Refer to project specific documentation.
- **Execution**: 90-65-25/620 Installing time switches.

380 Time switches type B

Used by: 70-80-35/110 Hard wired general lighting system.

- **Manufacturer**: Refer to project specific documentation.
- **Standards**: To BS EN 60730-1 and BS EN 60730-2-7.
- **Third party certification**: British Electrotechnical Approvals Board Control Mark (BEAB).
- **Equipment interconnectivity**: Refer to project specific documentation.
- **Format**: Refer to project specific documentation.
- **Display**: Refer to project specific documentation.
- **Programme capability**: Refer to project specific documentation.
- **Number of switching channels**: Refer to project specific documentation.
- **Inductive switching capacity**: Refer to project specific documentation.
- **Cable termination capacity**: Refer to project specific documentation.
- **Override facility**: Refer to project specific documentation.
- **GMT/BST daylight saving**: Automatic.
- **Enclosure**:
  - **Ingress protection (minimum)**: Refer to project specific documentation.
  - **Material and construction**: Refer to project specific documentation.

- **Battery backup**: Refer to project specific documentation.
- **Execution**: 90-65-25/620 Installing time switches.

380 Time switches type C

Used by: 70-80-35/120 General lighting systems with prefabricated wiring.

- **Manufacturer**: Refer to project specific documentation.
- **Standards**: To BS EN 60730-1 and BS EN 60730-2-7.
- **Third party certification**: British Electrotechnical Approvals Board Control Mark (BEAB).
- **Equipment interconnectivity**: Refer to project specific documentation.
- **Format**: Refer to project specific documentation.
- **Display**: Refer to project specific documentation.
- **Programme capability**: Refer to project specific documentation.
- **Number of switching channels**: Refer to project specific documentation.
- **Inductive switching capacity**: Refer to project specific documentation.
- **Cable termination capacity**: Refer to project specific documentation.
- **Override facility**: Refer to project specific documentation.
- **GMT/BST daylight saving**: Refer to project specific documentation.
- **Enclosure**:
  - **Ingress protection (minimum)**: Refer to project specific documentation.
  - **Material and construction**: Refer to project specific documentation.
- **Battery backup**: Refer to project specific documentation.
- **Execution**: 90-65-25/620 Installing time switches.

Execution

610 Installing emergency stop buttons

Used by: 90-65-25/370 Emergency stop buttons.

- **Standards**: In accordance with BS 7671 and to BS EN 60204-1.
- **Mounting**:

620 Installing time switches

Shared by: 90-65-25/380 Time switches; type A; type B and type C.

- **Position**: Refer to project specific documentation.
- **Interconnection**:
  - **Input**: Refer to project specific documentation.
  - **Output**: Refer to project specific documentation.

Ω End of section

90-65-55 Monitoring, metering and test products

Products

315 Current transformers

Used by: 70-70-45/110 Low voltage distribution system type A.

- **Manufacturer**: Refer to Schedule of Manufacturers
- **Standard**: To BS EN 61869-2.
- **Accuracy classification**:
  - **For use with protective equipment**: Refer to project specific documentation.
  - **For use with measuring equipment**: Refer to project specific documentation.
- **Format**: Cast resin encapsulated solid ring.
- **Size**: Refer to project specific documentation.
- **Primary rating**: Refer to project specific documentation.
- **Secondary rating**: 5 A.
- **Rated short time current**: Match the rating of the circuit in which the current transformer is installed.
- **Test links**: Provide for connection of calibration instruments and meters.
- **Mounting arrangement**: Refer to project specific documentation.
- **Execution**: 90-65-55/610 Installing current transformers.

320 Digital metering equipment

Used by: 70-70-45/110 Low voltage distribution system type A.

- **Manufacturer**: Refer to Schedule of Manufacturers
- **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 (VA(r));
  Active energy (kWh);
  and Apparent power (VA) and Harmonics (THD) (individual harmonics to the 63rd order).
- **Mounting**: Recessed into switchgear assembly.
- **Enclosure**: Match assembly enclosure.
- **Outputs**: Ethernet and Pulse output module.
- **Execution**: 90-65-55/620 Installing electrical monitoring and metering equipment.

380 Radio teleswitches for tariff and load control

Used by: 70-70-45/110 Low voltage distribution system type A.

- **Manufacturer**: Refer to project specific documentation.
- **Standard**: To BS 7647.
- **Execution**: 90-65-55/620 Installing electrical monitoring and metering equipment.

385 Residual current monitoring devices

Used by: 70-70-25/110 Earthing and bonding system.

- **Manufacturer**: Refer to Schedule of Manufacturers
- **Standard**: To BS EN 62020.
- **Enclosure**:
  - **Ingress protection (minimum)**: To BS EN 60529, IP20.
  - **Material**: Polycarbonate.
  - **Finish**: Manufacturer's standard.
  - **Colour**: To match cubicle switchboard.
- **Mounting**: DIN rail mounted.
- **Rated operational voltage (Ue)**: 230 V a.c.
- **Nominal frequency**: 50 Hz.
- **Discrimination threshold**:
  - **Main alarm**: 80% of set differential current.
  - **Pre-alarm**: Adjustable between 10–90% of main alarm threshold.
- **Response time**: Adjustable between 0.1s–1s.
- **Output**: Integral audible alarm and Integral visual indicator.
- **Execution**: 90-65-55/620 Installing electrical monitoring and metering equipment.

390 Timeswitches for tariff and load control

Used by: 70-70-45/110 Low voltage distribution system type A.

- **Manufacturer**: Refer to project specific documentation.
- **Standard**: To BS EN 62054-21.
- **Rated operational voltage (Ue)**: 230 V a.c.
- **Switching capacity**: Refer to project specific documentation.
- **Mode of operation**: Refer to project specific documentation.
- **Number of channels**: Refer to project specific documentation.
- **Programming functions**:
  - **Period**: Week.
  - **Programme steps (minimum)**: Four
  - **Time changeover**: Automatic from GMT to British summer time.
  - **LCD backlight**: Required.
  - **Control**: Holiday program;

Pulse switching;
and On/ off manual override.

- **Mounting**: DIN rail.
- **Execution**: 90-65-55/620 Installing electrical monitoring and metering equipment.

Execution

610 Installing current transformers

Used by: 90-65-55/315 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.

620 Installing electrical monitoring and metering equipment

Shared by: 90-65-55/320 Digital metering equipment; 90-65-55/380 Radio teleswitches for tariff and load control; 90-65-55/385 Residual current monitoring devices; and 90-65-55/390 Timeswitches for tariff and load control.

- **Standard**: In accordance with BS 7671.
- **Digital metering equipment**: Connect to building management system.

Ω End of section

90-70-05 Assistance call products

Products

310 Radio based equipment for emergency voice communication type A

Used by: 75-70-05/110 Assistance call system.

- **Manufacturer**: Refer to project specific documentation.
- **Standards**: In accordance with BS 5839-9.
- **Power supply**: Refer to project specific documentation.

310 Radio based equipment for emergency voice communication type B

Used by: 75-70-05/120 Emergency voice communication system.

- **Manufacturer**: Refer to project specific documentation.
- **Standards**: In accordance with BS 5839-9.
- **Power supply**: Refer to project specific documentation.

320 Pull cord units

Used by: 75-70-05/110 Assistance call system.

- **Manufacturer**: Refer to Schedule of Manufacturers
- **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.
- **Execution**: 90-70-05/610 Installing pull cords.

330 Press button units

Used by: 75-70-05/110 Assistance call system.

- **Manufacturer**: Refer to project specific documentation.
- **Mounting**: Refer to project specific documentation.
- **Material**: Refer to project specific documentation.
- **Accessories**: Refer to project specific documentation.
- **Execution**: 90-70-05/620 Installing press button units.

350 Overdoor indicators

Used by: 75-70-05/110 Assistance call system.

- **Manufacturer**: Refer to Schedule of Manufacturers
- **Wall mounting**: Refer to project specific documentation.
- **Material**: Refer to project specific documentation.
- **Visual indicator**: Red.
- **Integral buzzer**: Required.
- **Execution**: 90-70-05/650 Installing overdoor indicators.

360 Remote indicators

Used by: 75-70-05/110 Assistance call system.

- **Manufacturer**: Refer to Schedule of Manufacturers
- **Mounting**: Refer to project specific documentation.
- **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**: 90-70-05/660 Installing remote indicators.

380 Reset units

Used by: 75-70-05/110 Assistance call system.

- **Manufacturer**: Refer to Schedule of Manufacturers
- **Mounting**: Refer to project specific documentation.
- **Integral visual and audible alarm**: Not required.
- **Execution**: 90-70-05/670 Installing reset units.

390 Power supply units type A

Used by: 75-70-05/110 Assistance call system.

- **Manufacturer**: Refer to Schedule of Manufacturers
- **Standard**: To BS EN 54-4.
- **Standby source**: Rechargeable battery.
- **Standby capacity**: Refer to project specific documentation.
- **Integral replaceable fuse**: Required.
- **Power-on indicator**: Required.
- **Execution**: 90-70-05/680 Installing power supply units.

390 Power supply units type B

Used by: 75-70-05/120 Emergency voice communication system.

- **Manufacturer**: Refer to Schedule of Manufacturers
- **Standard**: To BS EN 54-4.

- **Standby source**: Rechargeable battery.
- **Standby capacity**: Refer to project specific documentation.
- **Integral replaceable fuse**: Required.
- **Power-on indicator**: Required.
- **Execution**: 90-70-05/680 Installing power supply units.

Execution

610 Installing pull cords

Used by: 90-70-05/320 Pull cord units.

- **Mounting arrangement**: Ceiling mounted.
- **Position within room**: Refer to project specific documentation.
- **Bangle**: Set one at 100 mm and the second between 800 mm and 1000 mm above the floor.

620 Installing press button units

Used by: 90-70-05/330 Press button units.

- **Mounting arrangement**: Wall mounted.
- **Position within room**: Refer to project specific documentation.
- **Mounting height**: Refer to project specific documentation.

650 Installing overdoor indicators

Used by: 90-70-05/350 Overdoor indicators.

- **Position**: Refer to project specific documentation.

660 Installing remote indicators

Used by: 90-70-05/360 Remote indicators.

- **Position**: Refer to project specific documentation.

670 Installing reset units

Used by: 90-70-05/380 Reset units.

- **Mounting arrangement**: Wall mounted.
- **Position**: Refer to project specific documentation.
- **Mounting height**: Refer to project specific documentation.

680 Installing power supply units

Shared by: 90-70-05/390 Power supply units; type A and type B.

- **Position**: Refer to project specific documentation.

Ω End of section

90-75-30 Fire alarms

Products

310 Fire detection devices generally

Shared by: 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.

- **Device address setup**: Automatic via control and indicating equipment (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.
- **Execution**: 90-75-30/660 Installing end of line devices.

311 Radio based equipment type A

Used by: 75-65-30/110 Fire detection and alarm systems in non-domestic premises type A.

- **Standard**: To BS EN 54-25.
- **Power supply**: Refer to project specific documentation.
- **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.

311 Radio based equipment type B

Used by: 75-65-30/115 Fire detection and alarm systems in domestic premises.

- **Standard**: To BS EN 54-25.
- **Power supply**: Refer to project specific documentation.
- **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.

330 Manual call points

Used by: 75-65-30/110 Fire detection and alarm systems in non-domestic premises type A.

- **General requirements**: 90-75-30/310 Fire detection devices generally.
- **Manufacturer**: Refer to project specific documentation.
- **Standard**: To BS EN 54-11.
- **Third party certification**: LPCB approved.
- **Operation**: Type A.
- **Frangible element**: Non-resettable.
- **Integral red visual indicator**: Required.
- **Environmental category**: Refer to project specific documentation.
- **Mounting**: Refer to project specific documentation.
- **Time delay**: 3 s maximum between activation of manual call point and the evacuate signal being generated.
- **Protective covers**: Refer to project specific documentation.
- **Execution**: 90-75-30/630 Installing manual call points.

335 Optical beam smoke detectors

Used by: 75-65-30/110 Fire detection and alarm systems in non-domestic premises type A.

- **General requirements**: 90-75-30/310 Fire detection devices generally.
- **Manufacturer**: Refer to project specific documentation.
- **Standard**: To BS EN 54-12.
- **Third party certification**: LPCB approved.
- **Detector type**: Refer to project specific documentation.
- **Operating range (minimum)**: Refer to project specific documentation.
- **Ingress protection (minimum)**: To BS EN 60529, IP54.
- **Controller**:
  - **Display type**: LCD accessible via pass code.
  - **Display the following information**: Refer to project specific documentation.
  - **Functions**: Refer to project specific documentation.
- **Power source**: Refer to project specific documentation.

340 Point flame detectors

Used by: 75-65-30/110 Fire detection and alarm systems in non-domestic premises type A.

- **General requirements**: 90-75-30/310 Fire detection devices generally.
- **Manufacturer**: Refer to project specific documentation.
- **Standard**: To BS EN 54-10.
- **Third party certification**: LPCB approved.
- **Mounting**: Refer to project specific documentation.
- **Classification**: Refer to project specific documentation.
- **Detector type**: Refer to project specific documentation.
- **Operating range (minimum)**: Refer to project specific documentation.
- **Ingress protection (minimum)**: Refer to project specific documentation.
- **Power source**: Refer to project specific documentation.
- **Accessories**: Refer to project specific documentation.
- **Execution**: 90-75-30/620 Installing point detectors.

345 Point heat detectors

Used by: 75-65-30/110 Fire detection and alarm systems in non-domestic premises type A.

- **General requirements**: 90-75-30/310 Fire detection devices generally.
- **Manufacturer**: Refer to project specific documentation.
- **Standard**: To BS EN 54-5.
- **Third party certification**: LPCB approved.
- **Classification**: Refer to project specific documentation.
- **Suffix**: Refer to project specific documentation.
- **Execution**: 90-75-30/620 Installing point detectors.

350 Point smoke detectors

Used by: 75-65-30/110 Fire detection and alarm systems in non-domestic premises type A.

- **General requirements**: 90-75-30/310 Fire detection devices generally.
- **Manufacturer**: Refer to project specific documentation.
- **Standard**: To BS EN 54-7.
- **Third party certification**: LPCB approved.
- **Detector type**: Refer to project specific documentation.
- **Execution**: 90-75-30/620 Installing point detectors.

360 Sounders

Used by: 75-65-30/110 Fire detection and alarm systems in non-domestic premises type A.

- **General requirements**: 90-75-30/310 Fire detection devices generally.
- **Manufacturer**: Refer to project specific documentation.
- **Standard**: To BS EN 54-3.
- **Third party certification**: LPCB approved.
- **Sounder type**: Refer to project specific documentation.
- **Rated voltage**: Refer to project specific documentation.

- **Sound patterns**: In accordance with BS 5839-1.
- **Ingress protection standard**: Refer to project specific documentation.
- **Sound pressure level (minimum)**: Refer to project specific documentation.
- **Integral beacon**: Refer to project specific documentation.
- **Mounting**: Refer to project specific documentation.
- **Power supply**: Refer to project specific documentation.
- **Execution**: 90-75-30/640 Installing sounders.

370 Vibrating radio pagers

Used by: 75-65-30/110 Fire detection and alarm systems in non-domestic premises type A.

- **Manufacturer**: Refer to project specific documentation.
- **Standard**: To BS 5446-3.
- **Type of licence**: Refer to project specific documentation.
- **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

380 Fire detection and alarm control and indicating equipment (CIE)

Used by: 75-65-30/110 Fire detection and alarm systems in non-domestic premises type A.

- **Manufacturer**: Refer to project specific documentation.
- **Standard**: To BS EN 54-2.
- **Third party certification**: LPCB approved.
- **Main display**: Refer to project specific documentation.
- **Zone indication**: Refer to project specific documentation.
- **Installed capacity**: Refer to project specific documentation.
- **Monitored sounder circuits (minimum)**: Refer to project specific documentation.
- **Printer**: Refer to project specific documentation.
- **Indications**: Refer to project specific documentation.
- **Controls**: Refer to project specific documentation.
- **Outputs**: Refer to project specific documentation.
- **Input device**: Refer to project specific documentation.
- **Enclosure**:
  - **Type**: Refer to project specific documentation.
  - **Ingress protection (minimum)**: To BS EN 60529, IP 30.

  - **Material**: Refer to project specific documentation.
  - **Finish**: Refer to project specific documentation.
  - **Colour**: Refer to project specific documentation.
  - **Mounting**: Refer to project specific documentation.
- **Execution**: 90-75-30/610 Installing main control and indicating equipment (CIE).

385 Fire detection and fire alarm power supply equipment

Used by: 75-65-30/110 Fire detection and alarm systems in non-domestic premises type A.

- **Manufacturer**: Refer to project specific documentation.
- **Standard**: To BS EN 54-4.
- **Third party certification**: LPCB approved.
- **Stand-by power supply**: Rechargeable battery sufficient to maintain the system in operation for a minimum of 24 h and to provide an 'Evacuate' signal in all alarm zones for a further 30 minutes.
- **Housing**: Refer to project specific documentation.
- **Monitoring of power supplies**: By the CIE.
- **Execution**: 90-75-30/610 Installing main control and indicating equipment (CIE).

390 Mimic panels

Used by: 75-65-30/110 Fire detection and alarm systems in non-domestic premises type A.

- **Manufacturer**: Refer to project specific documentation.
- **Standard**: To BS EN 54-2.
- **Format**: Illuminated site layout panel.
- **Enclosure**:
  - **Ingress protection (minimum)**: Refer to project specific documentation.
  - **Material**: Refer to project specific documentation.
  - **Mounting**: Refer to project specific documentation.
- **Functional requirements**:
  - **Display**: Refer to project specific documentation.
  - **Controls**: Refer to project specific documentation.
- **Printer**: Refer to project specific documentation.
- **Execution**: 90-75-30/610 Installing main control and indicating equipment (CIE).

405 Automatic door release mechanisms

Used by: 75-65-30/110 Fire detection and alarm systems in non-domestic premises type A.

- **Manufacturer**: Refer to project specific documentation.
- **Standard**: To BS 5839-3.
- **Control type**: Refer to project specific documentation.
- **Mounting type**: Refer to project specific documentation.
- **Operation**: Refer to project specific documentation.

- **Power**: Refer to project specific documentation.
- **Integral manual release button**: Required.

410 Remote indicators

Used by: 75-65-30/110 Fire detection and alarm systems in non-domestic premises type A.

- **Manufacturer**: Refer to project specific documentation.
- **Lamp**: High intensity LED.
- **Lens**:
  - **Material**: Polycarbonate.
  - **Colour**: Red.
- **Ingress protection (minimum)**: Refer to project specific documentation.
- **Execution**: 90-75-30/670 Installing remote indicators.

415 Visual alarm signal devices

Used by: 75-65-30/110 Fire detection and alarm systems in non-domestic premises type A.

- **General requirements**: 90-75-30/310 Fire detection devices generally.
- **Manufacturer**: Refer to project specific documentation.
- **Standard**: To BS EN 54-23.
- **Device type**: Refer to project specific documentation.
- **Environment type**: Refer to project specific documentation.
- **Category**: Refer to project specific documentation.
- **Lens colour**: Refer to project specific documentation.
- **Execution**: 90-75-30/650 Installing visual alarm signal devices.

Execution

610 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**: Refer to project specific documentation.
- **Power supply**: Derive from a dedicated circuit from the main switchboard and connect to CIE via unswitched fused connection units.

620 Installing point detectors

Shared by: 90-75-30/340 Point flame detectors; 90-75-30/345 Point heat detectors; and 90-75-30/350 Point smoke detectors.

- **Protective cage**: Refer to project specific documentation.

630 Installing manual call points

Used by: 90-75-30/330 Manual call points.

- **Position**: Refer to project specific documentation.
- **Mounting height**: Refer to project specific documentation.
- **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.

640 Installing sounders

Used by: 90-75-30/360 Sounders.

- **Circuit wiring**: Refer to project specific documentation.
- **Protective cage**: Refer to project specific documentation.

650 Installing visual alarm signal devices

Used by: 90-75-30/415 Visual alarm signal devices.

- **Position**: Refer to project specific documentation.
- **Mounting height**: 2.1 m above finished floor level.
- **Protective cage**: Refer to project specific documentation.

660 Installing end of line devices

Used by: 90-75-30/310 Fire detection devices generally.

- **Position**: Refer to project specific documentation.
- **Labelling**: Identify the presence of an end of line device, and describe its function.

670 Installing remote indicators

Used by: 90-75-30/410 Remote indicators.

- **Concealed detection devices**: Install individual LED indicators.

Ω End of section

90-75-50 Lightning and earth conductors

Products

310 Earth bars

Used by: 70-70-25/110 Earthing and bonding system.

- **Material**:
  - **Bar type**: Hard drawn copper to BS EN 13601.
  - **Support**: PVC-U.
- **Size**:
  - **Profile**: Refer to project specific documentation.
  - **Length**: Refer to project specific documentation.
- **Predrilled connections (minimum)**: 10.
- **Disconnecting links**: 1.
- **Execution**: 90-75-50/610 Installing earth bars.

320 Earth plates type A

Used by: 70-70-25/110 Earthing and bonding system.

- **Manufacturer**: Refer to project specific documentation.
- **Standards**: To BS EN 62561-2 and In accordance with BS 7430.
- **Material**: Refer to project specific documentation.
- **Size**: Refer to project specific documentation.
- **Execution**: 90-75-50/620 Installing earth plates.

320 Earth plates type B

Used by: 75-85-45/110 Lightning protection system.

- **Manufacturer**: Refer to project specific documentation.
- **Standards**: To BS EN 62561-2 and In accordance with BS 7430.
- **Material**: Refer to project specific documentation.
- **Size**: Refer to project specific documentation.
- **Execution**: 90-75-50/620 Installing earth plates.

330 Earth rods type A

Used by: 70-70-25/110 Earthing and bonding system.

- **Type**: A
- **Manufacturer**: Refer to project specific documentation.
- **Standards**: To BS EN 62561-2 and in accordance with BS 7430.
- **Material**: Copper bonded rods.

- **Size**:
  - **Diameter**: Refer to project specific documentation.
  - **Length**: Refer to project specific documentation.
- **Earth rod clamps**: Rod to cable;
  Rod to cable lug;
  Rod to tape;
  and 'U' bolt.
- **Execution**: 90-75-50/630 Installing earth rods.

330 Earth rods type B

Used by: 75-85-45/110 Lightning protection system.

- **Manufacturer**: Refer to project specific documentation.
- **Standards**: To BS EN 62561-2 and In accordance with BS 7430.
- **Material**: Copper bonded rods.
- **Size**:
  - **Diameter**: Refer to project specific documentation.
  - **Length**: Refer to project specific documentation.
- **Earth rod clamps**: Rod to cable;
  Rod to cable lug;
  Rod to tape;
  and 'U' bolt.
- **Execution**: 90-75-50/630 Installing earth rods.

340 Earth rod inspection pits

Used by: 75-85-45/110 Lightning protection system.

- **Manufacturer**: Refer to project specific documentation.
- **Standard**: To BS EN 62561-5.
- **Material**: Refer to project specific documentation.
- **Load rating (minimum)**: 5000 kg.
- **Identification**: Permanently identify with the wording “EARTH ROD”.
- **Execution**: 90-75-50/640 Installing earth rod inspection pits.

350 Earthing and bonding clamps

Used by: 70-70-25/110 Earthing and bonding system.

- **Standard**: To BS 951.

370 Air terminals

Used by: 75-85-45/110 Lightning protection system.

- **Manufacturer**: Refer to project specific documentation.
- **Standard**: To BS EN 62561-2.

- **Material**: Refer to project specific documentation.
- **Format**: Refer to project specific documentation.
- **Size**:
  - **Diameter**: Refer to project specific documentation.
  - **Length**: Refer to project specific documentation.
- **Execution**: 90-75-50/650 Installing air terminals.

380 Aluminium tape

Used by: 75-85-45/110 Lightning protection system.

- **Manufacturer**: Refer to project specific documentation.
- **Standards**: To BS EN 755-1, BS EN 755-2 and BS EN 755-5.
- **Size**: Refer to project specific documentation.
- **Cover**: Refer to project specific documentation.
- **Execution**: 90-75-50/660 Installing earth conductor tapes.

390 Copper tape

Used by: 75-85-45/110 Lightning protection system.

- **Manufacturer**: Refer to project specific documentation.
- **Standards**: To BS EN 13601.
- **Size**: Refer to project specific documentation.
- **Cover**: Refer to project specific documentation.
- **Execution**: 90-75-50/660 Installing earth conductor tapes.

400 Aluminium solid circular conductors

Used by: 75-85-45/110 Lightning protection system.

- **Manufacturer**: Refer to project specific documentation.
- **Standards**: To BS EN 755-1, BS EN 755-2 and BS EN 755-3.
- **Size**:
  - **Cross-sectional area (minimum)**: Refer to project specific documentation.
  - **Diameter (minimum)**: Refer to project specific documentation.
- **Cover**: Refer to project specific documentation.
- **Execution**: 90-75-50/660 Installing earth conductor tapes.

420 Copper solid circular conductors

Used by: 75-85-45/110 Lightning protection system.

- **Manufacturer**: Refer to project specific documentation.
- **Standards**: To BS EN 13601.
- **Size**:
  - **Cross-sectional area (minimum)**: Refer to project specific documentation.

  - **Diameter (minimum)**: Refer to project specific documentation.
- **Cover**: Refer to project specific documentation.
- **Execution**: 90-75-50/660 Installing earth conductor tapes.

430 Lightning protection conductor clamps

Used by: 75-85-45/110 Lightning protection system.

- **Manufacturer**: Refer to project specific documentation.
- **Standard**: To BS EN 62561-1.
- **Lightning current withstand classification**: Refer to project specific documentation.
- **Material**: Refer to project specific documentation.
- **Clamp type**: Jointing clamp;
  Pipe clamp;
  Rebar connecting clamps;
  Rebar to cable clamp;
  Square tape clamp;
  Structural steelwork bonding clamp;
  Tee clamp;
  and Test clamp.

460 Soil conditioning agents type A

Used by: 70-70-25/110 Earthing and bonding system.

- **Material**: Bentonite and Marconite TM.
- **Manufacturer**:

460 Soil conditioning agents type B

Used by: 75-85-45/110 Lightning protection system.

- **Manufacturer**: Refer to project specific documentation.
- **Material**: Refer to project specific documentation.
- **Execution**: 90-75-50/670 Installing soil conditioning agents.

Execution

610 Installing earth bars

Used by: 90-75-50/310 Earth bars.

- **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.

620 Installing earth plates

Shared by: 90-75-50/320 Earth plates; type A and type B.

- **Position**: Refer to project specific documentation.
- **Arrangement**: Install vertically. Backfill immediately following installation.
- **Depth of plate top (minimum)**: 1000 mm below finished ground level.

630 Installing earth rods

Shared by: 90-75-50/330 Earth rods; type A and type B.

- **Position**: In undisturbed ground, at least 2 m from building and metal fencing, avoiding communications cabling.
- **Rod separation**:
  - **General earth installations**: Space the rods apart by at least 1.25 times the depth of the longest rod.
  - **Clean earth installations**: Space rods apart by at least 6 times the depth of the longest rod.
- **Rod alignment**: Vertical.
- **Couplings**: Apply corrosion inhibiting paste to the threads and enclose so that rods meet at centre of coupling.
- **Earth rod heads**:
  - **Enclosure**: Concrete inspection pit;
    Lightweight plastics inspection pit;
    and Lightweight plastics inspection pit with concrete lid.
- **Earth rods**:
  - **Tape depth**: 750 mm below ground.
  - **Jointing method**: Bolts.
- **Internal earth rods**: Provide seals.

640 Installing earth rod inspection pits

Used by: 90-75-50/340 Earth rod inspection pits.

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

650 Installing air terminals

Used by: 90-75-50/370 Air terminals.

- **Position**: Refer to project specific documentation.

660 Installing earth conductor tapes

Shared by: 90-75-50/380 Aluminium tape; 90-75-50/390 Copper tape; 90-75-50/400 Aluminium solid circular conductors; and 90-75-50/420 Copper solid circular conductors.

- **Position**: Refer to project specific documentation.

- **Number of joints**: Minimize.
- **Contact surfaces**: Clean. Coat with corrosion inhibitor.
- **Bimetallic joints**: Do not cross-contaminate.
- **Conductors passing through roofs**: Provide puddle flanges.
- **Fasteners**: Spaced at a maximum of 600 mm apart.

670 Installing soil conditioning agents

Used by: 90-75-50/460 Soil conditioning agents type B.

- **Position**: Refer to project specific documentation.

Ω End of section

90-75-75 Security fittings

Products

310 Padlocks and keys

Used by: 70-65-35/110 Reciprocating internal combustion engine driven alternating current generator system.

- **Manufacturer**: Refer to Schedule of Manufacturers
- **Locking mechanism**: Refer to project specific documentation.
- **Material**: Refer to project specific documentation.
- **Padlock identification**: Stamp padlock describing its function.
- **Execution**: 90-75-75/615 Padlocks and keys.

Execution

615 Padlocks and keys

Used by: 90-75-75/310 Padlocks and keys.

- **Quantity**: Refer to project specific documentation.
- **Padlock keys**: Two for each padlock.
- **Padlock identification**: Stamp padlock describing its function.

Ω End of section

90-90-55 Notices, identification and labels

Products

320 Electrical shock treatment signs type A

Shared by: 70-70-25/110 Earthing and bonding system; 70-70-35/110 High voltage distribution system; 70-70-45/110 Low voltage distribution system type A; 70-70-75/110 Hard wired low voltage small power system; 70-80-25/110 Roadway lighting system; 70-80-25/120 Amenity lighting system; 70-80-35/110 Hard wired general lighting system; 70-80-35/120 General lighting systems with prefabricated wiring; 70-80-35/130 Central battery supplied emergency lighting system; and 70-80-90/110 Underwater lighting system.

- **Format**: Plastics encapsulated.

320 Electrical shock treatment signs type B

Used by: 70-65-35/110 Reciprocating internal combustion engine driven alternating current generator system.

- **Manufacturer**: Refer to project specific documentation.
- **Format**: Plastics encapsulated.

390 Equipment labels and warning notices

Shared by: 70-70-25/110 Earthing and bonding system; 70-70-35/110 High voltage distribution system; 70-70-45/110 Low voltage distribution system type A; 70-70-75/110 Hard wired low voltage small power system; 70-80-25/110 Roadway lighting system; 70-80-25/120 Amenity lighting system; 70-80-35/110 Hard wired general lighting system; 70-80-35/120 General lighting systems with prefabricated wiring; 70-80-35/130 Central battery supplied emergency lighting system; and 70-80-90/110 Underwater lighting system.

- **H&S Requirements**: To be in accordance with current Health and Safety guidance
- **Material**: Face engraved rigid plastic laminate.
- **Colour**:
  - **Background**: Black - general;
    Red - warnings
  - **Lettering**: White.
- **Typography**:
  - **Font**: Helvetica medium.
- **Notice wording**: Function and/or warning, as appropiate;
  Panel/board reference

395 Electrical diagrams

Shared by: 70-70-25/110 Earthing and bonding system; 70-70-35/110 High voltage distribution system; 70-70-45/110 Low voltage distribution system type A; 70-70-75/110 Hard wired low voltage small power

system; 70-80-25/110 Roadway lighting system; 70-80-25/120 Amenity lighting system; 70-80-35/110 Hard wired general lighting system; 70-80-35/120 General lighting systems with prefabricated wiring; 70-80-35/130 Central battery supplied emergency lighting system; and 70-80-90/110 Underwater lighting system.

- **H&S Requirements**: To be in accordance with current Health and Safety guidance
- **Material**: Engraved plastics laminate and Paper print, encapsulated.
- **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.

Ω End of section

90-90-60 Plant and equipment supports

Products

310 Battery shelving racks

Used by: 70-70-45/110 Low voltage distribution system type A.

- **Manufacturer**: Refer to project specific documentation.
- **Arrangement**: Refer to project specific documentation.
- **Material**: Welded carbon steel.
- **Finish**: Epoxy powder coated.

320 Ballasted mounting frame for solar modules

Used by: 70-65-60/110 Grid connected photovoltaic system.

- **Material**:
  - **Type**: High-density polyethylene (HDPE).
    Standard: UV stabilized in accordance with BS EN ISO 4892-1.
  - **Recycled content**: 100% to BS EN ISO 14021.

330 Free standing mounting frame for solar modules

Used by: 70-65-60/110 Grid connected photovoltaic system.

- **Material**: Extruded aluminium frame and rails and Stainless steel module clamps.
- **Cable ways**: Integral within mounting frame with clip in UV resistant cover.

340 Metal cladding solar module clamps

Used by: 70-65-60/110 Grid connected photovoltaic system.

- **Material**: Extruded aluminium and Stainless steel.
- **Clamp type**: Suitable for use on standing seam roof and Suitable for use on trapezoidal profile metal cladding panel.

350 Solar module support rails

Used by: 70-65-60/110 Grid connected photovoltaic system.

- **Material**: Extruded aluminium and Stainless steel.
- **Accessories**: Connector rails;
  Module clamps;
  and End clamps.

360 Roof anchors for solar modules

Used by: 70-65-60/110 Grid connected photovoltaic system.

- **Material**: Extruded aluminium and Stainless steel.
- **Anchor type**: Integral height adjustment;
  Suitable for use on concrete tile roof;
  Suitable for use on pantile roof;
  or Suitable for use on slate roof.

Ω End of section